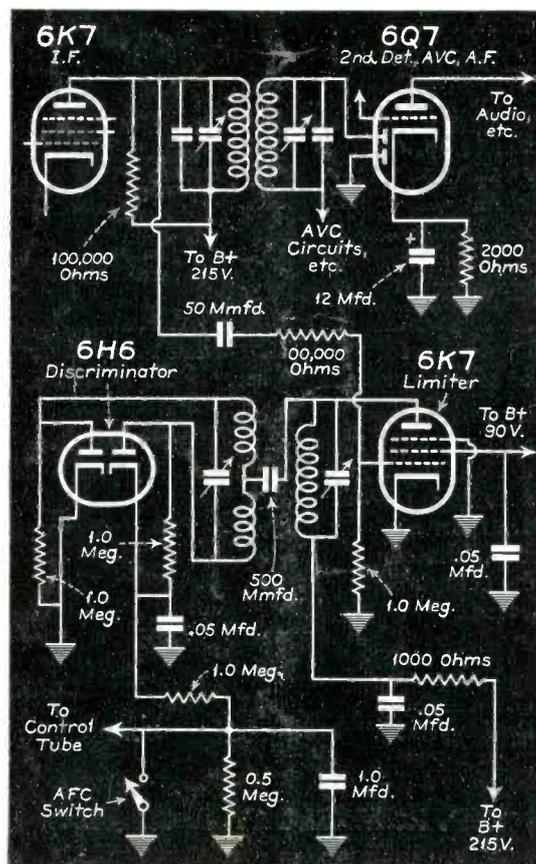


# SERVICE

A Monthly Digest of

# RADIO

and Allied Maintenance



Limiter Tube

(See Page 208)

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25 CENTS

APRIL  
1937

# MALLORY-YAXLEY

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### Parts Cost No More

### Than Ordinary Products

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The General Electric Company has been a pioneer in the development of electronic devices for the electrical and radio industries. In 1917, General Electric developed the first high-vacuum tube used for commercial purposes. Battery receiving tubes, the first radio tubes known to the public, were announced in 1921. The screen-grid tube was perfected in 1927. And, in 1935, General Electric contributed the metal tube.

The new lines of General Electric Metal Radio Tubes and Glass Radio Tubes are manufactured and tested under conditions which conform to the most exacting specifications. To capitalize on the superior quality of General Electric Radio Tubes — they are merchandised under the name "PRE-TESTED."

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# GENERAL ELECTRIC

APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONN.

# SERVICE

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

EDITOR

APRIL, 1937

Robert G. Herzog

VOL. 6, NO. 4

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Write for Bulletin ST-66

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CABLE ADDRESS

VELOCITY

AMPERITE

MICROPHONES

# THE ANTENNA . . .

---

## INTERCOMMUNICATING SYSTEMS AND THE SERVICE MAN

DURING THE PAST YEAR the manufacturers of p-a equipment have given special attention to the design and construction of intercommunicating equipment. A number of typical systems with brief technical descriptions are shown on pages 210-12, this issue.

With the many types available and with the improved operation possible it should be an easy task for the Service Man to tackle the job of selling these systems to the 1,700,000 or more potential business customers and to the increasing number of prospects in the home. Practically every factory, office, store and restaurant represents an eventual sale—there is not a single type of business that could not benefit from the innumerable time saving advantages which these systems provide. The possibilities inherent in this lucrative field have barely been scratched—and *the sale and installation of such equipment presents problems for which the Service Man is peculiarly adapted.*

The Service Man can readily enter into the necessary explanations preceding the sale of such equipment and his suggestions will be received by the prospect as the counsel of a technical adviser rather than as the ballyhoo of a counter salesman or department store clerk.

The Service Man knows just what to expect from each type of equipment and can therefore recommend the proper one to suit the individual requirements of the customer.

And, when the sale is completed the Service Man is certainly suited to the job of installing, adjusting and servicing the equipment.

It remains only for the Service Man himself to scout for live prospects and push the sale of intercommunicating systems—the setup is a natural for him.

## AUTO-RADIO SALES

FROM TIME TO TIME, in these columns we have pointed out that auto-radio sales are properly within the capacity of the Service Man. It is not only within his sphere to sell these sets to the old car owner but to the new car purchaser as well—and these new car purchasers can be reached through arrangements made with the new car dealer. The Service Man can offer the automobile dealer convincing arguments that mean sales that stay sold and profits without comebacks.

The automobile dealer is not through with the receiver sale upon the installation of the set in the car. The auto-radio receiver is subjected to rough duty and in spite of rugged construction does require service—and the Service Man can guarantee prompt service to his customers. The radio purchaser must protect his investment and the dealer must insure his sale. His goodwill and future car sales depend upon 100 percent customer satisfaction. The best (and cheapest) insurance in this case is reliable service.

There are, of course, the usual additional arguments concerning the Service Man's unique ability to recommend the proper type and installation of auto antenna, the most practical noise suppression and more prompt installation.

The Service Man should not feel chicken hearted—he should contact his local auto dealers and make every effort to agree on some mutual arrangement for selling auto-radio receivers to every new car purchaser.

• • •

## OUTDOOR P-A

IN ADDITION TO being the time when extra effort may be spent in selling customers on the idea of having their sets tuned up in anticipation of the splurge of new programs in the fall, the summer should provide numerous opportunities to keep the p-a equipment busy.

• SERVICE FOR

YOU ARE LOOKING AT THE  
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Model 108  
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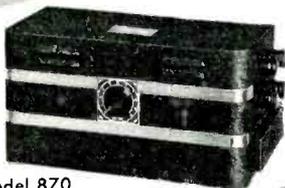
Model 110-R  
 20 Watt Portable P. A. Unit  
 List Price \$190



Model 835  
 35 Watt Amplifier  
 List Price \$120



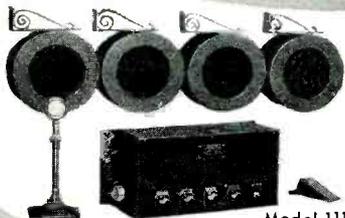
Model 855  
 55 Watt Amplifier  
 List Price \$180



Model 870  
 70 Watt Booster Amplifier  
 List Price \$125



Model 132-BAC  
 25 Watt Mobile P. A. System  
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Model 111  
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 List Price \$220



Model 135  
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\*All Prices  
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APRIL, 1937 •

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 Kind of Business.....  
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WITH A  
**2"**  
INCH



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4. Exclusive SNAP-LOCK SYNCHRONIZER for positive interlock between linear time base and incoming signal—Range 15 cycles to over 500 k.c.!
5. Exclusive UNI-CONTROL allows separate control of two potentiometers from one shaft protrusion—Grouping of controls eliminates groping for controls!
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9. Exclusive "POWER ON" INDICATOR lamp!
10. Exclusive FLEXIBILITY OF CONTROL FUNCTIONS!

### Model 530—2" Oscilloscope

**8 EXCLUSIVE features found in no other instrument of similar price!**

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2. Exclusive SELECTIVE RETURN SWEEP ELIMINATOR for inclusion or rejection of power supply frequency return sweep!
3. Exclusive UNI-CONTROL allows separate control of two potentiometers from one shaft protrusion on the panel!
4. Exclusive ANTIQUE BRONZE PANEL!
5. Exclusive LIGHT WEIGHT and SMALL SIZE!
6. Exclusive "POWER ON" indicator lamp!
7. Exclusive MAXIMUM FUNCTIONS with MINIMUM number of PANEL KNOBS!
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GREENWOOD, MISSISSIPPI

# SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR APRIL, 1937

## THIS SERVICE BUSINESS

By ALFRED E. TEACHMAN

THESE has been a tendency on the part of many to view the service business from the angle of a profession. This tendency to stress its professional aspects while denying it a sensible business foundation is, in the opinion of the writer, largely responsible for the poor state of affairs which exist in this industry.

Over the past few years there has appeared from time to time much statistical data, gathered by trade magazines and government departments which show (should one doubt it) that the radio service business has, on the whole, been relatively small and not too highly profitable. The chart of Fig. 1 gives an idea of the importance of radio repairing as compared to other common services. The graph is constructed from data taken from the Federal Census of Business 1935 showing the dollar volume of business in the several industries.

The figures on which the graph is based represent the national average annual wage paid for full-time work in the industries shown. Accepting the fact that averages make a rather poor showing, nevertheless, the comparisons made are accurate and indicate the situation of most Radio Service Men. Another situation not brought out in the census report, but nevertheless a matter of common knowledge, is that Radio Service Men are required to work all kinds of hours to earn these wages, whereas for the most part the other industries listed enjoy more standardized working hours. That the radio service business is in need of the application of sound business principles need hardly be emphasized. The injustice of the Service Man's situation is intensified when attention is given to the minimum requirements of special training and schooling necessary to even enter the business, as compared to the other three industries, any one of which can be entered by simple apprenticeship.

Further examination of census fig-

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IN NO SENSE is this an attempt to degrade the status of the service business, but rather an effort to view it in its normal aspects in order that defects may be detected and improvement undertaken.

---

ures reveals another interesting fact—the highest sales quotas, the highest employee ratio (employee to owners) and the highest wages go hand in hand. This last fact is full of vital significance for it highlights what, in the opinion of the writer, is one of the fundamental faults of the business setup common to radio repairing and that is, the one-man shop. The one-man shop is typical of the professional idea and here we have proof that it is economically unsound. (More about that later.)

Summarizing briefly some other trends we find, in the parts situation, that extreme competition through the depression years caused manufacturers to focus considerable attention on the cost of component parts used in receivers. Many expensive items are no longer used, such as dual volume controls, high voltage paper condensers, expensive capacitor packs, interstage audio transformers, and the like. Consequently, the dollar volume of parts required on an average service job is falling. Examination of individual records shows the seriousness of this factor, with an indicated drop of 50 per cent over the past three years in the price of parts required for the average service job. This is to be expected since the majority of sets now being repaired are of mid-depression vintage, consequently, lacking in parts of an expensive nature.

In the tube situation, until recently, a similar condition existed. For several years, although tubes were used in increasing numbers, the average price per tube had been falling at such a rate as

to bring less return in gross replacement sales. This trend was checked in the past year and, from present indications, will reverse itself this year.

The depression radios of the past few years are all over for the receiver manufacturer, but they remain like a bogey over the Service Man's head for they are now becoming the leading group in service work at a time when rising prices of tubes and parts make the cost of repair high in comparison to the original cost.

The average list price of radios sold between the years 1933 and 1936 ranged from \$40.00 to \$57.00. Little wonder that there are few ten and fifteen dollar repair jobs these days. It will be some time before the newer and more expensive sets require extensive repairing.

From the survey conducted by SERVICE in 1936 we have an estimate that there are 29,000 full-time Service Men at work with 15,000 Service Men doing part time. In addition to this there are probably as many more screwdriver tinkerers, experimenters and fans who dabble in the business either for some slight profit or as a hobby. Under these circumstances it is easy to see that the volume of service business is widely scattered and it is difficult for any one man to gather in a large amount.

### WHAT TO DO ABOUT IT

To prescribe remedies for the situation is no doubt a very ticklish business and one which invites controversy. However, a start should be made if progress is to be had, and in any event, the whole remedy will unfold only as time goes on. From the data presented, it was shown that Mr. Average Service Man does a yearly business which is too small to yield an adequate annual income. For any reasonable degree of success, each man must obtain at least \$3,000 to \$4,000 gross sales per year. Of this amount from 30 to 50 per cent can be realized as earned wages depending on the cost of doing business

and the percentage of gross profit. To attain this, Service Men must become better salesmen in selling their service. Something must also be done to discourage the dabbler from continuing along his aimless way and thus concentrate the flow of service work to the legitimate shops. Service Men's organizations should take up this matter as one of their prime problems. This does not mean seeking legislative action for licensing, for it cannot be shown that licensing would benefit anyone except the state.

The plan that is here suggested is practical, workable, and certain to bear fruit. It begins with you personally, depends only on your ability and can be put to work at once. Its cardinal principle is, *operate your business efficiently*. Study your own business carefully, ferret out wasteful practices, set up businesslike procedure. Control your business by your own thoughtful action, fretting no time about Johnny Competitor's actions and feel not compelled to emulate his unsound practices. Bear in mind that the service business is very young as a business and a great deal remains to be done to put it on an efficient basis. Concentrate your efforts on *improving your business methods* for this is perhaps one of the strongest tools which may properly be employed to divert the stream of business in your direction. To do a thorough job and handle it in a businesslike way makes mighty stiff competition for the blundering dabbler to cope with.

#### CARRYING OF STOCK

The lack of adequate stock is characteristic of practically all service stations. Because of hand-to-mouth buying a considerable sum is lost in expensive parcel post shipments, C.O.D.s and low discounts, to say nothing of lost motion occasioned by the delay in obtaining parts. Good parts and tubes should always be used, and it will be found that they can be bought at much better discounts, shipped inexpensively in bulk,

when bought in reasonable quantities. Were it not for the fact that much service work can be done with only a basketful of supplies we would have much less competition from service dabblers, but this fact should not hide the truth that the way to do service work efficiently is to have a good stock of tubes and parts on hand ready for instant use.

#### CARRY TUBES ON THE JOB

In addition to a complete stock of tubes on the stock shelves, every effort should be made to carry a large supply of tubes in the service car. At the present time there are well over 125 types in common use, which makes it exceedingly difficult to carry enough tubes to the job to insure that no return trip will have to be made. This is definitely becoming a very serious problem, but the only way to meet it is to carry as large a portable stock as possible, for in the case of simple tube troubles new tubes must be installed then and there or the profit is gone. It is poor business logic to carry a \$40 tube tester and only \$15 worth of tubes. It is the tubes that are for sale!

#### ADVANTAGE IN TUBE MARKET

While many bemoan the seemingly endless procession of tubes being introduced, there is one fortunate circumstance in the situation which may have escaped their notice. The complication of keeping an adequate stock of so many different types of tubes on hand, plus the technical knowledge required to recommend the proper type, is driving most all of the big cut-price merchandising outlets out of the radio tube business. No one is better suited to recommend and sell tubes than the Service Man, and it should properly fall in his sphere to sell all replacement tubes. In the past the Service Man has sold less than one-half of the replacement requirements, but the situation is changing rapidly and bids fair to dump the whole business in his lap. Obviously, every effort should be made to carry a

complete and adequate stock of tubes, for they represent the largest single item of sale and constitute more than half of all material sales.

#### LOAN SMALL SETS

A number of small sets should be kept on hand for the purpose of lending them to customers when repairs are delayed. Carry one on the job to loan when a chassis must be removed. In this way impatient customers can be satisfied with better regulation of work. Such action creates more flexibility, preventing the loss of new business on rush days and permits the return of repaired sets in an orderly route rather than in an inefficient helter-skelter way.

#### LIMIT YOUR TERRITORY

For economical operation the shop should be near the center of the area which it is intended to serve. It is unwise to cut out a large territory for normal operation, because not only does the cost of transportation go up rapidly, but also the time spent each day in driving becomes a large portion of the hours of work. A territory within a radius of three miles should be the limit for normal operations and beyond this an extra charge should be made for traveling expense and time consumed.

#### CASH AND CARRY WORK

Experience has demonstrated that a considerable volume of work can be obtained on a cash-and-carry basis with great satisfaction to the customer and Service Man alike. There are millions of small sets in use on which service must be had, but the low initial cost of these sets makes it imperative that the service cost be kept low. The last few years table models have constituted more than half the total production. The majority of these sets must be repaired for less than \$3 to warrant the work being done. It is practically impossible to do work at this price on a home call basis. A solution for this problem is to run advertising and window displays calling attention to a considerable saving when receivers are brought to the shop for repairs. This advertising need not specify small sets only, for it will soon be discovered that many people are capable of removing a full size chassis and supplying their own transportation. The advantage is mutual since the Service Man is really not vitally interested in making money from taxiing himself around. The more hours he can spend actually working on sets, the more successful he will be. This practice increases the efficiency of the shop since it is evident that the efficiency must be near zero in the absence of the Service Man. There is more opportunity to contact customers who drop in. The minimum charge for shop testing should be about half the

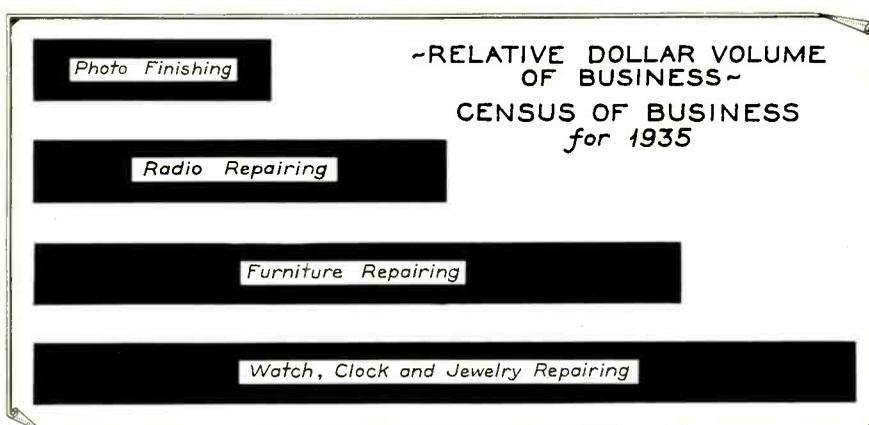


Fig. 1. Relative dollar volume of radio repairing as compared with other lines.

rate for home calls. The price differential will help to justify the higher cost of home service.

#### IMPORTANCE OF LABOR CHARGES

It is a fact that the total cost of tubes and parts per average repair job is becoming smaller all the time. This brings to light the truth of what many have long been claiming—that labor charges should not be shaded with the idea of making-up on the sale of parts. Every effort should be made to see that for each hour of work *a full hour's labor charge is made*. Even the small jobs which take but a few minutes should be charged for or otherwise many a busy day will pass with surprisingly little to show for it. By far and large the principal stock item that the Service Man has to sell is expert time, and this should be guarded just as zealously as the tangible stock on the shelves.

#### AGAINST FREE INSPECTION

Much has been said pro and con free inspection and undoubtedly it will always be a hotly contested issue. However, there are four inescapable arguments against it which should be carefully considered before indulging in such a program: (1) Free service test creates the impression that service is a lucrative business—which most certainly it is not; (2) Free service test makes it appear that testing is a minor part of the whole job—which most certainly it is not; (3) Free service test degrades the value of a service expert's time and abridges his right to demand more than the charge for common labor; and (4) It puts the industry involuntarily on a contracting basis, and if it continues to grow more common will eventually wreck all possibility of doing work at reasonable rates which leave a profit. It is tacitly deceitful to offer something for nothing when someone must sooner or later pay for the wastefulness. When the public comes to accept free inspection as customary, forcing all concerned into it, then the temporary and doubtful advantage of a few will be completely lost and multiple inspection for "lowest bid" will be the order of the day. The result will be ruination of profits and an increase of cost to the customer as well.

#### CUT PRICES

There are those Service Men who spend their idle hours wishing that work would come in more steadily. They figure that by charging less than the other fellow they will get more work and in the end make more money. Sadly and with empty pocketbooks they live to learn that service is not sold by the pound or bushel. The only thing the public knows is that some jobs cost

more and some cost less. Comparison of job prices is almost impossible. The Service Man who works for low rates finds no appreciation of his sacrifice and has just as many customers who think his prices are still too high.

#### MAXIMUM SERVICE CHARGES

We all read and talk much about proper charges for repairing a receiver. Prices and estimates are arrived at in various ways according to the systems developed by individuals. Nearly every thinking man is on the side of those that argue that prices should be higher. Many scales of prices have at different times been advanced as guides in the matter of establishing fair and equitable charges that leave a profit for the Service Man. However, one fundamental fact is always standing between the Service Man and such a list of standard prices. In the final analysis the charge that can be levied is strictly in proportion to the economic value of the receiver being serviced. The limit for service charges is some percentage of the replacement cost of the set. This is so not only in radio service but in every branch of service with the single exception of the human repair service supplied by doctors. Were it not for the limitless value we place on life and good health, it is quite likely that doctors would be little better off than Service Men. About 10 to 15 percent of the replacement cost is all that most people are willing to pay for a major repair job and even then some form of guarantee is usually requested. Exactly the same condition prevails in the automotive industry as many Service Men have no doubt discovered. At the other end of the spectrum we have those sets which are not worth repairing. This fact should be squarely faced. It *should not* be the purpose of Service Men to keep the existing receivers forever in operation.

#### BUSINESS SETUP

One of the principal characteristics of independent service is the one-man shop. According to the Census of Business, there are approximately four shops to every five men. This, in the writer's opinion, makes for a very inefficient form of business. In this connection it might be pointed out that one-man bands, while oftentimes interesting, exhibitions of great dexterity and skill, have in general never succeeded. In business or in bands a proper division of duties makes for better results. In radio service we should get away from this one-man band idea and establish larger and stronger units on something like a partnership basis. Druggists, public accountants and lawyers find this setup almost an absolute necessity. The Business Census report

shows distinctly that the greater the number of men per shop the more successful the business is all around. Washington, D. C., has 23 shops with 26 owners and 33 employees. The average shop did \$4,500 worth of business in 1935 or approximately \$1,780 gross sales per man with the employee receiving the highest average wage in the country.

The many advantages to be had by joining hands are too numerous to mention in detail here, but just to consider a few:—the ease of keeping the shop covered at all times to meet customers and answer phone calls—the pooling of otherwise separate advertising allowances—the increased purchasing power and improved discounts on larger orders—the better location of shop obtainable when rent allowances are combined.

There are many items of overhead expense that are divided by the number of men joining hands and very few advance in proportion. The cost of telephone service remains the same—a set of manuals will do for several men, special equipment such as oscilloscopes, etc., can be better afforded, but what is more important can be put to use often enough to earn the cost before old age takes it.

The amount of money tied up in stocks of goods does not advance in proportion to the number of men drawing from that stock. What constitutes an ordinary stock of service goods for one man does not have to be doubled for two or tripled for three. The net result is that with less capital investment per man a greater variety of stock is available, the turnover is more rapid, and the profit is greater.

Several forms of business organization tending toward these ends are available and range from simple partnership to companies or corporations. There is, of course, no object in forming units larger than reasonably necessary to take care of the available trade. At the present time the volume of service work in concentrated areas is approximately \$400 per year per thousand population. Service Men possessing sufficient capital might well own their own business outright, but should seek to interest less fortunate but otherwise good Service Men *with a following* to work for them. Those Service Men not having sufficient capital for their own business will find it a wise move to accept such employment even if only temporary or until they can establish themselves.

It is the studied conviction of this writer that in these last suggestions regarding larger operating units lies the most certain direction to success in service work.

# LIMITER TUBE

(See Front Cover)

THE diagram on the front cover shows a limiter tube used by Bosch in their model 678 twelve-tube double superheterodyne receiver.

## THE CIRCUIT

A portion of the signal from the plate of the last i-f amplifier stage is fed through a 50-mmfid coupling condenser and a 100,000-ohm filter resistor to the grid of the 6K7 limiter tube. The grid of this tube is returned to the cathode (and grounded) through a 1-megohm resistor. Grid current flows through this resistance when any signal whatever is applied to this grid, resulting in a negative bias voltage which increases with increasing input.

The gain in the limiter stage is relatively high (of the order of 200 or more) and the plate circuit overloads for all signals above approximately 1 volt on the grid of the 6K7 tube. Because of the relatively high level of the signals at the plate of the last i-f, voltages on this grid are rarely less than 1 volt.

This results in a substantially constant voltage across the tuned plate circuit, even though the signal (at the receiver antenna) may be quite weak, over a sufficient range of frequencies so that the induced voltage on the 6H6 discriminator circuits is substantially constant under all normal operating conditions.

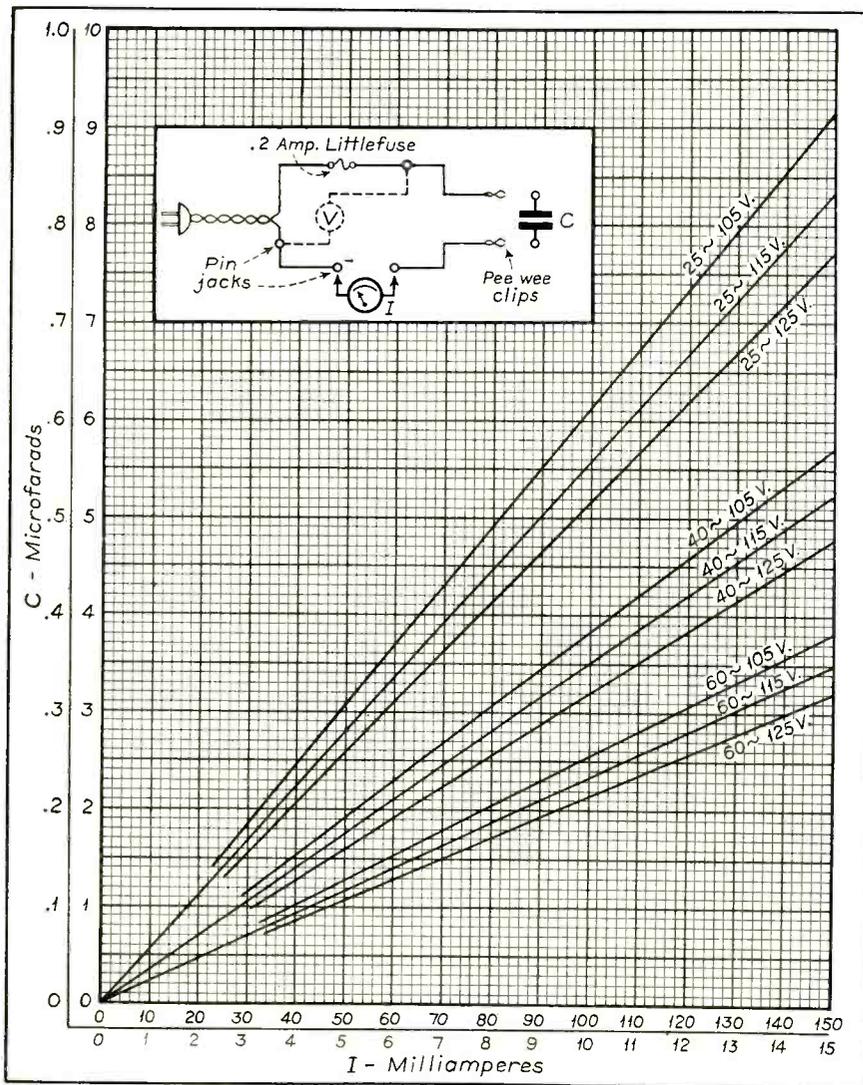
The coils, condensers and resistors

in the discriminator circuits are carefully shielded and isolated to prevent stray signals from entering into the tuned circuits.

## ADVANTAGES

The chief advantage of using the limiter tube is that it provides an intermediate-frequency voltage for the discriminator that is substantially constant regardless of the strength of the incoming signal. This is particularly important on the short waves where, due to the narrow separation of the stations across the frequency range, fading of the signal may cause the discriminator to fail momentarily and tune the receiver to a stronger neighboring station.

# CAPACITY MEASUREMENT



In general service work the necessity of measuring capacity is rare. However, should the occasion arise, capacities may be determined with a fair degree of accuracy through the use of the simple device indicated in the accompanying diagram, together with an a-c milliammeter. The device may be built on a panel and placed in a box if desired.

The condenser is first tested for shorts. Connect the test condenser into the circuit by means of the pee-wee clips. Measure the applied voltage (V) and then measure the current (I).

To simplify matters and eliminate the need for computation, a series of curves are given in the accompanying illustration. Refer to the curves for the frequency of the supply you use. Use the curve nearest the voltage you read, and locate on the bottom scale the current read. Trace vertically upwards until you intersect the correct frequency and voltage curve. Trace horizontally to left and read the capacity. In measuring current always use the 0-150-ma range first. If the value obtained is below 15 ma, use the lower current meter.

The chart is based on the formula

$$C = \frac{160 I}{f V} \text{ microfarads}$$

where I is in milliamperes.

Capacities from 0.0025 to 0.38 mfd can be measured with a 0-15 milliammeter. Capacities up to 3.8 mfd can be measured with a 0-150 milliammeter.

Courtesy, National Radio Institute.

# INTERCOMMUNICATING SYSTEMS

THE reader who has witnessed the performance of Charlie Chaplin in "Modern Times" will undoubtedly remember the omnipresent executive who, by pressing a button in his office, was able to envisage and converse with any portion of his plant.

The idea is not such a gross exaggeration as would first appear. Although television and facsimile may not be developed to such an extent, the modern executive can have the remote portions of his plant at his fingertips through the use of one of the many types of intercommunicating systems now available.

Quite a number of the public-address equipment manufacturers have added new types of intercommunicating systems to their lines. The newer systems, by and large, are less expensive and somewhat simpler in operation and installation and cover a wider scope than those previously offered. Earphones and headsets have been eliminated, except where desired, in most of the units. Improved response is obtained in practically every instance.

## CLASSIFICATION

In general, intercommunicating systems can be divided into five classes. These divisions, however, are not final in that some of the systems pictured on the accompanying pages do not fall definitely in one particular class but, rather, are a combination of two classifications or sacrifice some feature described for some other not mentioned.

Literature describing the individual makes and prices can be obtained directly from the manufacturers upon request.

### TWO-STATION SYSTEM

The two-station system is designed for use in an office or organization where two persons or departments wish to be in communication. In some types either station can talk at any time independently of the other. In other types only one-way conversation is permissible.

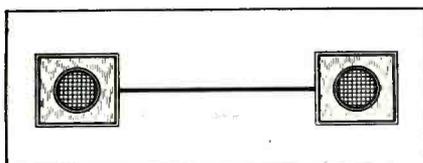


Fig. 1. Simple two-station system. One-way or two-way conversation.

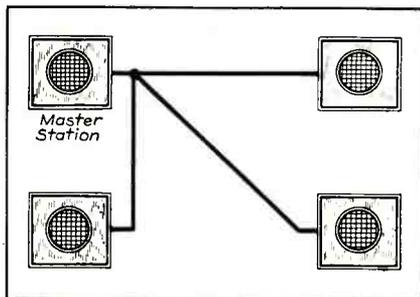
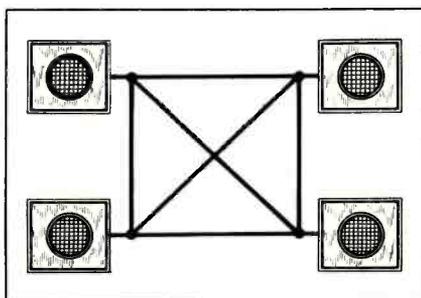


Fig. 2. Master station selective system. One-way or two-way conversation.

Fig. 3. Multiple station selective system. Simultaneous private conversations.



### MASTER SYSTEM

Under another classification we have a more complicated system which consists of a master and a number of outlying stations. These are usually designed for service in organizations where it is necessary for one person to be in communication with a number of other persons or departments. Outlying stations usually can talk back to the master station but cannot talk to other outlying stations. In some of the systems described one or more of the outlying stations are so connected to enable them to call the master station (only) independently.

### MULTIPLE SELECTIVE SYSTEM

The multi-station type, permitting intercommunication between any two stations in the system, comes under this head. With an eight-station installation of this type it is usually possible to carry on four pairs of separate conversations at the same time. Each position is independent and can call and hold conversation with any other station in the system at any time. Various other combination systems can be classified under this heading.

## CALL SYSTEMS

The call system is designed for use where it is necessary for one person or department to be in touch with a number of outlying departments at the same time. In this type of system the conversation is heard at every position of the system at all times. Some makes permit return conversations which would also be heard at all positions in the system.

## WIRELESS SYSTEMS

Another group of intercommunication systems can be plugged directly into the power lines and require no additional wiring between positions. The conversation is used to modulate a local oscillator signal which is carried over the power lines to the other positions where it is detected and amplified.

## DEMAND FOR SYSTEMS

Intercommunicating systems of some form or other have always been in demand. At present, according to a survey made by RADIO ENGINEERING there are over 1,700,000 logical business prospects which remain to be sold some type of intercommunicating equipment—to say nothing of the many more that have such equipment in need of expansion or complete replacement.

It would indeed be superfluous to mention the many uses for these systems in factories, offices, stores, restaurants, etc. We can say without exaggeration that intercommunication systems could be put to use in every type of business with great advantage and added economy. In larger homes, as well, such systems can save time and steps, "upstairs, downstairs, in my lady's chamber."

Even in the simple household they can be useful for communicating with the basement, garage, etc. A unit placed near the crib will transmit the infant's awakening cry to the busy mother's anxious ear at some distant point.

The sales possibilities inherent in this field have barely been scratched.

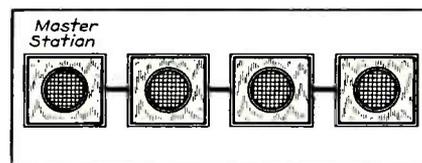
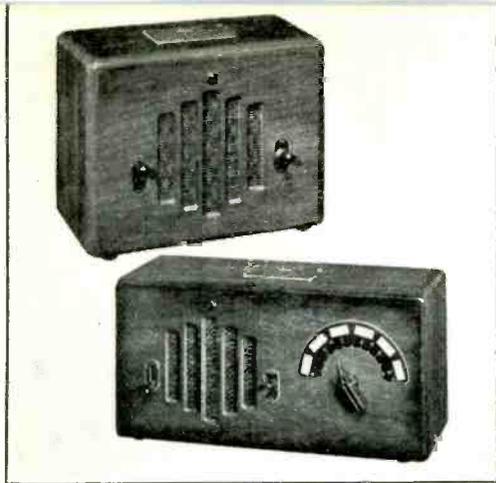


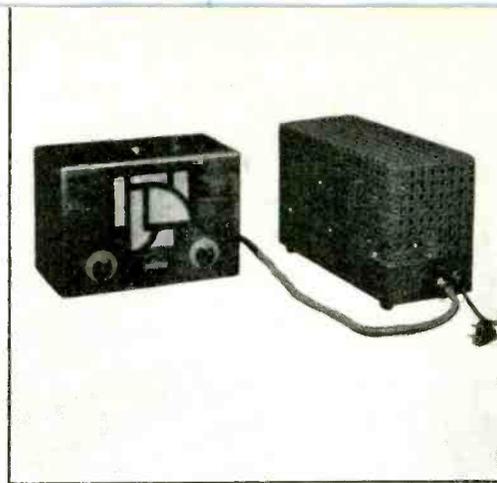
Fig. 4. Master station call system. One-way conversation only.



UNITED SCIENTIFIC "ELECTRO-CALL"

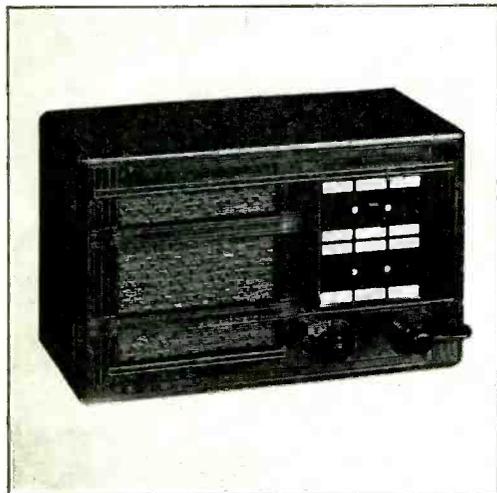


THE "CARRIER-CALL"



BELFONE STATION AND CENTRAL

## NEWER TYPES OF



THE REMLER TYPE M-70

ON THESE pages and on the following page are shown some of the newer types of intercommunicating systems. A brief description of each is contained in the following paragraphs.

The Webster-Chicago Model OC-2 is designed for operation between two points. A three-tube a-c, d-c amplifier is used in the unit.

The Webster-Chicago Model OCM is a multiple selective system designed to accommodate up to 10 stations. A number of simultaneous conversations can be carried on at the same time. A three-tube a-c, d-c amplifier is used.

A Webster-Chicago factory call system called the "Amplicall" is also available. In this type of system calls or announcements made at the master station are heard at every position of the system.

The Operadio Type A system is a two-position, two-way system designed to permit conversation to originate at either position. The amplifiers operate on three tubes and are powered from 110-volt a-c or d-c lines.

The Operadio Type B system is designed for communication between a master station and any one of a number (up to 10) outlying stations. Outlying stations are able to talk back to

the master station, but cannot call the master independently or talk to other outlying stations. A three-tube a-c, d-c amplifier is also used with the type B system.

The Operadio Type C system consists of a multiple number of selective units (from 3 to 11) all interconnected to allow any one of the locations to call or talk to any other at any time. Three tube a-c, d-c amplifiers are used.

The Bell Sound Systems' "Belfone" systems provide for a master station and any number (up to 10) outlying stations permitting two-way communication originating at the master station. By using a number of master stations a two-way multiple selective system can be obtained with the additional flexibility of this type. In addition, a number of loudspeakers can be connected to the master station permitting its use as a call system.

The Transducer "Bullet-Phone" Series C consists of a master and up to three outlying stations. The outlying stations can call the master, but cannot call or converse with other outlying stations. The Series T is also a master and (up to) three-station system, but has the added feature which permits the master to call or converse with any or

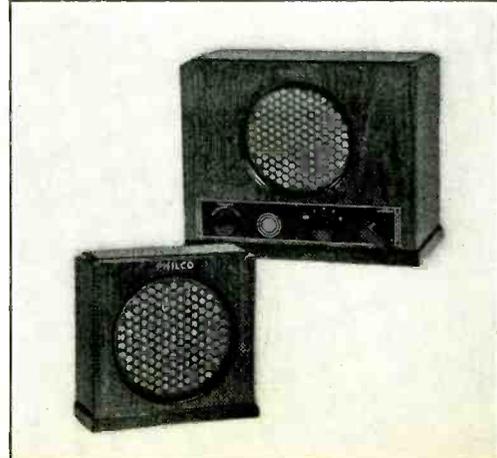
OPERADIO TYPE A



THE ELECTRONIC SOUND LABS. M-50

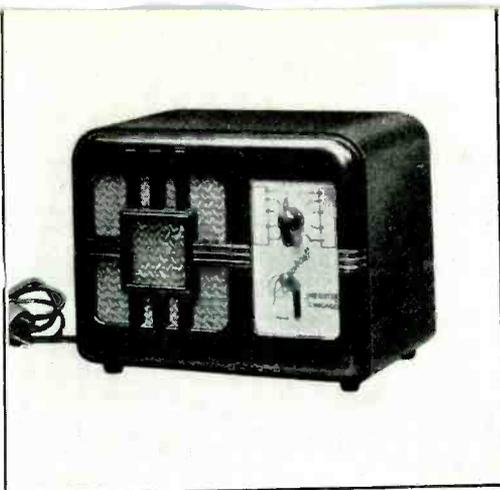


THE "PHILCO-PHONE"





THE ELECTRONIC SOUND LABS.  
MS-50



WEBSTER-CHICAGO TYPE 0CM



DICTOGRAPH "DUO-MATIC"

## INTERCOMMUNICATING SYSTEMS

all of the remote stations. The remote stations can call the master, but cannot contact the outlying stations.

The Series S system is a multiple selective system consisting of four or more stations which can hold simultaneous, independent conversations.

The "Philco-Phone" is of the master and remote station type permitting conversation with any one of (up to) four remote stations either separately or all at once. The remote stations can talk back to the master, and by prearrangement the conversation can originate at the remote station. The remote stations cannot, however, contact the other remote stations.

The Remler Type C-10 consists of a master and one station permitting two-way conversation controlled at the master station. The model M-50 consists of a master and up to twelve remote stations. The model M-70 is a flexible two-way selective system permitting a multiple number of combinations of master and remote stations as well as multiple selective units. Three-tube a-c operated amplifiers are used with the Remler systems.

The Turner PDQ system consists of a master and a number of outlying stations with the usual features of these

systems. The Turner "Speech Relay" systems permit group call connection, master and remote station connection and two-way multiple selective connections. In these more complex systems an "automatic" central is used which permits (in most cases) calling any one or all of the interconnected stations.

The United Scientific Laboratories "Electro-Call" type 202 is a multiple selective unit which may be connected with other 202 models to form a two-way multiple selective system. When the Model 202 is interconnected with other 200 models a master and remote station system can be obtained.

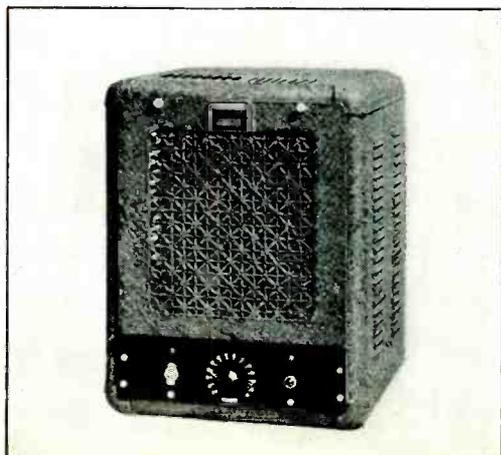
The American Carrier-Call Corporation "Carrier-Call" systems are of the plug-in "wireless" type permitting conversation among any number of plugged-in units. A four-tube oscillator-amplifier is used in each unit and is powered from the 110-volt a-c or d-c line. Line blocking devices can be obtained where necessary to isolate the system on any given line.

The Sound System "Intercommunicator" is so designed that from one to eighteen units may be used with one central amplifier and it may be combined for two-station one-way or two-way conversation. Combinations of



TRANSDUCER "BULLET-PHONE"

WEBSTER-CHICAGO FACTORY CALL SYSTEM

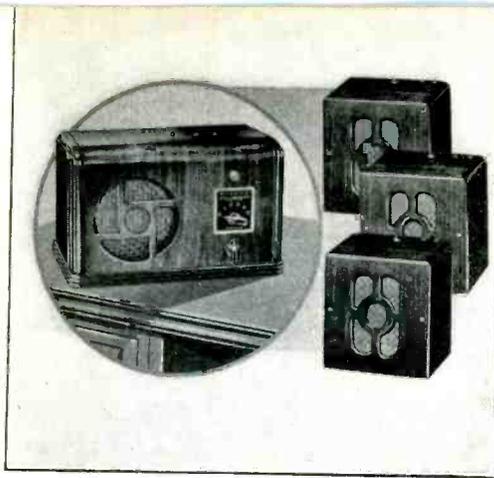


SOUND SYSTEM'S "INTERCOMMUNICATOR"



OPERADIO MASTER STATION





RADOLEK SYSTEM



BOGEN "COMMUNO-PHONE"



WRIGHT-DECOSTER "TALK-BAK"  
SPEAKER

from two to eighteen station one-way master systems, two-way master systems or all two-way selective multiple systems. Additional combinations of these systems are also possible.

The Dictograph "Duo-Matic" system is a tubeless, battery operated system consisting of a master and a number of remote stations. Two-way conversation originating at either the master or the outlying station can be carried on without the use of a talk-listen switch.

The Electronic Sound Laboratories, Inc., manufacture two types—the M-50 master station and the type MS-50 substation. Conversations may originate at either the master unit or the substation. A three-tube a-c amplifier is used. The master unit may be obtained with a switching arrangement for as many as ten substations and other models are available with a telephone type automatic dial for selection of as many as two or three thousand units.

Electronic Devices' "Portaphone" unit is of the "wireless" a-c, d-c type which permits intercommunication among a number of plugged-in units over the power lines. Additional wired systems are available both of the master-substation type and of the two-way multiple selective type.

Five models, three wired and two "wireless" types are available in the Bogen "Communo-phone" series. The 3W and 5W types are "wireless," permitting intercommunication over the a-c, d-c power lines. The three wired

systems consist of the 5SC, a five-station multiple selective system; the 2SC, a two-station, two-way selective system and the 3A, a master and up to four remote station system.

The Auburn systems, distributed by Wholesale Radio Service Co., Inc., are available in two models. The first offers communication from a master to any one or all of up to five remote stations.

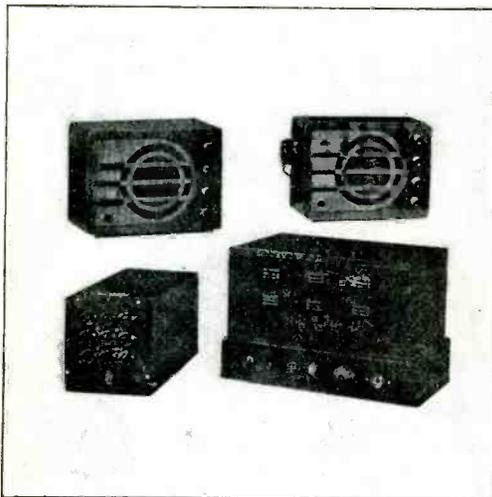
The second system is a common call unit in which the conversation originating at the master is heard at all the remote stations.

Up to five outlying stations may be used with the Radolek master unit. Outlying stations can call the master independently, but conversation is controlled at the master station.

The Webster Electric Co. manufactures several types of systems powered from the 110-volt a-c, d-c lines. A two-station type permitting two-way conversation, a master and substation type and a multiple selective type use three-tube amplifiers and provide for the various combinations of systems which might be required in present-day offices, etc.

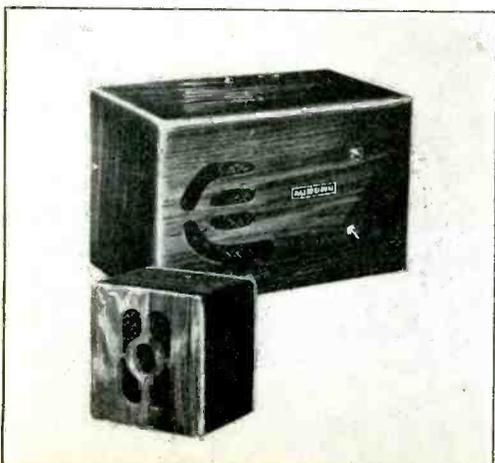
The Simplex Radio Co. manufacture a "wireless" type which permits conversation over the power lines among the plugged-in units.

The Interfone Co. manufactures a "wireless" type for transmission of conversation over the power lines to other plugged-in units.

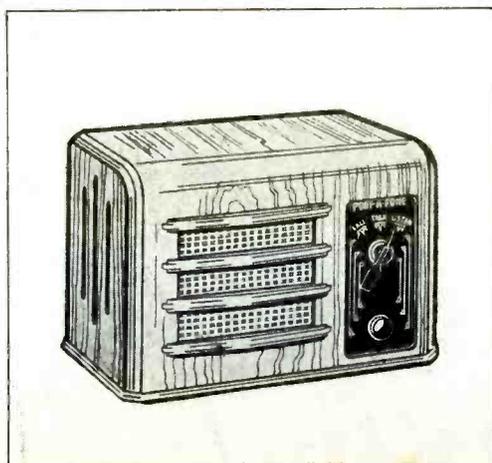


THE TURNER "SPEECH-RELAY" UNIT

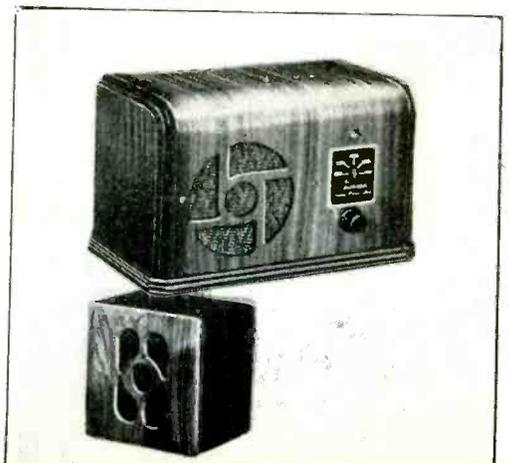
THE AUBURN INTERCOMMUNICATORS



ELECTRONIC DEVICES' "PORTA-PHONE"



THE AUBURN INTERCOMMUNICATORS



**THERE *is* STILL TIME *to Enter*  
the RAYTHEON CONTEST!**



• Picture shows Mr. Eddie Riedel, Raytheon General Sales Manager, and Mr. Earl Dietrich, Manager of Distributor Sales, Photographed with Grand Prize Sound Truck.

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RAYTHEON IS THE MOST COMPLETE LINE—ALL TYPES OF GLASS, OCTAL BASE, METAL, RESISTANCE AND AMATEUR TRANSMITTER TUBES

# General Data . . .

## G. E. E-155

Model E-155 is a 15-metal tube receiver using a superheterodyne circuit. In addition to the fundamental requirements of superheterodyne design it incorporates many technical improvements which are of advantage in improving efficiency of performance and ease of operation.

Design features built into this receiver include the "Sentry Box"; separate coils for each frequency band; high efficiency converter with a separate oscillator; two stages of i-f amplification for high sensitivity and selectivity; automatic volume control; automatic frequency control (afc); noise limiter; silent tuning; bass and treble compensated volume control; music-speech switch operated in conjunction with a continuously variable tone control; push-pull beam-power tube output; audio degeneration; large electrodynamic speaker; and colorama tuning.

Five bands cover the frequency ranges between 140 to 420 kc and from 540 kc to 70 mc. An undistorted power

output of 30 watts is available at the 15-in speaker with a maximum of 37.5 watts. The impedance of the voice coil at 400 cycles is 10 ohms. The average power consumption of the 155 is 195 watts.

### "SENTRY BOX"

The r-f and oscillator sections of the receiver are contained in the "Sentry Box" which consists of a separately contained and shielded, five-band antenna—r-f—oscillator tuning unit. Individual coils are employed for each frequency range and are properly selected and connected into the circuit by the range switch. To avoid absorption effects, the range switch shorts all unused coils which might resonate at some frequency in the band being used. The section of the range switch controlling selection of the antenna coil primary also changes the antenna connection to these coils in such a manner as to insure maximum signal transfer in each range. When the V doublet antenna system is connected to terminals "A" and "G" at

the rear of the "Sentry Box," the range switch provides for true doublet operation in the short-wave D band where this connection is advantageous, and for operation as a T antenna in all other bands. When a doublet antenna providing noise reduction on the broadcast band is used, it is essential that a link be connected between terminals "G" and "GR" at the back of the "Sentry Box" in order to obtain the desired action.

The antenna is coupled to the control grid of the 6K7 r-f tube through the antenna transformer selected by the range switch. Likewise, the output of the r-f amplifier tube is coupled to the control grid of the 6L7 converter tube through the properly selected tuned r-f transformer. The only exceptions to this procedure occur when the receiver is operating on the long-wave A band or the ultra-short wave E band, in which positions the r-f tube is disconnected from the circuit and the antenna coupled directly to the 6L7 grid through the tuned antenna transformer.

The oscillator circuit, with the exception of the ultra-short wave E band, employs a 6J7 tube in a conventional tuned grid, plate feedback circuit. In the ultra-short-wave E band, the common impedance between the grid and plate circuits provided by the secondary of L-13 in the cathode circuit of the

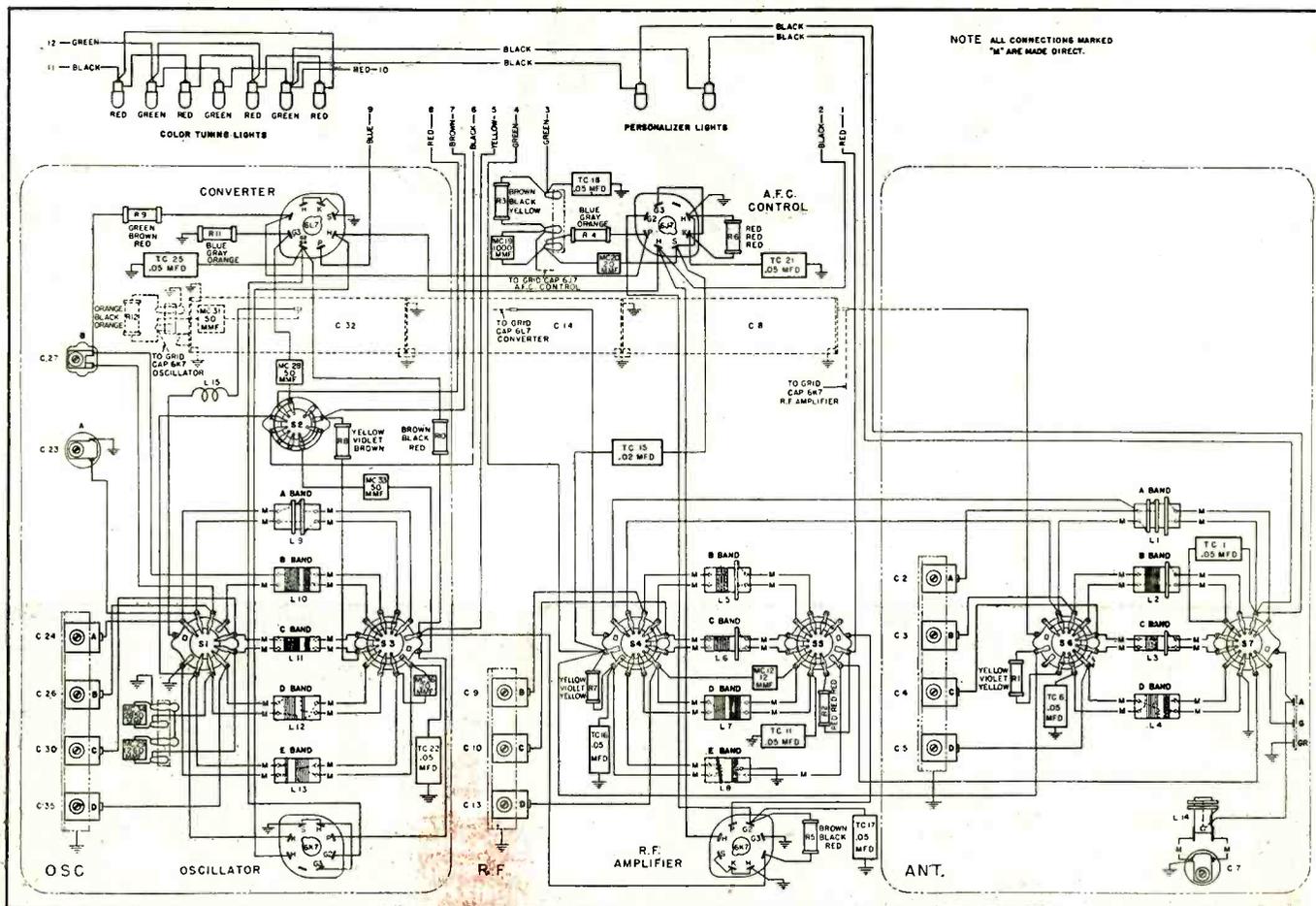


Fig. 2. "Sentry Box" wiring diagram.

# THOUSANDS HAVE SELECTED *this* \$18<sup>00</sup> TUBE TESTER



MODEL 430

## MODEL 430

Positively Checks All Type Tubes According to Data Contained in Latest Recommendation of Tube Engineers.

- Tests All Type Tubes
- Has Line Voltage Adjustment
- Has Leakage and Short Test
- Uses Triplet Direct Reading Instrument (Good-Bad Scale)

\*Model 430 is an up-to-the-minute 1937 Tube Tester. Five flush type sockets provide for all tubes. The tester operation is very simple and indicates condition of the tube for dealer and customer on Direct Reading GOOD-BAD colored scale of Triplet instrument. Will also test for inter-element shorts and leakages. Com-

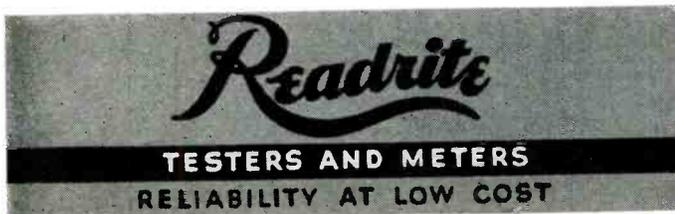
plete in attractive, sturdy, quartered-oak case. Sloping panel of silver and black. Suitable for portable and counter use.

Dealer Price - - - - - \$18.00

Model 431 same as 430 except has Readrite GOOD-BAD meter.

Dealer Price - - - - - \$14.40

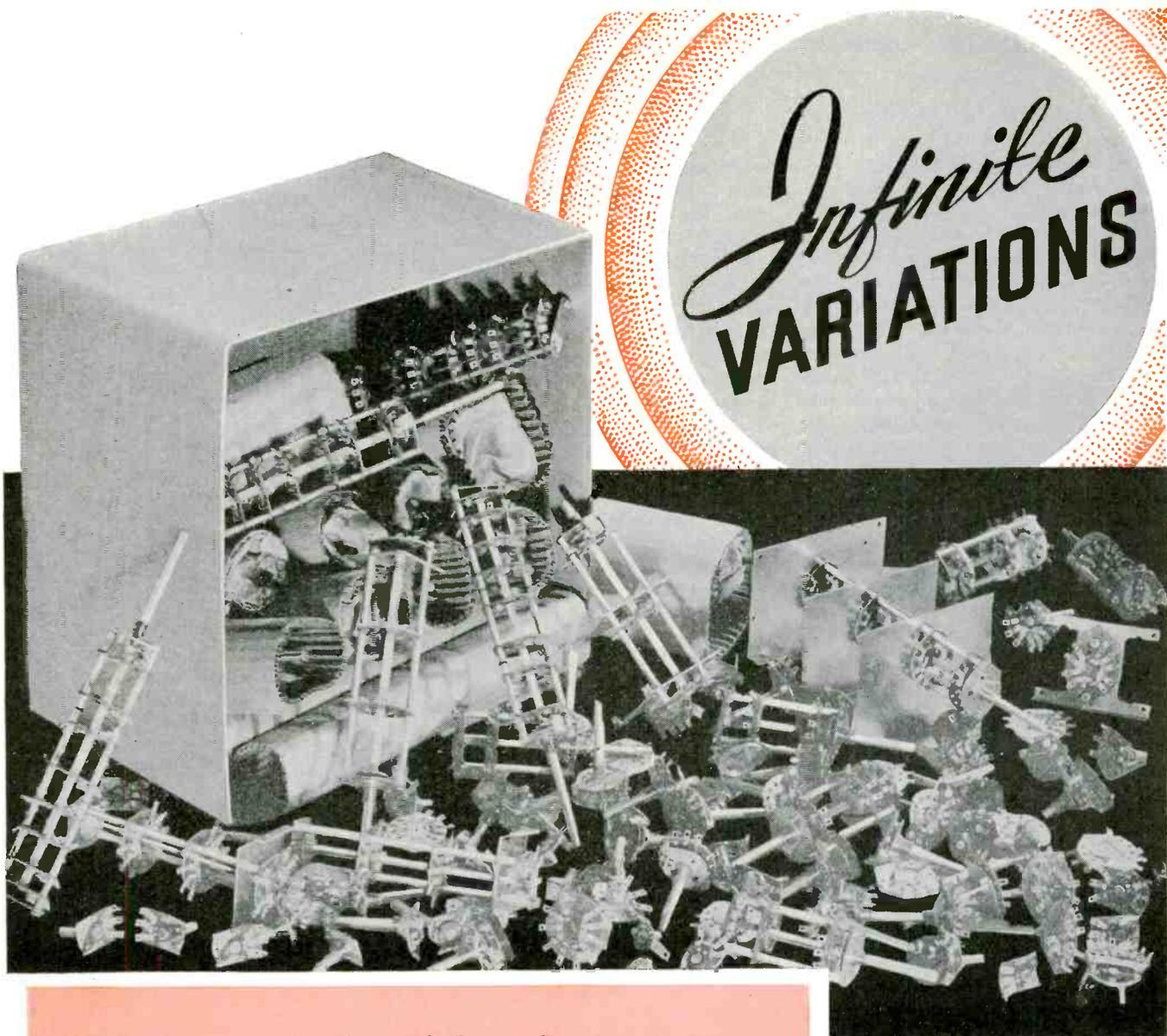
*See Your Jobber*



READRITE METER WORKS, 417 College Dr., Bluffton, Ohio  
Without obligation, please send more complete information  Model 430;  Model 431. I am also interested in.....

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





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## GENERAL DATA—continued

and variable resistor R-36 shunting the grids of the push-pull output tubes.

### SILENT TUNING

Silent tuning is provided by the switch S-9 which is actuated by the tuning knob of the receiver. Pulling the tuning knob out closes the switch S-9 and silences the audio output by grounding the 6F6 control grid. The afc is also removed by this operation which permits a sharp indication of resonance by noting the "Colorama" lights. When a station has been satisfactorily located in this manner, the tuning knob is pushed into its original position and the switch opened.

### POWER SUPPLY

D-c power for operation of the receiver is supplied by two 5Z4 tubes each operating as a half-wave rectifier. The output of the rectifiers is fed through a two-section filter furnishing substantially pure d-c to the voltage divider system from which taps supply correct voltages to the various receiver circuits.

### "COLORAMA" TUNING

These receivers are equipped with Colorama Tuning, a novel method which indicates the approach to resonance by means of a change in the color of the light illuminating the tuning scale.

This system of tuning was completely described in the December 1936 issue of SERVICE.

### AUTOMATIC FREQUENCY CONTROL

Automatic frequency control (afc) is a device for automatically controlling the oscillator frequency in such a way that, although the receiver is not exactly tuned to the signal being received, the correct intermediate frequency will still be produced.

Automatic frequency control, as applied to these receivers, was completely described in the October and November 1936 issues of SERVICE.

### ALIGNMENT PROCEDURE

The receiver should first be allowed

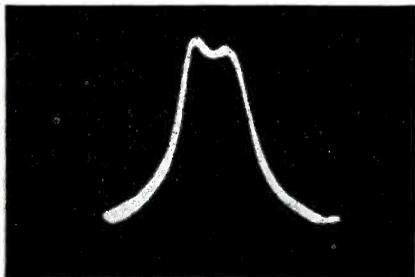


Fig. 4. Overall i-f curve.

to run for fifteen minutes in order to reach its approximate normal operating temperature. Before making any adjustments, it is wise to determine the correctness of the existing alignment. This may be done by supplying a signal to the receiver from the test oscillator at the alignment frequency and inserting a tuning wand into the coil involved. The tuning wand consists of a rod of insulating material having a ring of non-magnetic metal attached to one end, and a small core of finely divided iron compacted into the opposite end. By inserting the metal ring end into the center of the coil, the inductance of this coil is lowered, increasing its resonant frequency. Inserting the iron-filled end into the coil raises its inductance, lowering its resonant frequency. If the r-f circuits are in exact alignment, inserting either end of the tuning wand into the coil will result in a decrease in output. When an increase of signal is obtained with the iron-filled end of the wand, a decrease in resonant frequency of that circuit by increasing its trimmer capacity is indicated. When an increase of signal is obtained with the metal ring, a decrease in trimmer capacity is indicated.

To realize the full advantage of the performance built into these receivers at the factory, circuit alignment using cathode ray oscilloscope equipment is much to be preferred. The oscilloscopic method is particularly advantageous in aligning the i-f tuned circuits.

The location of all alignment trimmer capacitors is shown in Fig. 3.

### VISUAL I-F ALIGNMENT

For visual alignment it is necessary to vary the frequency of an unmodulated test oscillator signal over a range extending on both sides of the peak frequency. This variation must take place in synchronism with the horizontal traverse of a cathode-ray beam on its screen. The frequency modulator must, therefore, provide means for synchronizing the periodic test frequency variation with the cathode-ray horizontal deflection circuit. The test oscillator may advantageously have facilities for audio-frequency amplitude modulation of a fixed radio-frequency test signal, as well as for frequency modulation, but audio modulation is not required for visual i-f alignment.

Instead of an output meter across the speaker voice coil, the vertical plates of the cathode-ray tube are connected across the load resistor of the diode rectifier. With the frequency modulator

in operation in conjunction with the test oscillator, the resonance curve of the circuit under test will be then shown on the screen.

Set the tuning indicator at the low end of the broadcast band at some point where no signal is received, since an extraneous signal might interfere with the aligning process. The volume control should be in an off, or nearly off, position. Apply a frequency modulated signal to the grid of the first i-f amplifier tube through a 0.05-mfd condenser, leaving the grid clip in place. Connect the vertical plates of the oscilloscope between ground and the junction point between R-23 and R-24, and with the afc switch in the off position proceed to align the primary and secondary of the second i-f and the afc i-f transformers.

The object should be to make the two curves coincide with each other at the top and throughout their length with the maximum amplitude obtainable. This will require that all four i-f trimmers be adjusted in the usual manner *excepting the AFC secondary (hexagonal nut) trimmer which must be adjusted for minimum amplitude* before the curves will coincide properly. Fig. 4 gives the appearance of the curve when the alignment adjustments have been completed satisfactorily thus far. Apply the same frequency modulated input to the grid of the converter (6L7) tube through a 0.05-mfd capacitor as before. Adjust the primary and secondary of the first i-f transformer until the curves coincide as before and have the appearance of Fig. 4.

A further adjustment of the afc secondary (hexagonal nut) trimmer is necessary in order to complete the i-f alignment satisfactorily. Apply the *same* signal to the grid of the second i-f amplifier tube. Unsolder the ground end of TC-53 and connect the vertical deflecting plates of the oscilloscope between ground and the 6H6 cathode prong K1.

Since the cathode prong is inaccessi-

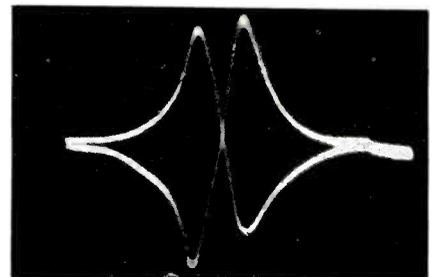
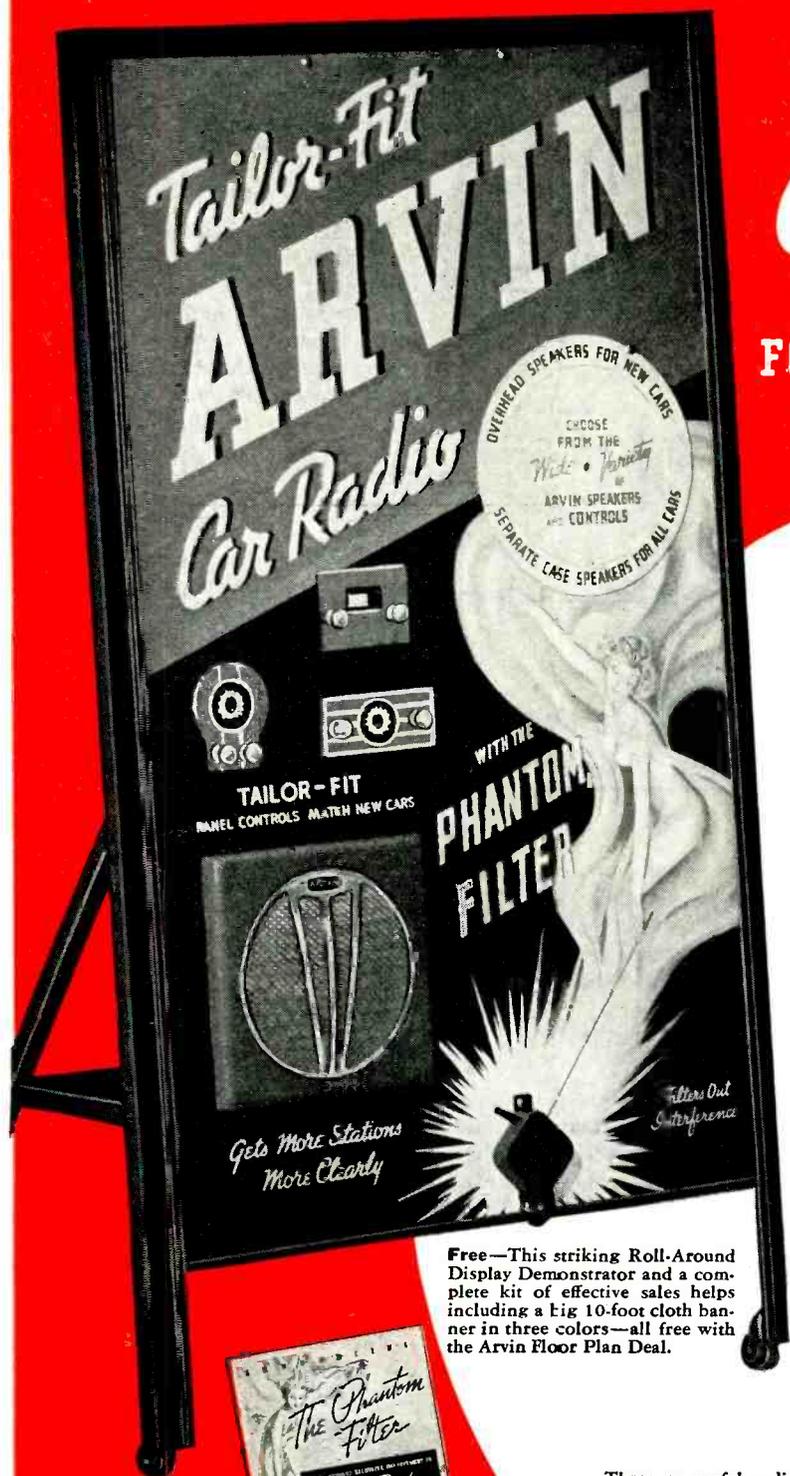


Fig. 5. Afc trimmer adjustment curve.

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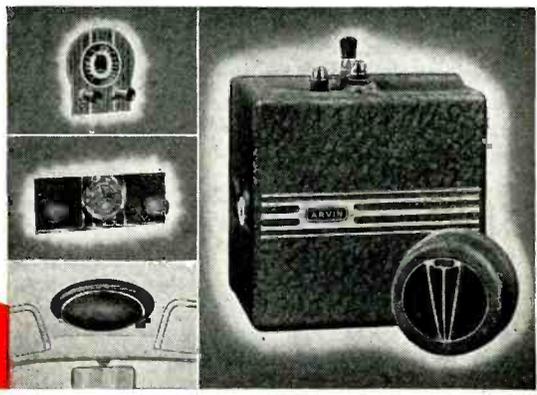
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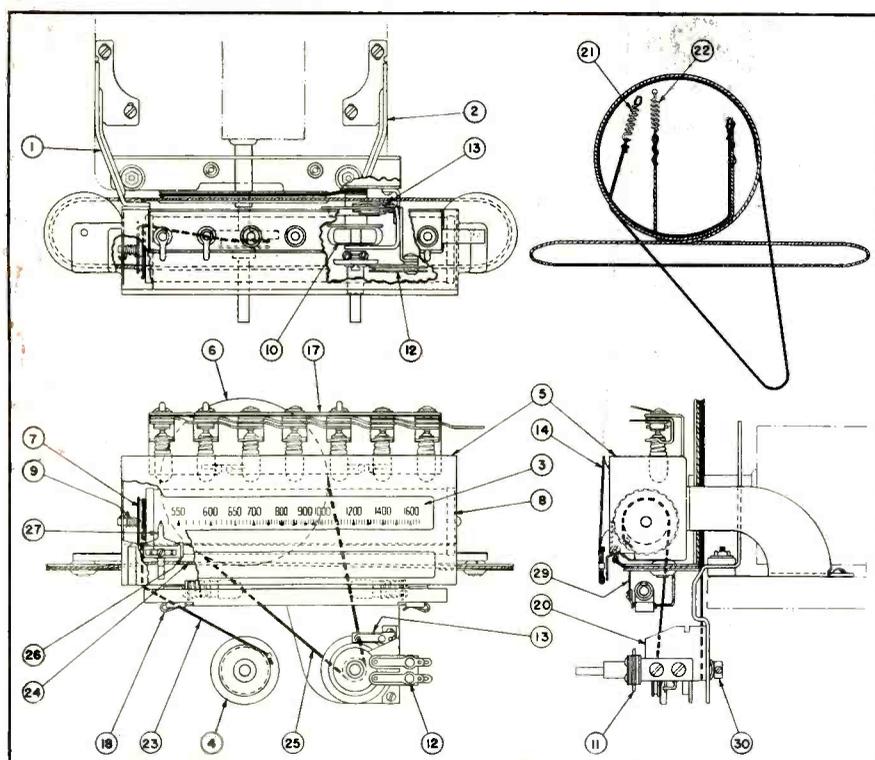


Fig. 6. Dial drive mechanism.

ble, this connection can be made at the afc switch center contact.

Carefully adjust the afc secondary trimmer until a curve is obtained which is similar to that shown in Fig. 5. Correct adjustment is made when the two sides of the curve are symmetrical and intersect exactly at the horizontal axis. No adjustment of the other i-f trimmer should be made at this time.

If a metal aligning tool is used, the curve will change when the tool is withdrawn. Therefore, it is advisable to use a fiber hex-headed wrench for this aligning adjustment. At any rate, the final curve should be as shown with aligning tool removed.

#### WAVE TRAP ALIGNMENT

Leave the band switch at band B and tune receiver to about 1000 kc.

With the test oscillator set at 465 kc, apply this signal to the antenna terminal through a dummy antenna consisting of a 400-ohm resistor and 250-mmfd capacitor in series. With the 465-kc signal applied to the antenna terminal, adjust the i-f wave-trap trimmer for *minimum* output indication.

#### R-F ALIGNMENT

First check the position of the dial pointer by rotating the tuning condenser to maximum capacity position, i. e., plates fully meshed. At this position, the pointer should coincide with the end mark at the left-hand end of the scale.

If it does not, it may be set by loosening the pointer set screw and setting the pointer to its correct position. During r-f alignment the afc switch *must* be set in its off (counter-clockwise) position.

#### BAND A

Set the test oscillator for operation at 400 kc and connect its output to the antenna terminal of the receiver through the dummy antenna described under i-f wave-trap alignment. Tune the receiver until the pointer is at 400 on the scale. Set the tone control for minimum high response and reduce the volume control setting so as to avoid excessive noise response. Adjust the band A oscillator and antenna trimmers respectively (see Fig. 3) to give maximum deflection on the output meter. Maintain the test oscillator at the lowest level which will give an easily readable output indication.

Now set the test oscillator at 145 kc and tune the receiver to resonance with this signal. Adjust the 145 kc padding capacitor rocking the tuning condenser back and forth through resonance as the padding capacitor is adjusted and note the deflection of the tuning meter each time the receiver is tuned in this manner. Leave the padding capacitor at the setting which gives greatest deflection.

Retune the receiver to 400 kc and set

the test oscillator for this frequency. Check the alignment by again adjusting the band A oscillator and antenna trimmers for maximum deflection on the tuning meter.

#### BAND B

Set the test oscillator for operation at 1500 kc and tune the receiver until the pointer is at 1500 on the scale. Adjust the band B oscillator, r-f, and antenna trimmers respectively (see Fig. 3) to give maximum deflection on the output meter. Maintain the test oscillator output at the lowest level which will give an easily readable output indication.

Now set the test oscillator at 580 kc and tune the receiver to resonance with this signal. Adjust the 580-kc padding capacitor, rocking the tuning condenser back and forth through resonance as the padding capacitor is adjusted and note the deflection of the tuning meter each time the receiver is tuned in this manner. Leave the padding capacitor at the setting which gives the greatest deflection.

Retune the receiver to 1500 kc and set the test oscillator for this frequency. Check the alignment by again adjusting the band B oscillator, r-f and antenna trimmers for maximum deflection of the tuning meter.

#### BAND C

With the test oscillator connected to the receiver as above, tune the receiver until the pointer is at 5220 on the C band scale. Set the test oscillator for operation on this frequency and, with the volume and tone controls set as above adjust the band C oscillator, r-f, and antenna trimmers, respectively (see Fig. 3) to give maximum deflection on the output meter.

#### BAND D

Turn the band switch to band D. Set the test oscillator at 18,000 kc (18.0 mc) and tune the receiver until the pointer coincides with the 18.0 mark. Adjust the band D oscillator trimmer (C-35) to give maximum output indication. It will probably be found that there will be two settings of the oscillator trimmer that will give an output response. The lower capacity setting of the trimmer is the one that should be used. To be sure that correct adjustment has been obtained, tune for the image signal at 17.07 mc with the test oscillator at 18.0 mc. It may be necessary to increase the test oscillator output to obtain response at this point.

Retune the receiver to 18.0 mc and adjust band D antenna and r-f trim-

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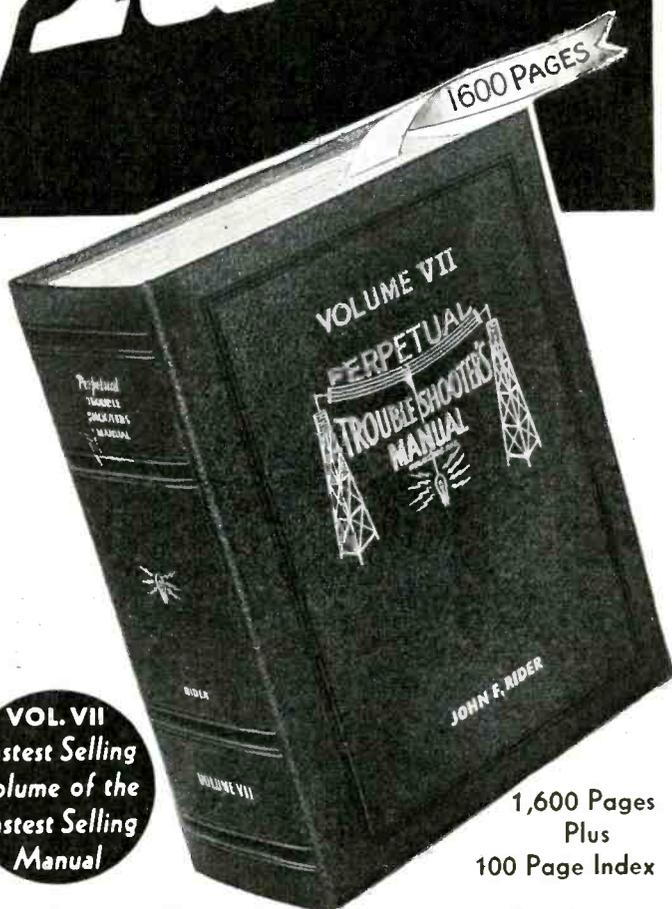
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## GENERAL DATA—continued

mers, respectively for maximum output indication. When adjusting the r-f trimmer rock the tuning condenser back and forth through resonance as in the 580-kc padding capacitor adjustment.

Alignment of the receiver is now complete as no adjustments are provided on band E.

### METER I-F ALIGNMENT

Although the use of the cathode-ray oscilloscope for alignment purposes is to be preferred, it is possible to make the i-f trimmer adjustments with reasonable accuracy using a 465-kc signal generator and output meter.

Place a modulated signal of 465 kc on the grid of the last i-f (6K7) tube with the volume control set at maximum and the afc switch *turned off*. Place a low range a-c voltmeter or other output indicator across the voice coil of the loudspeaker. Adjust the output of the signal generator so that an indication of not more than two or three volts is obtained on the output meter.

Adjust and readjust the primary trimmer for maximum output and *the secondary for minimum output*. This latter adjustment will be very broad. Apply the signal input to the grid of the first i-f (6K7) tube and adjust both primary and secondary trimmers for maximum output, reducing the input as necessary to obtain approximately the same output indication as before. Apply the signal input to the grid of the converter (6L7) tube and adjust both primary and secondary trimmers for maximum output indication in the same manner as before.

It is now necessary to make a fine adjustment of the secondary trimmer of the last i-f (afc) transformer, which is as follows: without changing the frequency of the signal generator, place the input lead on the rubber insulation of the converter (6L7) grid lead. This will provide a small signal input through the capacity between the leads. Increase the attenuator setting if necessary to make the output audible. If the signal generator is provided with a means of removing the modulation, this should be done. However, the adjustment may be carried out satisfactorily even with a modulated generator signal.

Now tune in any broadcast signal in the usual manner and tune carefully for zero beat between this carrier and the 465-kc signal generator. It may be necessary to use a short antenna or to remove it entirely if the station is a strong local. Throw the afc on and adjust the last i-f secondary (afc) trimmer to give zero beat. This adjustment is very critical and must be made with great

care. When the adjustment is properly made, there will be no appreciable change from zero beat as the afc switch is thrown off and on. This completes the alignment of the i-f and afc circuits.

The alignment of the oscillator and r-f circuits may be carried out in the usual manner. The afc switch must remain in the off position.

### DIAL ADJUSTMENT

The dial mechanism (Fig. 6) is rigidly mounted to the "Sentry Box" by means of two brackets and four screws. The dial pointer is operated by means of an "Automatic Vernier" reduction drive unit. Motion imparted to the gang condenser rotor is transmitted through a series of pulleys and an interconnecting cable to the dial pointer slider which is supported on a rail below the dial scale.

### CABLE REPLACEMENT

To replace cord or cable for the pointer or drive, the chassis should be removed from the cabinet and the dial scale box (No. 5). The black drive cord (No. 25) should run between the drum (No. 6) on the condenser and the drive pulley without crossing. Both the black cord (No. 25) and the bronze cable (No. 24) fasten on the same hook in the drum (No. 6) which is in front of the single lance on the outside diameter. The springs (21) and (22) are fastened on the ends of the cables after passing through the lances which are close together on the condenser drive drum. The light spring (No. 21) is on the bronze cable (No. 24) and the special syring loop hooks into the hole in the drum next to the hook for the spring on the black cord (No. 25). The solid end of the cord or cable should be fastened first to the drum, the line should be then strung around the pulleys and drum and lastly, the spring should be stretched into place.

### POINTER CALIBRATION

The pointer (No. 27) is adjustable by removing the escutcheon plate and also the dial mask (No. 14) which is held by four screws. The screw in the center of the pointer (No. 27) can then be loosened and the pointer adjusted as needed.

### RELACING SCALE

The scale (No. 3) can be removed by taking off the escutcheon and the dial mask (No. 14) as for the adjustment of the pointer. The pointer (No. 27) is moved to the left-hand end, the scale is then pushed to the left and the right-hand end is pulled out with the aid of a small screwdriver or a similar tool. When replacing the scale (No.

3) is it advisable to remove the cord (No. 23). The spring (No. 9), is put on the dial shaft and the shaft then inserted into the housing. The scale (No. 3) with the right-hand cap (No. 8) attached is then inserted into the left-hand cap (No. 7) which is held in position by pulling on the shaft on the outside of the housing. After the scale (No. 3) is inserted it should be rotated from one to two turns against the action of the torsion spring (No. 9). The cord (No. 23) is then replaced in the lance provided for it. It is advisable to have the band switch rotated so that the greatest length of cord possible is unwound from the lower pulley (No. 4) on the band switch shaft. It is best that the chassis be removed for the replacement of a scale.

It is important when replacing the chassis in the cabinet that the rubber grommets should be put in the chassis and not on the wood pins.

### ADJUSTING SCALE ROTATION

With the chassis out of the cabinet the scale (No. 3) can be adjusted to track properly on the various bands by loosening the set screw and rotating pulley (No. 4) on the band switch shaft.

### CHANGING DIAL LAMPS

Make certain that the copper-plated hex head shipping screw which secures the dial lamp bracket during shipment has been removed before attempting to remove the dial lamp bracket (No. 17). Lift the lamp bracket from the tabs under which it is clipped. Care should be taken that the lamp leads do not put an undue strain upon the drive cable. With the lamp bracket laid back horizontally the lamps may be replaced. When the lamp bracket is reinserted care should be exercised to avoid having the lamp leads foul the gang mechanism.

### Wells-Gardner OF

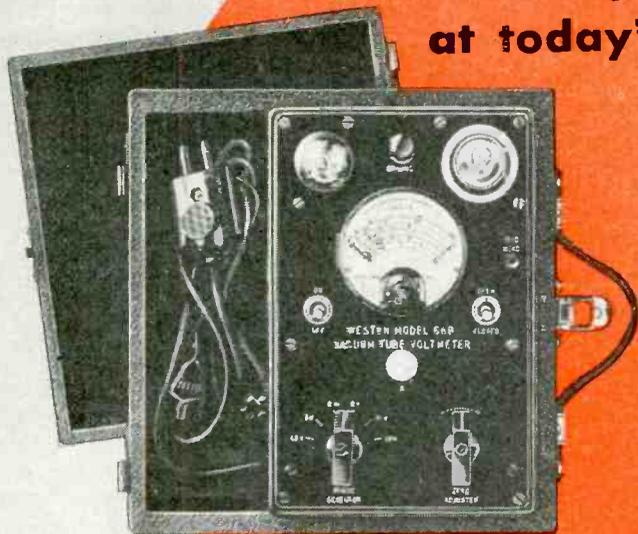
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### THE CIRCUIT

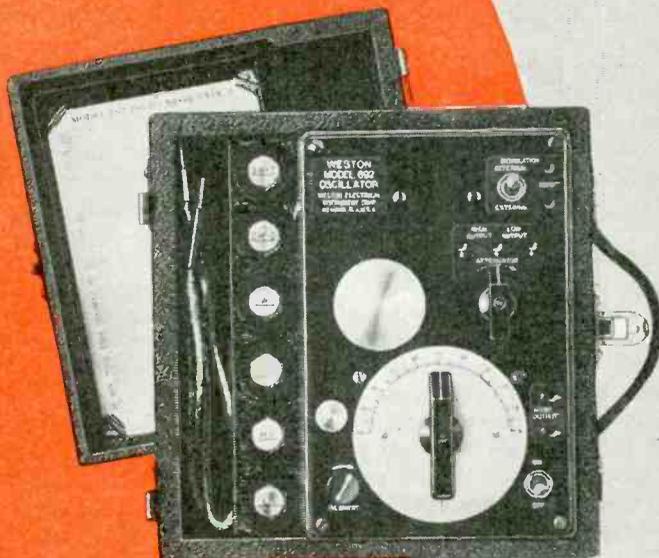
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# GENERAL DATA—continued

Referring to the schematic circuit diagram, Fig. 1, T1 and T2 are the antenna and interstage r-f transformer assemblies and T8 is the oscillator coil assembly. The standard wave, first and second short-wave coils in each assembly are indicated by the letters B, C and D respectively. The band switch sections are designated as sections 1, 2 and 3.

The band switch completes connections to the coils in use. It short circuits the r-f transformer secondaries and oscillator cathode and grid coils of lower frequency not in use. It also short circuits the interstage r-f transformer primaries of lower frequency not in use when in the range D position. The range D oscillator plate coil is short circuited by the band switch when it is in the range B and C positions.

The antenna transformer with tuned secondary feeds into a type 34 r-f amplifier tube. The output of this tube is fed through the interstage r-f transformer with tuned secondary into a type 32 tube which functions as the first detector.

A separate type 30 tube is employed in the oscillator circuit. The oscillating circuit is always resonant at a frequency

which is 456 kc above the frequency to which the r-f amplifier is tuned.

The oscillator potential is fed into the cathode circuit of the 32 first detector tube. As a result of the beating of the two frequencies, the intermediate or beat frequency of 456 kc is present in the plate circuit of this tube.

Two stages of i-f amplification are employed using 34 tubes. The primaries and secondaries of the first and second i-f transformers and the primary of the third i-f transformer are tuned by small trimmer condensers.

Referring to the first and second i-f transformers T3 and T4 in Fig. 1, it will be noted that there are coupling windings shown below the primaries in the illustration.

When the selectivity control is in the sharp position, the coupling windings are open circuited and the loose coupling which exists between the primary and secondary of these transformers results in high selectivity.

When the selectivity control is in the broad position, the coupling winding which is wound under the primary is connected in series with the secondary. This provides overcoupling which results in a greatly widened resonance

curve. Passage of a wide range of audio frequencies is thus obtained.

A type 30 tube functions as a diode second detector and as the automatic volume control tube. The avc voltage is applied to the r-f and first i-f tubes. The audio voltage developed across the volume control resistor R16 is applied to the control grid of the type 30 first a-f tube.

Across the volume control resistor R16 is a filter composed of condensers C36 and C37 and resistor R15. A tap connection near the low potential end of the volume control is connected between the two condensers. At high volume settings, the filter is not effective. At the low volume settings, as the movable arm approaches, the tap, the higher frequencies are by-passed through condenser C37. Very high frequencies are transmitted through condenser C36 to compensate for the reduction of these frequencies. At low volume settings the low-frequency amplitudes are increased as a result.

Resistance coupling is used between the first audio tube and the second audio stage which employs a type 30 tube. The latter is transformer coupled to the output stage which uses two type 30 tubes

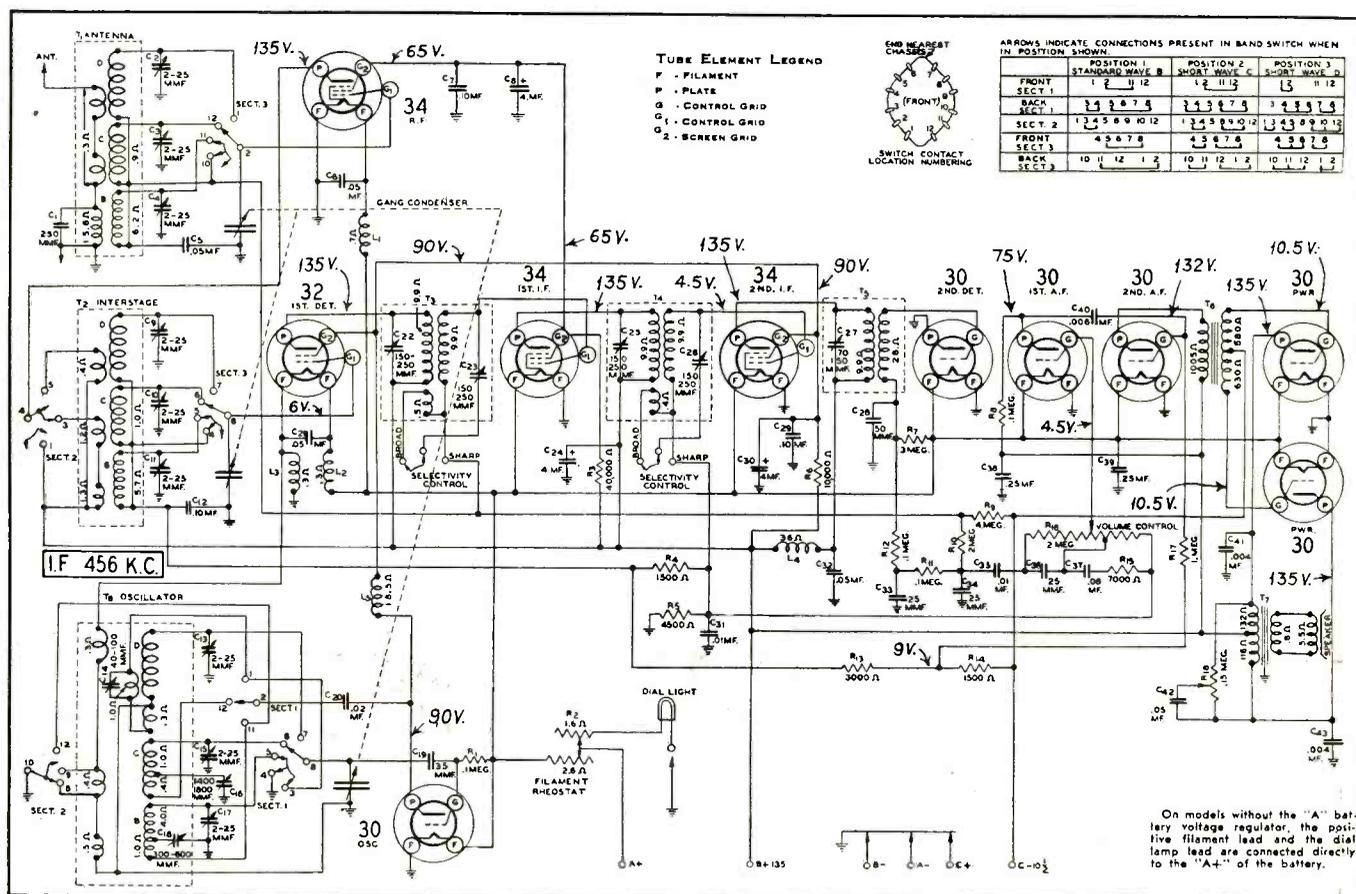


Fig. 1. Wells-Gardner OF Circuit diagram.

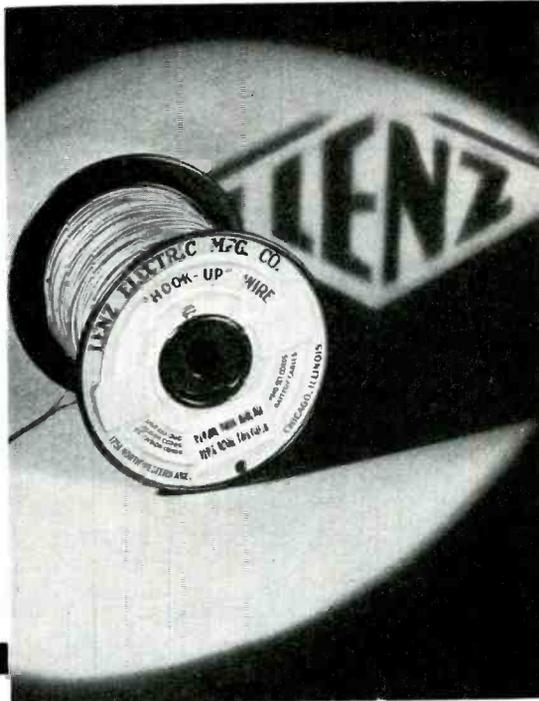
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## GENERAL DATA—continued

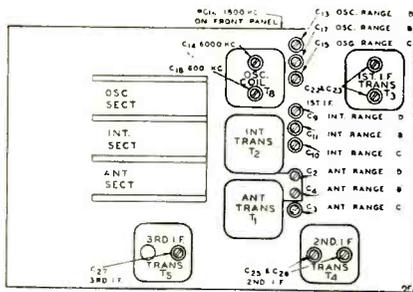


Fig. 2. Trimmer locations.

in a stage of class B amplification. An 8-in permanent magnet dynamic reproducer is used.

### BATTERY VOLTAGES

The C voltages are obtained from the 10½-volt C battery connection and from a voltage divider circuit connected between the 10½-volt C connection and the chassis.

Models with the filament rheostat are connected as shown in Fig. 1. This rheostat permits the use of a 3-volt A battery. As shown in Fig. 1, there are two separate variable resistors one of which controls the filament voltage and the other the dial lamp voltage. In the models which do not have the filament rheostat the A+ connection is made directly to the A+ line and the dial lamps.

The batteries and voltages required are shown in Fig. 1. The A drain is 0.6 amp at 2 volts. Class B amplification is used in the output stage and the B battery consumption will, therefore, depend upon the output volume. The B consumption will also depend, to some extent, upon the strength of the input signal as the latter affects the avc voltage. When no signal is received the B drain is 21 ma. When the volume control is at maximum and with high output volume the B drain can become 47 ma. A milliammeter in the B line will quickly determine if the B drain is excessive or normal.

As the dial lamps are not turned on except for tuning, it is easy to forget to turn off the radio. A continuous drain of this kind for a long period will shorten the life of the B batteries considerably.

Any C battery from which a 10½-volt connection can be obtained may be used.

Models with the voltage regulator on the back panel of the chassis may use any type of A battery delivering from 2 to 3 volts.

When a 3-volt dry A battery is used the voltage regulator pointer (see Fig. 3) should be turned to the left as far as possible. The purpose of this regulator is to reduce the voltage of the 3-volt

battery to the 2 volts required by the tubes. Keep this pointer turned to the left as far as possible. Advance it one-half mark when reception gets weak. This should be about once a week if the radio is used from two to three hours per day. If it is used from four to five hours a day, it will generally be necessary to turn the pointer up one mark a week.

Caution the customers not to turn the pointer up higher than necessary as it will burn out the tubes and run down the battery. Also tell them to turn the pointer back to the starting position when a new 3-volt A battery is installed.

When a 2-volt storage A battery is used the voltage regulator pointer should be turned to the position on the scale marked "2-volt storage battery" and left there at all times.

The models without a voltage regulator are designed for use with 2-volt storage battery. Any other battery of higher voltage if connected directly, will damage the tubes.

If an "Air Cell" A battery is used with these models a series resistor will be required to reduce the voltage to the proper level for the tube filaments.

If the receiver does not operate satisfactorily test the batteries under load. A high resistance meter is required for the B and C voltages. If any of the batteries are considerably below their rated voltage, new ones should be used. When the B batteries are replaced the C battery should also be replaced. The reason for this is that the C drain is such that the C battery is run down in about the same time as the B batteries.

### ALIGNMENT PROCEDURE

Correct alignment is extremely important in connection with all-wave radios. The receivers are all properly aligned at the factory with precision instruments and realignment should not be attempted unless all other possible causes of the faulty operation have first been investigated and unless the service technician has the proper equipment.

A signal generator that will provide an accurately calibrated signal at 456, 1730, 1500, 600, 5800, 5000, 1800, 18,300, 15,000 and 600 kc and an output indicating meter are required. It will be practically impossible to align the receiver if unsatisfactory apparatus is used.

Use a non-metallic screwdriver for the adjustments. The complete procedure is as follows:

#### I-F ALIGNMENT

Set the signal generator for a signal of 456 kc.

Connect the output of the signal gen-

erator through a 0.1-mfd condenser to the grid of the first detector.

Connect the ground lead of the receiver to the ground post of the signal generator.

Turn the band switch to the range B position (standard-wave band).

Turn the selectivity control to the sharp position and keep it in this position for all adjustments.

Turn the volume control to the maximum position.

Attenuate the signal from the signal generator to prevent the levelling-off action of the avc.

Then adjust each of the five i-f trimmers until maximum output is obtained. The adjusting screws for these condensers are reached from the top of the chassis and their location is shown in Fig. 2.

Repeat the i-f adjustments for greater accuracy.

#### RANGE B ALIGNMENT

After the procedure for the alignment of each range as explained below is completed, it is advisable to repeat the procedure as a final check.

**1730-kc adjustment:** Set the signal generator for 1730 kc. Turn the rotor of the tuning condenser to the full open (plates completely out of mesh) position.

Keep the band switch in the standard-wave position.

Connect the antenna lead of the receiver through a 200-mmfd condenser to the output of the signal generator.

For this and all subsequent adjustments keep the volume control at the maximum position and attenuate the signal generator to prevent avc action.

Adjust the oscillator range B trimmer (C17) until maximum output is obtained. The location of this trimmer is shown in Fig. 2.

**1500-kc adjustment:** Set the signal generator for 1500 kc. Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Loosen the pointer screw and set the

(Continued on page 256)

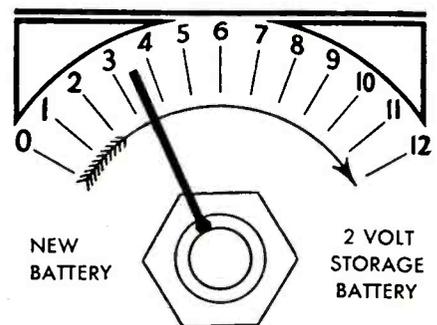


Fig. 3. Battery adjustment.

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## Admiral "Touch-O-Matic" Unit

The Touch-O-Matic tuner can be installed on any radio receiver which uses a six-volt source of supply, where the mechanical layout of the set is such that the tuner unit may be mounted near the variable condenser in the receiver. The Touch-O-Matic tuner is not a booster unit and will not increase the volume or the range of the receiver since it contains no tubes.

### INSTALLATION

The tuner box and the button unit are shipped from the factory connected together by a heavy cable. The only connections to be made are projecting from the open end of the tuner box. These seven wires are to be introduced into holes drilled into the side of the receiver container.

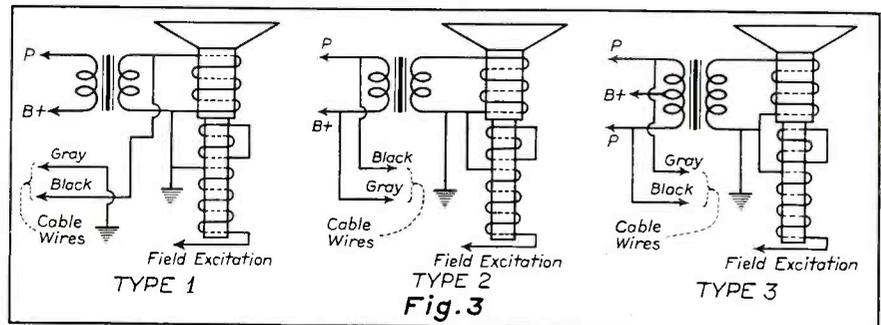
To install the Touch-O-Matic unit on any radio receiver, determine the position for the location of the tuner unit of the Touch-O-Matic, select such a position so that the three radio-frequency wires can be made as short as possible. These wires are the red, yellow and blue wires which connect directly to the switch segments of the Touch-O-Matic (see Fig. 1). The success of the installation is dependent largely upon the shortness of these wires. Long leads may not allow the reception of the high frequency stations at the high-frequency end of the dial.

Drill four No. 33 holes for mounting tuner to side of the receiver container. Drill three  $\frac{3}{8}$ -in holes close to the stator winding lugs of the tuning condenser. Locate these holes in such a manner as to provide the most direct

path for the red, yellow and blue leads. It is important that these wires do not cross each other and that they are not in close relation to one another. Should it be necessary for these wires to cross or come in close relation to one another, they should be provided with some form of low capacity shielding of the type found on the blue wire in the tuner box, as capacity between any of the wires on the gang or tuning condenser will cause excess oscillation and feedback.

made, it may be necessary to add a small shield around the yellow wire in the Touch-O-Matic unit. This shield should be of the low capacity variety, similar to that found on the blue wire, and not of the tight-fitting variety. Under every condition, the red wire should be selected for the antenna section of the tuning condenser. A fourth  $\frac{3}{8}$ -in hole is necessary to allow the admittance of the shielded wire and the gray and black wire into the receiver container. The location of this hole is purely arbitrary as long as it is in the confines of the tuner box.

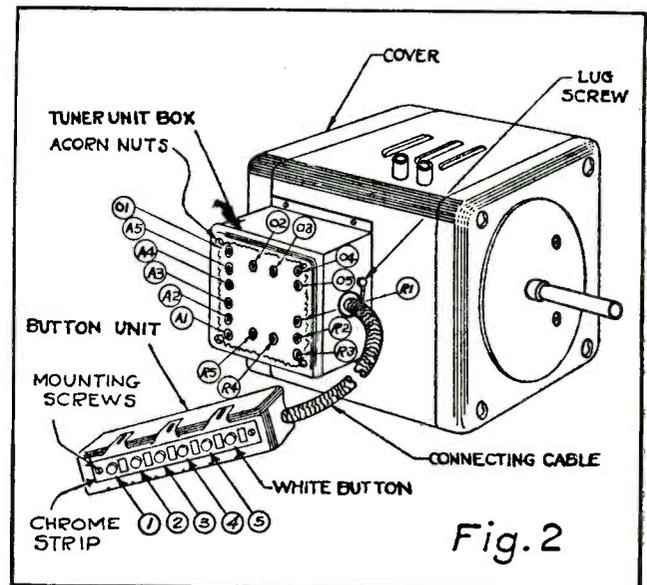
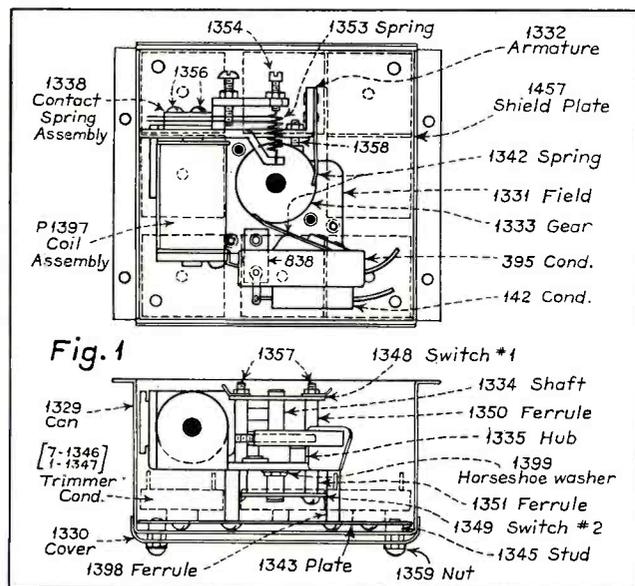
Fasten the tuner to the sides of the receiver by means of the four self-tapping screws provided in the bag of parts.



The importance of keeping these wires as short and as well separated as possible cannot be overstressed. Any tendency for the tuner to cause oscillation may be directly attributed to capacity between these three wires. Proper shielding will stop the oscillation in all cases. If the installation will permit the choice of the yellow wire for the oscillator section, the red for the antenna section, and the blue wire for the interstage or r-f section, the group letters "O," "A" and "R" stamped into trimmer plate of the Touch-O-Matic will have the following meaning: oscillator, antenna and r-f, respectively.

If this selection of wires cannot be

After cutting to the proper size, solder the yellow, blue and red wires to the stator section lugs of the tuning condenser, according to previous selection. Connect the copper strap to the frame of the tuning condenser. Connect the shielded wire to a convenient A source. This may be either at the tube socket, the ungrounded side of a tube filament, the dial light receptacle, or the ungrounded side of the speaker field. Proper choice of the location of this connection will insure a minimum amount of hash (vibrator disturbance) and motor noise. Solder the shield of the shielded wire to the chassis of the receiver.



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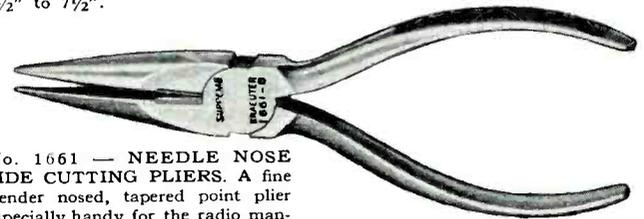


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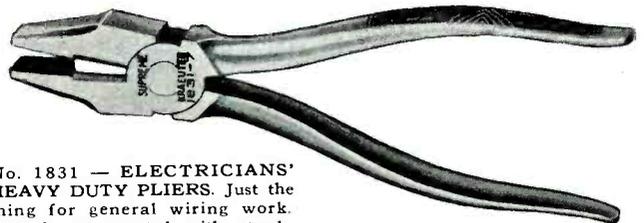
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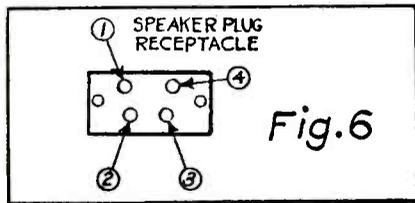
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The wiring of the gray and black wire is determined as follows:

(1) Determine whether or not the receiver in question has push-pull output.

(2) Determine whether the output transformer is mounted in the set or on the speaker (if an external speaker).

(3) Determine whether or not the voice-coil connections of the speaker are easily accessible.

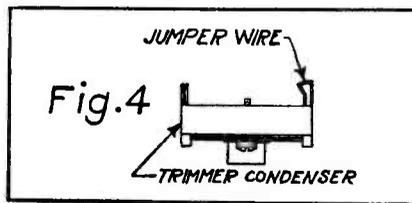
After the above data is obtained, connect the gray and black wires according to the most suitable method suggested by one of the three diagrams (Fig. 3, type 1-2-3). For sets with external or internal speaker with output transformer in chassis, use circuit Type 1. For sets with push-pull output, internal or external speaker, output transformer mounted in set or on speaker, use circuit suggested in Type 3. For all other sets, use circuit suggested in Type 2.

Connect the receiver to battery and turn the set on. Press white button and hold down until clicking stops. If no clicking is heard, press any red button (if still no clicking is heard, check wiring carefully. Be sure that the shielded wire is connected to some source of A supply). Press white button again and hold down until the clicking stops. This places tuner in minimum capacity position in which no trimmer condensers are connected to the receiver. Align the set in the conventional manner.

ADJUSTING UNIT

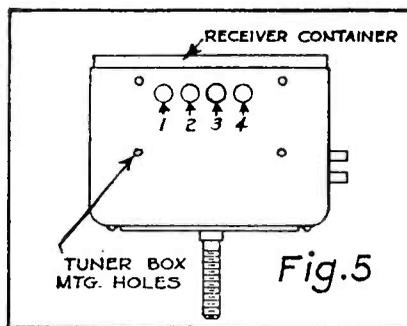
Connect the radio to a battery and turn the set on; press the white button and hold down until clicking stops. (If clicking is not heard, press any red button, then press white button. If a clicking is not heard now, check all the above connections for errors.

Turn the tuning condenser all the way out and by using a signal generator or a test oscillator, adjust the oscillator trimmer condenser located on tuning condenser to 1550 kc. Having once made this adjustment it is important that this trimmer condenser remains untouched while making further adjustments. Now set the signal generator to 1400 kc and rotate the tuning condenser until the signal is received. Ad-



just the r-f and antenna trimmer condensers to the loudest signal or for the greatest deflection of an output meter. No further adjustments of trimmer condensers located in the set are necessary. Rotate the tuning condenser to the extreme high-frequency end, that is, the position with the condenser plates all the way out. This is the position that the condenser plates must take when making adjustments on Touch-O-Matic.

Select the five most desirable stations in your vicinity. The best selection will lie in the most powerful local stations having a frequency of less than 1430 kc. For convenience, arrange the selected stations in order, according to their frequency—from the lowest to the



highest. Press button No. 1, shown in Fig. 2. Select the station of lowest frequency; set the generator to this frequency. Remove the tuner box cover by removing the four acorn nuts, located in the corners of the cover (Fig. 2). Now adjust trimmer screws O1, R1 and A1 (Fig. 2) in the order named, for the loudest signal or greatest deflection of an output meter. If the frequency of the station cannot be reached with the trimmer screw completely open, cut

jumper wire. (See note below.) It will be necessary to cut jumper wire for all stations having a frequency greater than 1000 kc. When all three trimmer screws O1, R1 and A1 have been adjusted for button No. 1, proceed with station No. 2.

Press button No. 2 and set the signal generator to the frequency of this station and adjust trimmer screws O2, R2 and A2.

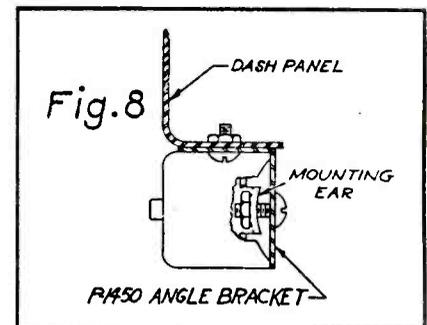
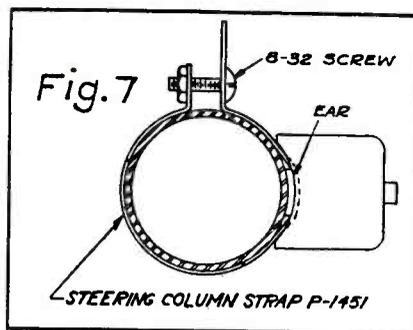
Repeat this operation for the three remaining stations, using O3, R3 and A3 for button No. 3; O4, R4 and A4 for button No. 4, and O5, R5 and A5 for button No. 5.

Note: If the frequency of the station selected cannot be reached when the trimmer screw is completely open, tighten the trimmer screw. Remove the lug screw, located on the cable side of the tuning unit, the four self-tapping screws (see Fig. 2) and the four nuts. Now the tuner box can be lifted off, leaving the inner mechanism exposed. Now cut jumper wire (Fig. 4) of trimmer which does not reach frequency. If any other trimmer condenser does not reach frequency when screw is completely opened, cut its jumper wire. Now replace the tuner box, the four self-tapping screws, the four nuts, and the lug screw. Adjust trimmers. Fasten tuner box cover in place, with the four acorn nuts. Replace the radio set cover.

INSTALLATION ON ADMIRAL MODELS 66, 660, 77, 770, 78, 780, 88, 880

Remove the cover of the radio and take the set out of the container. Now press out the four knockout slugs located on the condenser side of the container (see Fig. 5) (for models 88 and 880 see note below before replacing set in container). Replace and secure the set in the container. Scrape away the paint from around each one of the four mounting holes, shown in Fig. 5, to insure a good electrical contact with the tuner box. Fig. 2 shows a complete assembly view.

The seven wires projecting from the open end of the tuner box are to be



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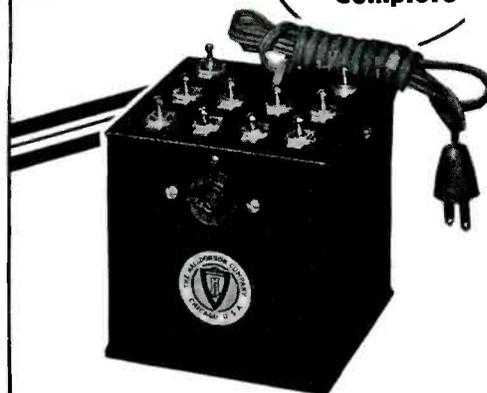
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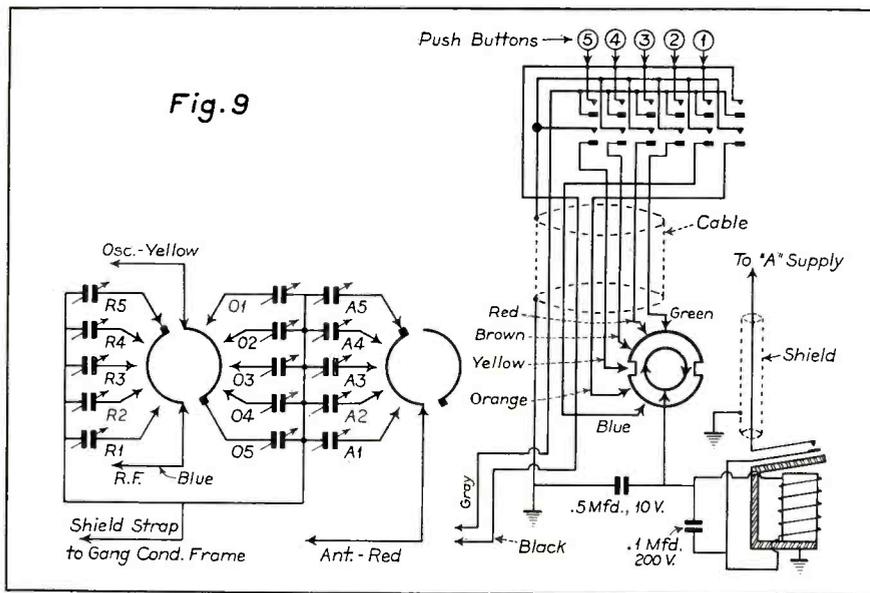
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introduced into the four large holes in the side of the receiver container. The gray, black and shielded wires through hole No. 1 (see Fig. 5); the blue wire through hole No. 2; the red wire and the copper strap through hole No. 3 and the yellow wire through hole No. 4. The tuner may then be mounted as shown in Fig. 2. Use the four self-tapping screws supplied in the bag of parts. After the tuner box has been securely fastened to the container, remove the single section shield located at the top of the r-f section of the tuning condenser. This may be removed by loosening the two bolts at the rear plate

of the tuning condenser. Now solder the blue wire to the lug left exposed by the removal of the shield, replace the shield and tighten bolts. Make the red, blue and yellow wires as short as possible without losing the floating properties of the tuning condenser. Solder the red wire to the stator lug of the middle section of the tuning condenser. Solder the copper strap to the frame of the tuning condenser; preferably one of the center partitions. Solder the yellow wire to the stator lug of the oscillator—front section of the tuning condenser. When the unit is being mounted on the models 66, 660; 77, 770; 78, 780: (For

88, 880 see note below) solder the gray wire to lug No. 2 of the speaker plug receptacle located in the set (see Fig. 6). Solder the wire of the shielded cable to lug No. 3 (Fig. 6). Solder the black wire to lug No. 1 (Fig. 6).

*Note:* When the unit is being mounted on the models 88, 880, solder the black wire to lug No. 4 (Fig. 6). Solder the shielded wire to the ungrounded side of the filament of any conveniently located tube, and the gray wire to lug No. 1 (Fig. 6). All the necessary connections are now made.

The Touch-O-Matic screws should then be adjusted as indicated above for the particular stations chosen.

### Arvin 39

The Arvin 39 is a 7-tube auto-radio receiver using G type tubes (glass tubes with octal bases) in a superheterodyne circuit. The frequency range from 540 to 1575 kc is covered with an available audio output of 7.5 watts. The average current drain with a 6-volt battery is 7.2 amperes.

### THE CIRCUIT

A complete circuit diagram is given in Fig. 1 with the tubes used, their functions and the various voltages encountered on the socket prongs lettered on the diagram. The voltages were measured with a 1000-ohm-per-volt voltmeter with the antenna shorted to the chassis and the volume control on full. The input battery voltage was 5.8 volts when the measurements were

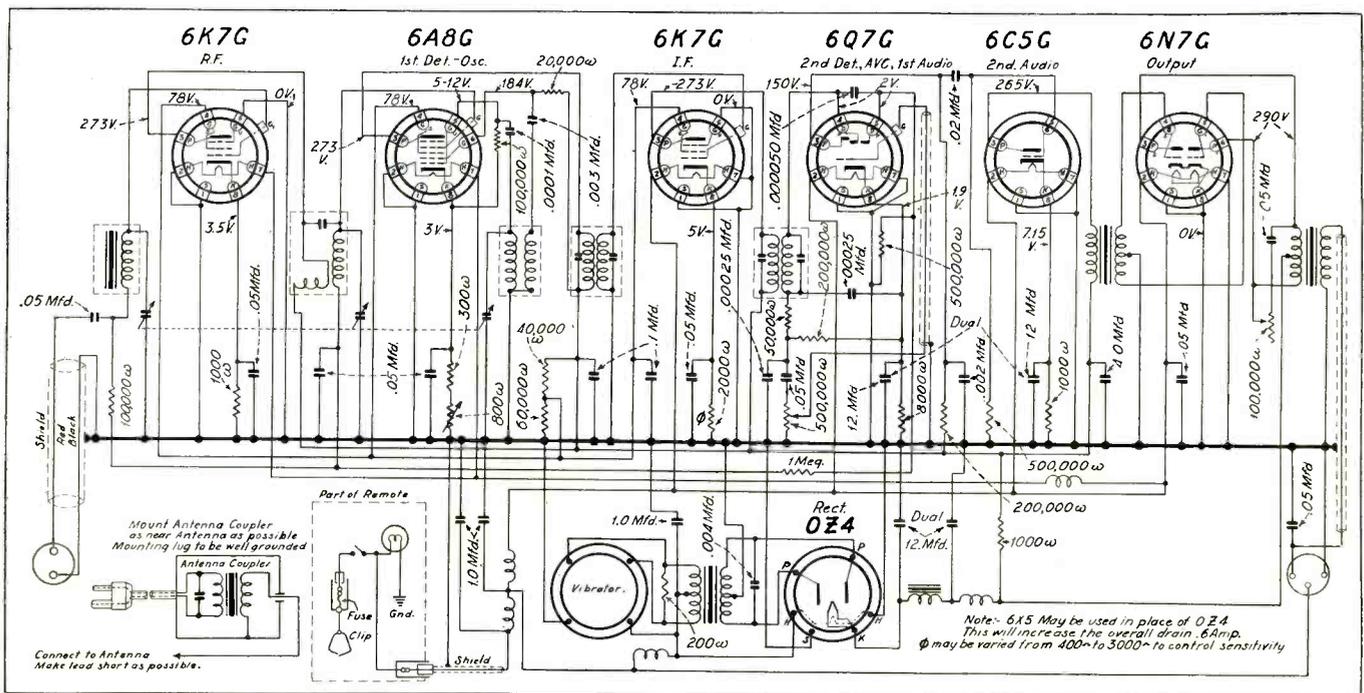
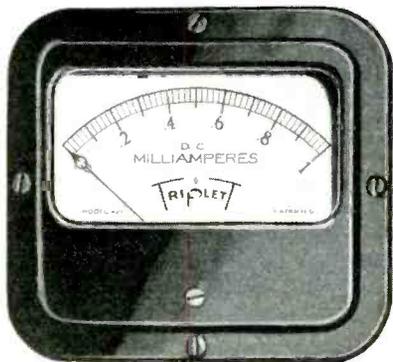


Fig. 1. Arvin 39 circuit diagram.

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237

made. The normal voltage present on the heaters should be 6.3 volts with a fully charged battery. It is assumed, however, that the average battery used on the service bench without constant charging would not show more than the 5.8 volts used in making the measurements. A corresponding increase in all the voltages should be expected if a fully charged battery is used.

In the Arvin Model 39 the signal is first fed into a "phantom filter" which is designed to improve the efficiency of the car antenna and reduce the noise-to-signal ratio. An iron-core antenna transformer feeds the 6K7G r-f stage with an even gain air-core coil between this and the 6A8G first detector-oscillator stage. A single i-f stage uses two "permaset" prebalanced i-f transformers with another 6K7G tube. One diode of the 6Q7G tube is used as the second detector and the other as an avc rectifier. The avc voltage is applied to the r-f and first detector stage. The bias on the i-f stage is controlled by means of a semi-variable "geographic compensator" connected in series with the cathode of the i-f tube. The voltage on this cathode may thus be adjusted from 2 to 6.4 volts, depending upon the sensitivity required in the particular location in which the receiver is to be employed.

The triode section of the 6Q7G is

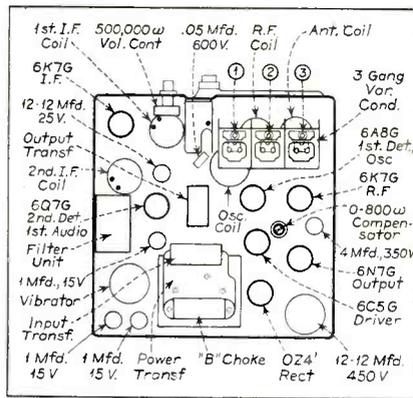


Fig. 2. Arvin 39 parts layout and trimmer locations.

used as a first audio stage and is resistance coupled to a 6C5G second audio or driver stage which in turn is transformer coupled to a 6N7G double triode. The 6N7G is used as a push-pull, class B power output stage—operating with zero initial bias.

**ALIGNMENT PROCEDURE**

The Arvin 1937 models are equipped with "permaset" prealigned i-f transformers which require no adjustment whatsoever. It is, therefore, necessary to adjust only the three screws located on the tuning condenser for complete alignments.

Connect the output meter across the voice coil or across the primary of the speaker transformer. Connect the test oscillator to the antenna and ground terminals of the "phantom filter." Rotate the tuning condenser until the plates are completely out of mesh. Turn the volume control on full.

With the test oscillator set at 1575 kc adjust trimmer No. 1 (see Fig. 2) for maximum output, keeping the signal in the speaker just audible by reducing the attenuator on the test oscillator.

Reset the test oscillator to 1400 kc. Rotate the tuning condenser until this signal is tuned to resonance (maximum deflection of the output meter). Reduce the output of the test oscillator until the signal barely deflects the output meter. Adjust trimmers Nos. 2 and 3 until maximum output is indicated on the output meter.

Repeat the r-f adjustments to assure more accurate alignment.

After the receiver is installed in the car tune in a weak station between 1150 and 1400 kc and readjust trimmer No. 3 for loudest response in the speaker.

**Howard HA-6**

The Howard HA-6 auto-radio receiver is a 6-tube superheterodyne de-  
(Continued on page 258)

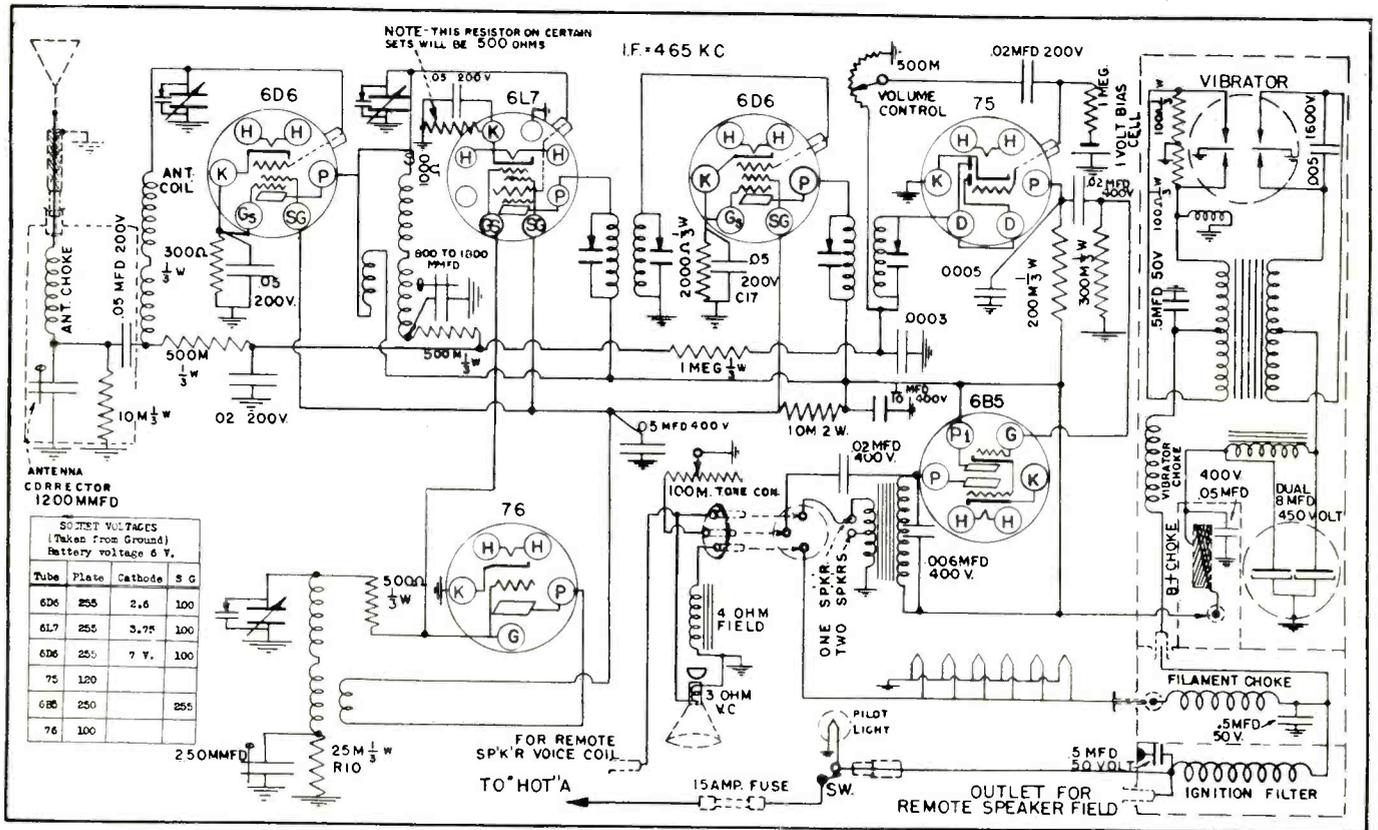


Fig. 1. Howard HA-6 circuit diagram.

**HIGHEST**



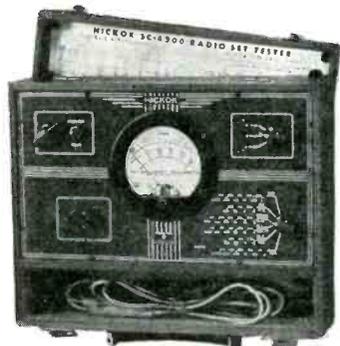
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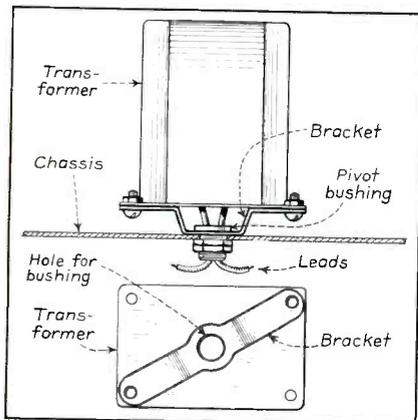
# ON THE JOB . . .

## Reducing Hum Pickup

Hum induced into the input or inter-stage transformers may often be reduced materially by rotating the transformers. To facilitate rotating the transformer may be mounted as shown in the accompanying diagram.

A "U" shaped bracket is bolted diagonally across the base of the transformer. The assembly is then mounted by means of a threaded bushing through the center of the bracket and the chassis. The transformer connections are then passed through the hole in the bushing.

After the transformer is connected into the circuit it may be rotated until minimum hum is evident in the speaker. It will be noticed that a slight turn (1 or 2 degrees) either way will bring back an appreciable amount of the hum. It is



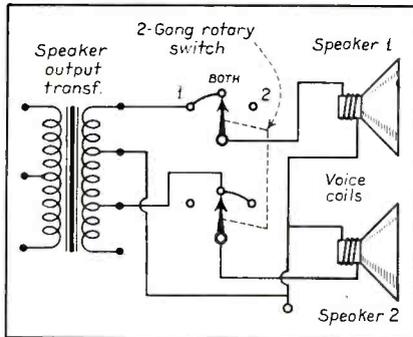
because of this that the method described is advantageous in reducing hum.

C. D. Miller.

## Speaker Selector

It is often desirable in dual speaker installations to be able to switch to either one of the two or to both together. Through the use of a two-gang rotary switch, connected as shown in the accompanying illustration, any of these alternatives is possible without mismatching of the output circuits.

For example, if it is desired to use two speakers, each having a 4-ohm voice coil, the voice coils are connected in series and the common connection is connected to the 4-ohm tap on the output transformer secondary. The 0-ohm tap is connected to the first and second contacts on the top deck of the rotary switch. The third contact on this deck is left free. The 8-ohm tap of the output transformer secondary is connected to the second and third contacts on the lower deck of the rotary switch. The first contact of this deck is left free.



Thus only the first speaker will be on when the switch is turned to the left; both will be on with the switch in the middle position and only the second speaker will be on with the switch to the right.

If it is desired to turn off the speaker fields as well as the voice coils, two additional decks on the same switch can be connected similarly for that purpose.

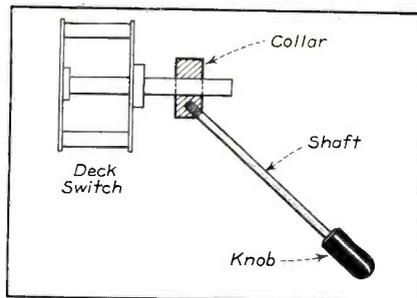
## Adjusting the Padder

It is often difficult to adjust the low-frequency padder and rock the tuning condenser at the same time because of the position of the padder. In such cases the same result can be obtained if the test oscillator tuning condenser is rocked while making the adjustment—after the gang condenser has been set for maximum output. In either case the final adjustment of the padder is the position giving the greatest output as a result of the combined operations.

## Telephone Type Toggle

A two- or three-position rotary switch, with any desired number of gangs, can be used as a toggle-switch similar to the anti-capacity type used in telephone circuits.

A collar, tapped for two set screws, is slid over the shaft with a long threaded rod in place of one of the set screws. The switch can be mounted at right angles to the panel on a suitable bracket.



## Phasing Speakers

Speakers may be phased, two at a time, by placing them face to face about 8 or 10 inches apart. The amplifier is turned on and the volume set so that the output is just audible. The listeners head is then placed between the two speakers.

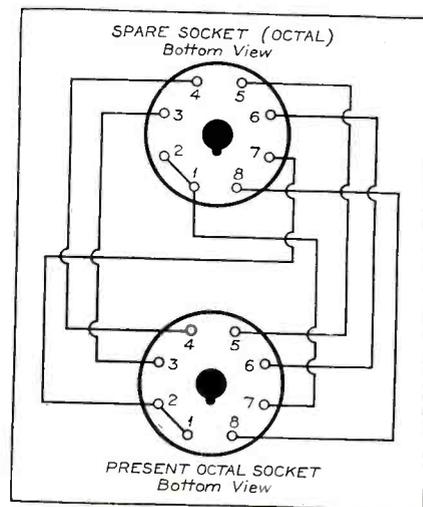
If the speakers are out of phase the sound will very definitely appear to come from one or the other of the speakers. If the speakers are in phase the sound will appear to originate in the listener's head. By phasing one with another any number of speakers can be properly connected.

If this method is used the speakers will be phased for operation on the same panel or parallel to each other. If operation calls for the facing of the speakers or back to back the voice coil connections of either speaker (only) can be reversed.

John Woslyng

## Adapting Weston 770, 771 to 5Y4G and 5X4G

The wiring changes indicated in the accompanying diagram will enable the user of the Weston Model 770 or 771 tube tester to check the 5Y4G and the 5X4G tubes. These testers were not



originally adapted to testing of these tubes.

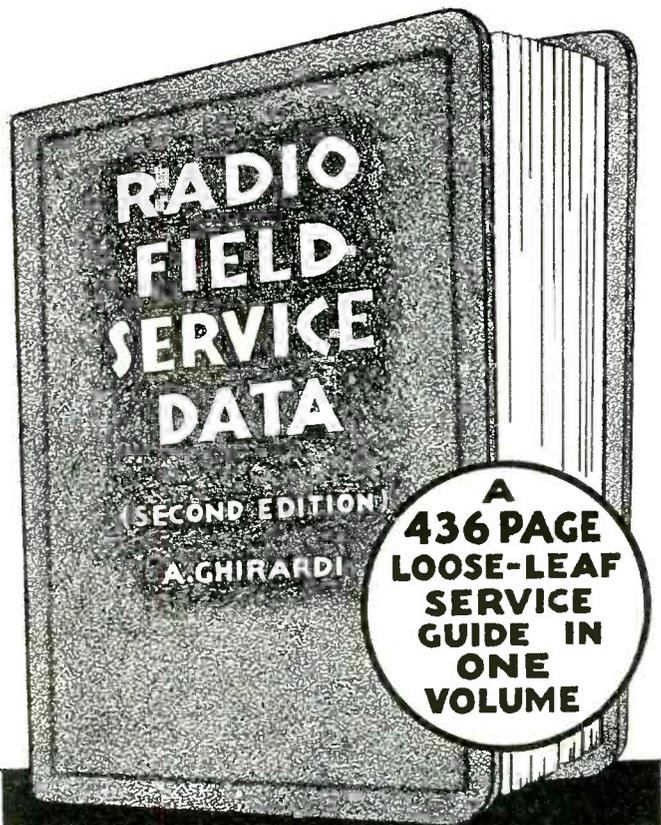
The spare socket should be wired to the octal socket already in use as indicated in the diagram. This diagram shows only the wiring which is to be added. The original wiring is not shown.

After the change is completed the 5X4G and the 5Y4G can be tested in the spare socket in accordance with the following data:

Tube type	5Y4G	5X4G
Filament Selector	5	5
Tube Selector	35	41
"In" Position	B	B
Second Plate	D	D

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# TEST EQUIPMENT...

## United Motors 652 Service Panel

The model 652 radio test panel is divided into three sections containing testing instruments necessary to locate and correct trouble in automobile or home radio receivers. The output meter is calibrated in both watts and volts. The meter reads directly in watts when used in conjunction with the universal test speaker which is located behind the louvres in the panel at the right-hand side of the instrument. Connection of the output meter is made directly to this speaker by throwing the switch in the master speaker position. When the output meter switch is thrown toward the output meter post, the meter can be used externally and is calibrated in volts.

### SIGNAL GENERATOR

The signal generator is located in the left-hand section. It covers fundamental frequencies from 100 kc to 30 mc and is furnished with calibrated charts. In addition a reference chart is located on the front of the instrument, showing the dial setting for current alignment and testing frequencies. The ranges covered by the signal generator are by means of five coils mounted on a rotary mechanism. Each tuning band is covered by a double action dial with 100 divisions for each quarter turn. Both 400-cycle modulated and unmodulated signals are available.

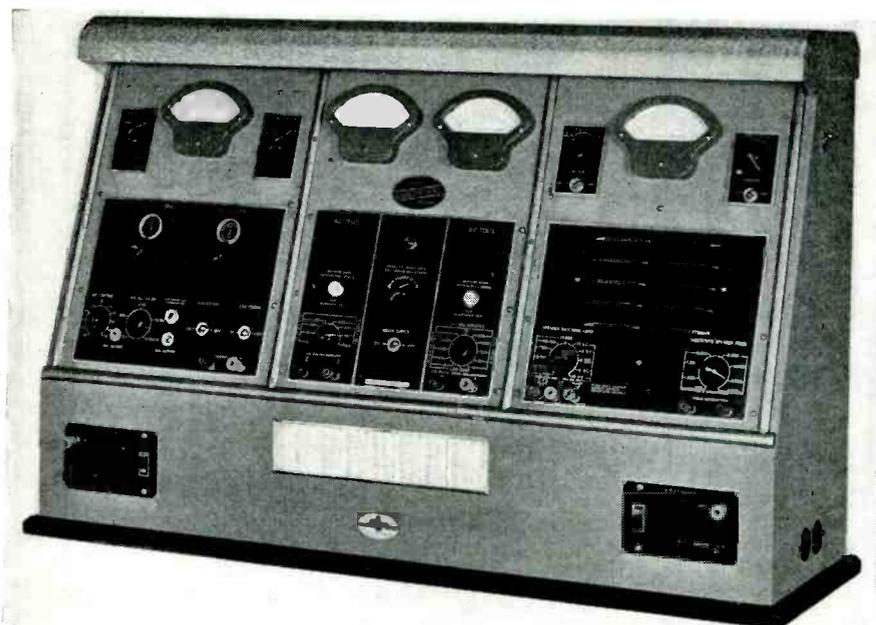


Fig. 1. United Motors 652 service panel.

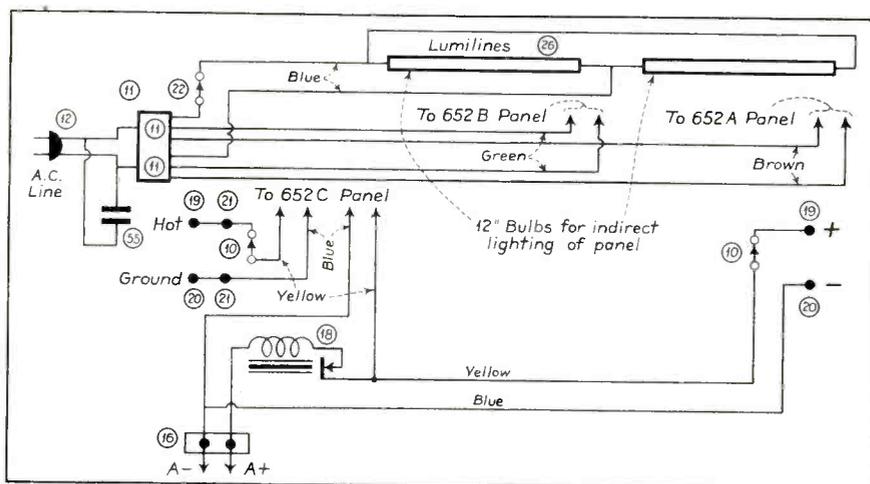


Fig. 2. Power supply circuits.

### VOLT-AMMETER

For testing voltage and current on auto-radio sets, there is a volt-ammeter permanently connected to the battery supply reading up to ten volts or twenty amperes. Auto-radio vibrators are tested without removal from the receiver by regulating the input voltage with a rheostat and noting the point at which the vibrator begins to operate which should be 5 volts or less. The condition of the rectifying contacts in the vibrator can be checked by measuring the voltage of the receiver. The measurement of the set output in conjunction with the step type attenuator

on the signal generator, indicates the condition of the tubes in the receiver.

### BATTERY CIRCUITS

The battery circuits are protected against overload by a relay which can be set to trip at 10 to 15 amperes. A loud buzzing sound from within the cabinet indicates that the relay has tripped due to overload or short circuit on the battery circuits.

The two binding posts and jumbo jacks at the lower left of the cabinet marked "+" and "-" are not metered as they are intended for use in connecting a radio to the battery for a playing test. The circuit is protected against overload by the same relay which protects the right-hand battery circuit.

The two binding posts at the lower right of the cabinet marked "Hot" and "Ground" are for general work and are fully metered as to voltage and current drawn from the battery circuit at this point.

The volt-ammeter can be selected to read "volts" (0-10 volts) or "amps" (0-20 amperes) by means of the switch marked "Meter." In addition, this current and voltage can be regulated by the rheostat marked "Vibrator Test." The switch designated "Polarity," is provided for changing the polarity of the current at the lower right-hand "6-volt supply."

### SUBSTITUTE SPEAKER

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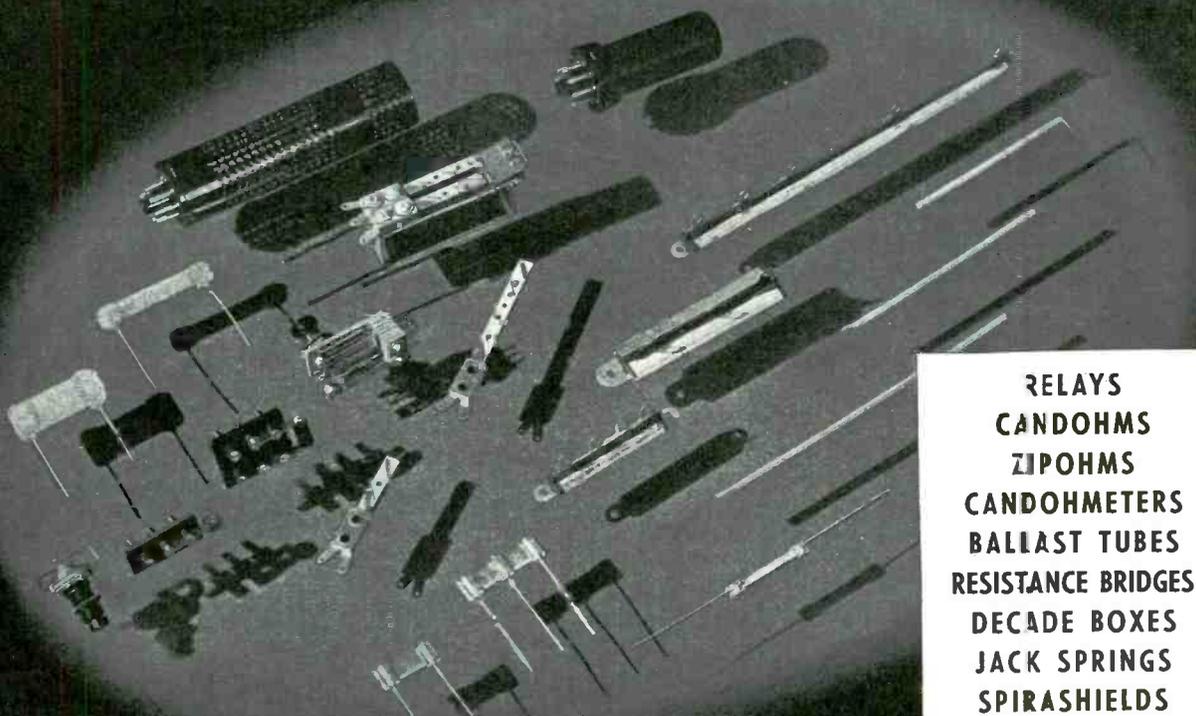
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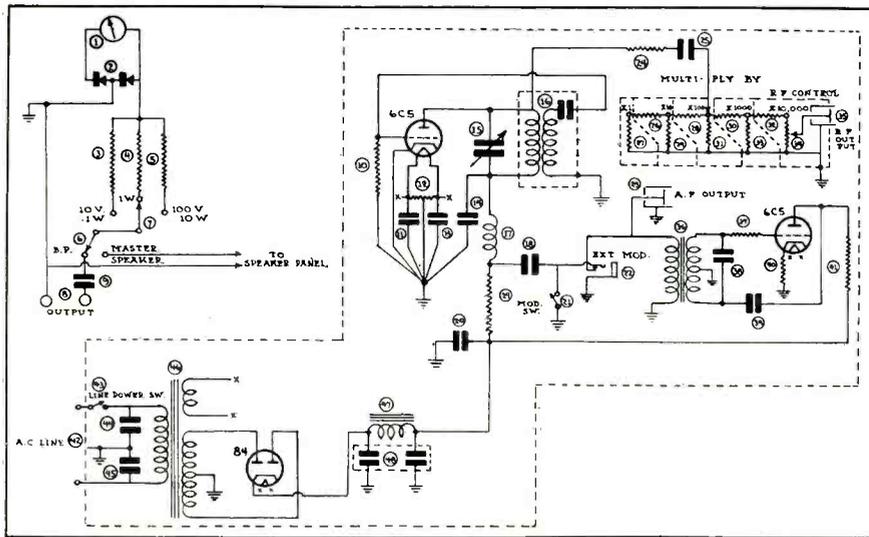


Fig. 3. Left-hand section with signal generator and output meter.

universal test speaker. Voice-coil impedances of 1½, 3, 5, 8 and 15 are provided with plate loads of 2500, 4000, 5000, 7500, 10,000 and 15,000. The nearest value should be used.

### MAINTENANCE

The four meters should be checked periodically to make sure that the indicating needles are set to zero. Adjustment is made by means of the small round head screw in the center of the

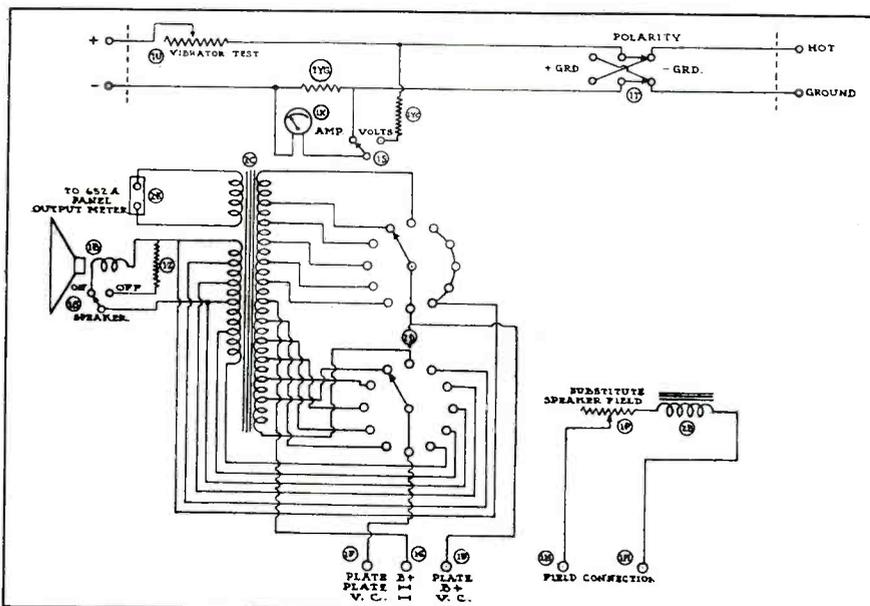
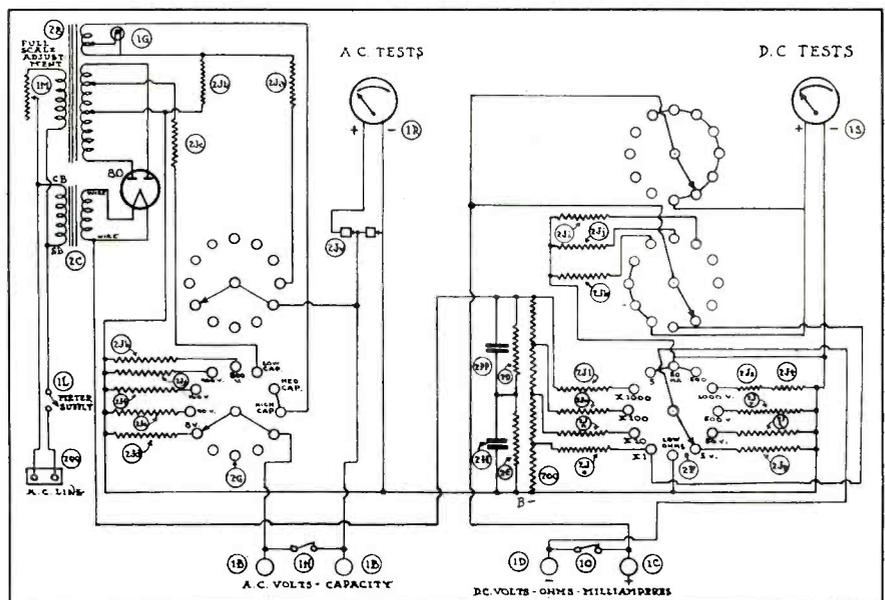
up to the output circuit by means of the universal output transformer which is an integral part of the speaker matching section.

No field current is necessary to energize the field as a "Perm-O-Flux" permanent magnet dynamic speaker is used.

A universal substitute speaker field is built in the panel for testing home radios where the speaker field is normally used as the power supply filter.

By means of the speaker test cable (652-8) and the proper adapter (also supplied with the test panel) the output of the receiver can be matched with the

Fig. 4. Center section for a-c and d-c volt-ammeter tests.



meter cover.

The ohmmeter is operated from a built-in power supply and rectifier tube. In case the ohmmeter ceases to operate caused by a worn-out tube it can be located and replaced by removing the back cover of the case.

The signal generator contains two 37 and one 36 tubes, which are not particularly critical. They are worked at a low level and should have a long life.

Two Mazda 40-watt 120-volt lumo-line bulbs are used at the top of the panel for lighting effect. These are removable by pulling straight down at each end of the bulbs.

Fig. 5. Right-hand section with substitute speaker and vibrator tests.

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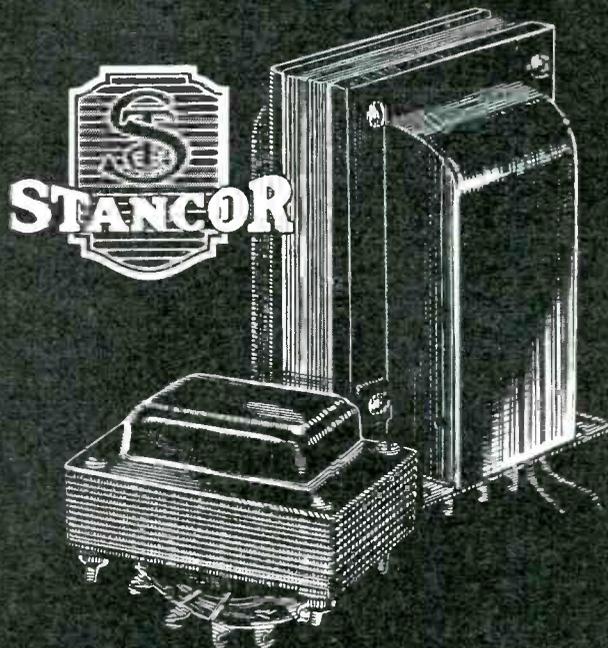
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## STANDARD TRANSFORMER CORPORATION

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# RECEIVER CASE HISTORIES

## Air-Castle (Radio Products Co.)

*Circuit diagrams:* Circuit diagrams of these receivers may be found in the manuals under Balkeit and others under Trutone (Western Auto).

*Inoperative on part of dial:* Trouble may be experienced on some models with the 6D8G which refuses to oscillate. Often the trouble may be eliminated by substituting a 6A8 (or 6A8G). The latter draws slightly more current but will not affect the circuit materially.

Francis C. Wolven

## Belmont 770-Series A, 777-Series B-C

*Frying noise:* When a model 777 or model 770 receiver is first turned on, a frying noise will generally be noted. This noise continues until the tubes warm up and the receiver begins to draw current. It is created by scintillation of the electrolytic filter condensers. During the time the tubes are warming up, they draw no current from the rectifier causing the voltage across the first condenser to exceed the scintillating voltage of the electrolytic condenser. The condensers used however are of the regulating type and are purposely designed in such a manner that during the heating period of the tubes, the condensers draw considerable leakage current, thereby loading the rectifier and preventing excessive voltage on other circuit components. The condensers are designed to withstand this temporary overload without detrimental effect on the life of the electrolytic or the receiver. Do not therefore replace condensers because of this scintillation noise. Rather consider it as a sign of normal operation.

*Intermittent hum:* In a few isolated cases, difficulty has been experienced with intermittent hum. This hum usually appears only after the receiver has been allowed to operate for some time and temporarily disappears upon snapping the line switch off and on. This difficulty is generally due to the opening up of the common lead of the dual condenser (0.1 and 0.25 mfd, 200 volt) at the point of attachment of the lead to the condenser foil.

This condenser is indicated as C-18 and C-14 on the circuit diagram, C-14 is the 0.1-mfd, 200-volt screen by-pass for the 6B7, while C-18 is a 0.25-mfd, 200-volt unit acting as a hum filter for the bias voltage of the type 42 tube. Examination of the circuit will show that when this occurs, the entire hum voltage

of the filter is impressed on the screen of the type 6B7 tube. When the above difficulty occurs, it is generally advisable to replace the entire unit by two separate units of identical capacity and voltage rating as the components of the original unit.

## Detrola 6P2, 6W, Etc.

*Low volume accompanied by distortion:* The 75 tube was found to be over-biased and the 42 was underbiased. This condition was caused by a leaky 0.01-mfd, 400-volt coupling condenser. The peculiar effects were due to the fact that the bias for the 75 is obtained from a low resistance in the negative side of the system. Anything that tends to increase the total drain through this resistor will overbias the 75 and, in the above case, decreased the plate current of the 75. This simply aggravated the effect of the leak in the coupling condenser. There was a difference of about 50 volts between the plate and screen voltages on the 42 due to the heavy plate current. This type of circuit is a favorite with some other manufacturers, notably Grunow, and is subject to the same type of trouble.

Francis C. Wolven

## G.E. A-125

*Noisy reception:* A bad case of noise and scratching in this model was cleared by tightening the bolts which hold the i-f shield cans to the chassis. Lockwashers will help prevent a repetition.

*Inoperative:* No voltage on 6L7 screen. Shorted 0.05-mfd screen by-pass condenser (C-16). Replace with one of the same value but higher voltage rating.

*Inoperative:* No voltage on 6L7 plate. Shorted plate return by-pass (C-43) and burnt-out plate return isolation resistor. Condenser value, 0.05-mfd; resistor, 2,000 ohms.

George F. Oelkers

## G.E. A-125

*Operative wide open, no avc action:* A common cause of this condition is a shorted by-pass condenser on the screen of the 6K7 avc amplifier stage. This is a 0.05-mfd, 200-volt condenser. It should be replaced by one of the same capacity but with a higher voltage rating. Because of the special design of the receiver anything that affects the operation of this stage will affect the avc action

Francis C. Wolven

## G.E. M-50

*Sputtering noises when the set is first turned on, apparently confined to the audio system but unaffected by the setting of the volume control:* This is often caused by poor connections at the point where the taps are taken off the voltage divider. The tap supplying the 6B7 in this case was the chief offender. The best remedy is to run a knife through the slot in the fiber insulation cutting all the wire winding between the taps. The connections can then be bridged with external wire-wound resistors. The values are 10,000, 5,000 and 5,000 ohms respectively.

Francis C. Wolven

## Hudson-Essex (RCA) DB-37

*Loses volume and finally becomes completely dead:* Set will motor-boat if shocked with the volume control wide open. A large voltage will be evident on one diode plate due to a short in the second i-f transformer. This is caused by the bare plate return lead rubbing up against the secondary winding. A new transformer is seldom necessary. Simply cover the bare leads with spaggetti.

Francis C. Wolven

## Motorola Golden Voice

*Motor noise:* It is easily possible for water to get into these receivers when they are mounted under the hood. Because of corroded grounds, in the receiver and eliminode unit, motor noise will result. In these cases it will be necessary to remove the chassis from its case and clean all the corroded connections in the receiver and eliminode.

Allan Siepman

## Packard-Bell 48

*No indication on 6G5 tube, set plays O. K. otherwise:* This was caused by an open 1-megohm resistor in the base of the 6G5 socket.

George F. Oelkers

## Philco 37-610B

*Weak at times:* The signal in the speaker would drop in strength when the 6K7G i-f tube grid was touched. Normal volume could be restored by removing and replacing any tube. After considerable checking the first i-f grid coil and cap connection were found to have developed excessive resistance. Replacement of the coil and resoldering of the cap eliminated the trouble.

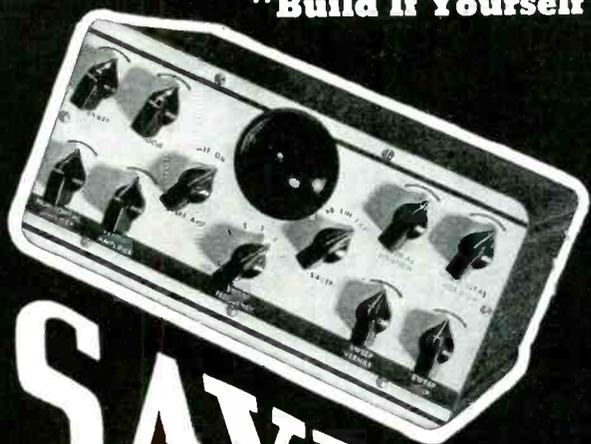
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WEBSTER-CHICAGO'S

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AC-DC Operation

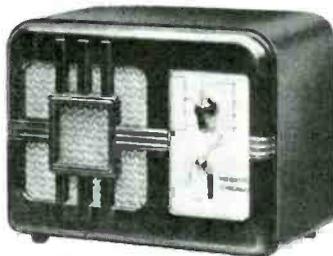
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## RECEIVER CASE HISTORIES—continued

### Philco 805, 806, 807, 808, 809

**Noisy reception:** The by-pass condensers on the underchassis of these models often break loose due to the vibrations of the car. To prevent a repetition of this defect a special bracket should be made for each condenser to secure it to the chassis.

Allan Siepman

### RCA 117, 214

**Sputtering noises when the set is first turned on:** (See G. E. M-50).

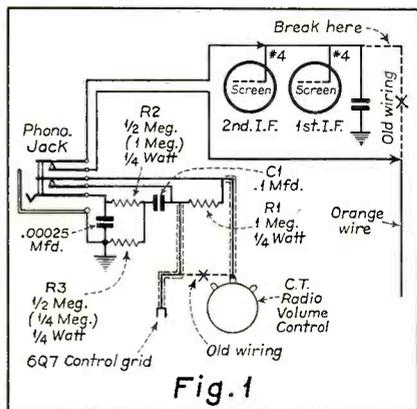
### Stromberg-Carlson 140-L, 145-L

**Phonograph connections:** These models have fine quality in reproduction of phonograph records. However, there are a few changes which will improve their performance both for records and radio reception.

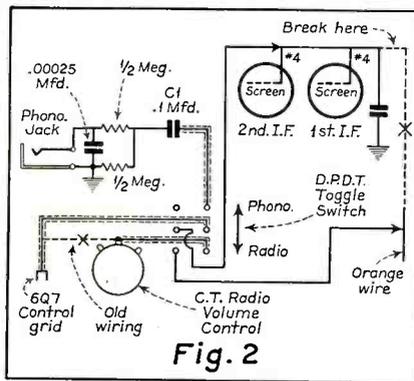
When playing records in which bass notes predominate, vibrations may be set up in the vicinity of the speaker. To prevent this remove the wooden back from the cabinet and unscrew the 10 wood-screws holding the labyrinth to the front of the cabinet. There are six unused holes in the flange of the speaker. Fasten this securely to the baffle board with wood-screws. The metal screen fastened to the bottom of the cabinet with staples should also be securely fastened with wood-screws and large fibre washers.

The front and back of the labyrinth should be fastened tightly against the sides (of the labyrinth). The seams should be sealed with gummed tape. To prevent the wood back panel from vibrating a large piece of felt or flannel can be glued to its inner side.

A phonograph pickup with an external volume control can be connected to the 140-L and 145-L using either of the following circuits: in the diagram given in Fig. 1, it is necessary to insert



Stromberg-Carlson 140-L, 145-L phonograph plug connections.



Stromberg-Carlson 140-L, 145-L phonograph switch connections.

the pickup plug in order to play records. The plug is removed for radio reception. In this circuit the condenser  $C_1$  and the resistor  $R_1$  are very essential. The former prevents the external volume control from grounding the 6Q7 grid to the chassis and causing incorrect bias. The latter maintains the correct bias on the grid when the phonograph connection is in use. If a high-level crystal pickup is used the resistors  $R_2$  and  $R_3$  should be changed to the values indicated in parenthesis. This change makes it unnecessary to turn the external volume control too near its off position in order to obtain a comfortable volume level.

The circuit given in Fig. 2 may be used if it is desired to switch from radio to phonograph without removing the plug. The double-throw switch may be mounted in any convenient location but the wires leading to it must be shielded.

E. M. Prentke

### Stromberg-Carlson 145, 150, 160, 180

**Secondary dial slips:** The slipping of the secondary dial in these models is caused by improper meshing with the driving gear. It will be necessary to remove the chassis from the cabinet to correct this.

The dial escutcheon plate is secured to the dial assembly with four self-threading screws. The large dial disc is locked on the shaft with two set screws at the rear of the disc. If the dial disc sticks insert a 10-32 machine screw in the center; screwing this up will remove the disc without damage.

The secondary dial slides off the shaft. A small bar (marked D) can be seen through a rectangular opening as indicated in the lower left corner of the accompanying diagram. Above it is a locking screw (marked A in the diagram). Loosen the screw A and with the point of a screwdriver pry the bar D as far to the left as it will go. During this operation the little gear on the rear

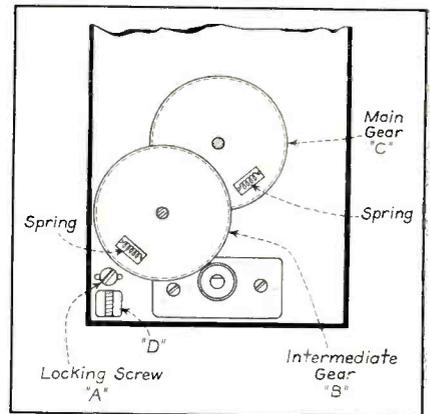
side of the gear marked B will disengage from gear indicated as C on the diagram.

Each of the gears B and C are made up of two thin sections with a small spring inserted through a slot in the sections. When the gears are properly adjusted these springs prevent backlash.

Rotate the rear section of gear C counter-clockwise for a distance of two teeth and hold it in this position while the bar D is pushed to the right with the screwdriver point so that the small gear on the back of gear B engages the teeth of gear C.

The rear section of gear C can now be released. Again, with the screwdriver pry the bar D very, very slightly to the left, to make gears work smoothly and freely and clamp screw A. Rotate the tuning shaft several times through its range to determine if the gears work the same throughout.

Now rotate the rear section of the gear B for a distance of one tooth and



Stromberg-Carlson 145, 150, 160, 180 dial gearing.

hold it in place while the secondary scale is replaced, meshing the teeth of its gear with those of gear B. Release gear B and test the smoothness of its action by rotating the tuning shaft.

Replace the main dial and the other parts as they were originally.

Stromberg-Carlson Telephone Mfg. Co.

### Zenith 6-M-90, 6-M-91, 7-M-91

**Noisy reception and set inoperative at times:** After checking the tubes and making necessary replacements if the set is still noisy examine the 600-kc padder condenser. The ground lead often breaks loose at the tuning condenser ground or at the padder itself. By grounding this lead to the chassis a permanent cure will be effected.

Allan Siepman

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# ASSOCIATION NEWS . . .

## IRSM REPORTS

### Cleveland Chapter

Local interest in new equipment and preparation for the NRSQP examination boosted the average meeting attendance for the Cleveland Chapter for March.

Maynard Elliott has been contacting the local jobbers in an effort to urge them to demonstrate the latest in test equipment—considerable success has crowned his efforts. This is proving to be an excellent method in keeping the gang posted on what's new and worthwhile.

We're going to miss Clark Quinn here—he has gone to Detroit for Philco Transistone—it's Detroit's gain, but our loss. Clark has been one of the standard bearers at the Cleveland Chapter since its early days. Happy days, Clark!

*L. Vangunten*

### Manchester Chapter

At a recent meeting of the newly formed Manchester Chapter the following officers were elected: Arthur B. Sanborn, chairman; George B. Craig, vice-chairman; Frank E. Allard, secretary; George Lefebvre, treasurer, and Raymond C. Gallagher, program committee chairman.

Through the efforts of our chairman, Radioneer Arthur B. Sanborn, Manchester, N. H., is represented in the IRSM. The chapter has a good start with fifteen paid-up members and more on the waiting list.

*Frank E. Allard, Secretary*

### Newark Chapter

On March 9, at the Krich Auditorium in Newark, N. J., RCA presented their lecture entitled "Training the Ear and Eye for Radio Servicing." An enthusiastic group attended, and from the remarks and number of side discussions in the hall after the meeting it seems a great deal was learned through the lecture.

At the Hotel Douglas on March 25, M. J. Shapiro of the Radiart Corporation, assisted by C. B. Cooper, factory representative, gave the boys some up-to-the-minute information on vibrators.

The recently elected officers (for 1937) are: Carl Rauber, chairman; J. J. Lax, vice-chairman; Ralph Hohman, secretary; R. H. Wright, treasurer; Berger Holmes, sergeant-at-arms, and T. W. MacDowell, publicity chairman.

The regular technical meetings of the Newark chapter of the IRSM are held on the second and fourth Thursday of each month at the Hotel Douglas in Newark, N. J.

*T. W. MacDowell, Publicity Chairman*

### ASSN. OF RADIO SERVICE ENGINEERS

The meeting of March 16 was turned over to H. P. Fillmore of the RCA-Victor Distributing Corporation. Mr. Fillmore introduced Paul Melroy of the RCA Manufacturing Company who conducted the current RCA lecture "Training the Eye and Ear for Radio Service."

After adjournment refreshments were served through the courtesy of the RCA-Victor Distributing Corporation.

*Anthony Schreiber, Secretary*

### MARYLAND RADIO SERVICE ASSN.

At the meeting held Friday, April 2, at the New Howard Hotel, George C. Connors, field engineer for Hygrade-Sylvania Corporation, gave the boys ninety minutes of practical information on the topic "A-C versus D-C Testing of Receivers." A sound picture was shown as part of the lecture.

On April 9, Robert G. Herzog, editor of SERVICE Magazine, is scheduled to speak on "Typical Receiver Troubles and Cures." The talk is to be in the nature of a discussion in which the members take part.

On April 23, John F. Rider, publisher, is scheduled to talk on "The Service Industry, Where Is It Heading?"

These meetings are to be held at the New Howard Hotel on the dates mentioned.

The officers and committees are making an earnest effort to provide interesting meetings and nationally known speakers. If members do not approve of the subjects offered—or if any changes can be suggested they are urged to come to the meetings and voice their opinions.

*William A. Thompson, Secretary*

### RADIO SERVICE ASSN. OF CALIFORNIA

Monday, March 15, at 921 Harrison Street, in Oakland, California, Herbert E. Metcalf, noted patent attorney, spoke on the "Farnsworth Multipactor Tube and Its Uses in Radio and Television." Mr. Metcalf is in a position to have intimate and first-hand knowledge of the progress and developments in the field of television. The talk was of outstanding interest to the attending members.

Al Grabau gave ten minutes of dope on the 6Q7 and the 6R7.

On March 26, RCA and the Leo J. Meyerberg Company are scheduled to hold their current talk on "Training the Ear for Radio Servicing," with S. J. Wilde as lecturer.

Harlan Eastman will talk on servicing the newer G. E. sets at the April 19 meeting.

*H. R. Anderson, Secretary*

### PR SMA

Positively exhilarating to see the nice long lists of new members the past few months. Come on in guys, the water's fine!

Herewith we also give a back-pat to Bob Thorn for spurring and prodding on the membership campaign.

Sorry to hear that Ed. Ward's wife has been troubled with serious illness. Wishing her a speedy recovery, Ed!

We see that the Tulsa (Oklahoma) service boys trotted out a bevy of beauties at their big annual party. (How about it, Philadelphia?)

*Willie DeWessel*

### RTG OF NEW ENGLAND

George Batt, the bat boy from Brookline, is batting a 100% and is leading the league, with his new Brookline R. T. G. Chapter. Atta boy, George

And Rugged Russ Roessel, the raging Roxbury roustabout, rightfully raises ructions with the b. b. from B., because Rugged Russ rangles in second place. (S' too bad second doesn't begin with "R" so that we could make it rhyme with R. R. R.; now our whole evening is wasted.) Never mind Russ, you're doing great work in Dorchester and Quincy.

Smilin' Sunny Staples, the sing-song (or is it sing) so'n'so and Chipper Chappie Chapman, the chubby cherub, are in third place gathering in all the boys around Arlington and Lexington.

For the benefit of those who can't understand the above, the whole story is that the good old RTG has branched out, and we are forming little Guilds all over the countryside. Each guild makes its own laws, finds its own meeting places, draws up its own by-laws, makes its own dues, and then elects one of their number to represent their Guild at the closed meetings of the Mother Guild. Similar to our many states sending their representatives to Congress.

At the closed meeting in Boston, these representatives make their wants known, bring up facts that are bothering their particular area, iron out their difficulties, cast their votes as they are instructed by their respective groups, so that their every wish is given due thought, and everything is hunky-dory.

So all youse guys what ain't tied up to some outfit better scout around, and see when your local chapter is calling a meeting, and join up so that your vote will count where it will do the most good.

*George Feldman*

### Rhode Island Chapter

The constitution for the government of the Radio Technicians Guild of Rhode Island has been altered, revised and what have you, for the good of the Guild.

Under the revised constitution, all members will be aware of what the Guild stands for, what the duties of each officer are, what committees stand for, their duties, who appoints them, why, what the board of directors are to do, the property of the Guild to whom intrusted, why, the payment of dues, cards or assessments to whom and when. The payment of bills, by whom, when and why. The ballot, kind, nominations, elections, installation of officers, appointments etc.

Sick members must report to the secretary at once for assistance by the body. A provision has been left in the Guild by-laws for increasing the dues to include accident and health insurance at the discretion of the body on the group plan which will be worked out with several companies.

We are cleaning house for a grand slam, our membership drive which is under way is bringing results from unexpected quarters.

The social committee is at it planning activities for the spring season. Under the new constitution a portion of each member's dues go into the social fund, however, the fund will be self supporting shortly.

The delinquent committee will shortly start swinging into action for reports on transfer cards and reinstatements.

*P. E. Provost, Secretary*

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• Plainly written and easy to understand. Only useful data included. M. N. Beitman author. (Size: 8½ x 11 in.)

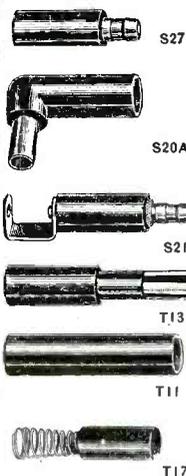
### RADIO SERVICING SHORT-CUTS

- 4 out of 10 radio jobs can be repaired with a screw driver, pliers, a soldering iron, and NO radio test equipment.
- 9 out of 10 radio jobs need only in addition a simple volt-ohmmeter.
- The fault of many radio receivers can be found with a simple visual inspection. The elimination of complex tests saves time and money—you should benefit by the Short-Cuts other servicemen found.
- The author, M. N. Beitman, for years in the servicing profession realized and kept data on these facts, and now presents this helpful handbook. Page after page of practical information on where to look for faults and how to repair radios quickly and with the minimum of equipment. General information applicable to all sets. A book that will really help you.

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# 5000 OHM CONTINENTAL Carbon Spark SUPPRESSORS



CONTINENTAL Carbon's new 5000-ohm low-voltage-coefficient spark suppressors effectively squelch ignition interference, thus releasing the avc circuit and the full sensitivity of your set.

Make this test—tune in a distant station while driving on a country road at 30 to 50 miles per hour. Shut off your ignition and note if the radio reception is better. If it is better with the motor shut off, you need CONTINENTAL suppressors.

For spark plug suppression select S27, S20A, or S21, in 5000-ohm resistance. Use T13 or T11 for the distributor in 10,000 ohms; T17 for Ford V-8 distributors. Available from leading radio jobbers.

Complete every auto noise-suppression job with CONTINENTAL Carbon by-pass condensers; heat resistant, moisture proof, economical. Handy Pocket Data on Radio Interference Elimination, 10c postpaid.

## CONTINENTAL CARBON Inc.

13912 LORAIN AVE., CLEVELAND, OHIO (Toronto, Canada)

Please send FREE. Auto Radio Engineering Bulletin 101A.

Name .....  
Address .....  
City ..... Jobber .....

# HIGHLIGHTS . . .

## CHICAGO TRADE SHOW

Even though the opening date of the Chicago Show at the Hotel Stevens, is June 10, every available inch of exhibition space has been contracted for, and the management has been forced to return contracts received from companies who filed their applications too late for consideration.

At least one special train will carry an eastern contingent of manufacturers, distributors, sales representatives, and others to Chicago for the show. Arrangements are in the hands of a Committee on Transportation of the "Representatives," headed by Perry Saftler of this city.

"The "Radio Industry Special," as it is called, will leave Grand Central Station over the New York Central Lines on June 9 to arrive in Chicago on the morning of June 10. Cars will be picked up at Albany, Rochester, Buffalo, Cleveland, and other points enroute. The car at Albany will start from Boston, thus permitting the Bostonian radio trade to join the New Yorkers on the "Special."

Ralph Hill of Ohmite Manufacturing Co., and Chas. Golenpaul of the Aerovox Corp., chairmen of the western and eastern divisions of the Sales Managers Club, respectively, were in conference in New York recently in preparation for the 1937 Chicago Convention of the Sales Managers Club to be held during the National Trade Show.

## CLOUGH-BRENGLE SALES MANAGER

Robert L. Barr, until recently application engineer and assistant to the general sales manager of Clough-Brengle Co., 2815 W. 19th St., Chicago, has been appointed general sales manager of that company.

In his new position, Mr. Barr will direct all sales and sales promotion activities for Clough-Brengle.

## WIDER USE OF OSCILLOSCOPE

From recent letters received from Service Men Alfred A. Ghirardi concludes that the use of the cathode-ray oscilloscope by Service Men is increasing rapidly. This trend he attributes to the introduction of the lower priced oscilloscopes.

Mr. Ghirardi states that Service Men are using oscilloscopes mostly for aligning r-f and i-f stages of superheterodyne receivers. Other common uses are found in measuring capacity and inductance, testing overall receiver sensitivity, testing overall audio fidelity, localizing audio distortion, and for checking receivers for intermittent reception.

Mr. Ghirardi's publishers, Radio & Technical Publishing Co., 45 Astor Place, point out that these subjects are discussed by him in the cathode-ray oscilloscope section of his book, Modern Radio Servicing.

## ARCTURUS WALL CHART

The Arcturus Radio Tube Co., Newark, N. J., has issued a wall chart of tube characteristics. Some 137 types with all their rated values are listed, tube application data is given and basing connections for the tubes listed are illustrated.

Dealers and Service Men can obtain the chart free, directly from Arcturus.

## SOLAR BAYONNE PLANT

Otto Paschkes, president of Solar Mfg. Corp., 599 Broadway, New York City, has announced factory space has been taken for the electrolytic department at W. 23d Street, Bayonne, N. J., effective immediately.

The new factory contains over 75,000 sq. ft. and is equipped with a power plant to generate steam and electricity.

## SYLVANIA "NO REPAIR" POLICY

Begun as an experiment about a year ago, the Hygrade-Sylvania "no repair" policy calls for the rejection of tubes having mechanical defects such as poor or excessive pin solder, protruding wires, cracked bases, broken guide pins, crooked or loose top caps, defective cap solder, defective etching, cement on bulbs, wires crossed in base, wires cut too short. Likewise tubes showing electrical defects such as low emission, gas, and high or low plate current are rejected and classed as "shrinkage." These tubes are then dumped into the crushing machine and ground to fragments of glass and metal.

Previously, many of these defects were corrected in a special salvage department, in accordance with general practice in the industry.

This elimination of salvaging has resulted in a gratifying reduction of shrinkage defects. Operators, knowing that slight defects in construction will no longer be accepted for salvage, are now more alert than ever to keep their production records above average.

## WEBSTER-CHICAGO APPOINTMENTS

G. J. Irving has been placed in charge of the sales promotion division of Webster-Chicago, with headquarters at the Chicago office, 3825 W. Lake St.

Mr. Irving's appointment creates a new division at Webster-Chicago, for the purpose of providing an increasing amount of sales helps.

M. F. Klicpera has been appointed western sales manager, with headquarters also in Chicago.

## UNITED SOUND CATALOG

The United Sound Engineering Co., St. Paul, Minn., has its 16-page list price catalog of microphones, stands, speakers and amplifiers ready for distribution.

The United Sound Engineering Co. recently completed arrangements with Electrical Research Products, Inc., for licensing under patents owned and controlled by American Telephone and Telegraph Co. and Western Electric Co., Inc.

## RADIART PRICE LIST

The Radiart Corp., Shaw Ave. at E. 133 St., Cleveland, Ohio, have issued an 8-page price list of their line of replacement vibrators. Copies of this list can be obtained directly from Radiart.

## SHURE BROTHERS CATALOG

Shure Brothers, 225 W. Huron St., Chicago, have issued a revised 1937 catalog covering their line of crystal pickups, microphones and accessories.

Copies may be obtained directly from Shure Brothers.

## NEW VENTURE FOR JOHN MECK

John S. Meck announces his resignation as sales manager of the Clough-Brengle Co. in order to devote himself to the formation of a new corporation which will engage in the manufacture of precision test apparatus sold in the low price field. Further information will be released shortly.

## BRUSH DEVELOPMENT MOVES

The Brush Development Co., Cleveland, moved to their own building at 3311 Perkins Ave., on April 1.

The growth of the Brush Co. has more than kept pace with the growth of the electronic industry. The company has enlarged facilities from 1,000 square feet in 1932 to the present four-story building and increased the number of employees accordingly.

## ADELMAN TO COVER TRADE

Leon L. Adelman, sales manager of the Cornell-Dubilier Corp., South Plainfield, N. J., will cover more than 35 principal trade centers in the next seven weeks on his itinerary which will take him some 12,000 miles.

## NATIONAL UNION DEAL

National Union Radio Corp., 570 Lexington Avenue, New York City, has added test equipment manufactured by the Simpson Electric Co., Chicago, to its line of free apparatus for the Service Man.

Several of the latest model Simpson instruments are now available with the purchase of National Union Radio tubes. Ask the manufacturer for full information.

## PRECISION INSTRUMENTS ON TIME PAYMENTS

Precision Instruments are now available on a time payment plan.

Literature listing the units and terms may be secured upon request from the Precision Apparatus Corp., 821 E. New York Ave., Brooklyn, N. Y.

## AMPERITE SALES HELPS

The Amperite Co., 599 Broadway, New York City, is preparing a series of sales helps for the sound man. This material will be available upon request to those sound men who signify immediately that they would like to be placed on the mailing list.

## RAYTHEON CONTEST

Scheduled for a period of six weeks, from March 15 to May 1, the Raytheon Contest offers as the first prize, a service truck with a built-in sound system—or its equivalent in cash. Another feature is the fact that the first prize winner's answer, name and photograph will appear in a Raytheon advertisement in the Saturday Evening Post six weeks after the contest. Over 500 other prizes are offered, consisting of such items as service instruments, radios, candid cameras, transmitter kits, etc.

Additional information on this contest can be obtained from the Raytheon Production Corp., 445 Lake Shore Drive, Chicago.

## • SERVICE FOR

# New TWIN SPEAKER P. A. SYSTEM 20 WATT OUTPUT



Completely Encased  
Easily Portable

The "top-notch" in P. A. value! No cost has been spared to make the finest and most convenient system offered at a nominal cost. For use in either permanent or temporary installations where volume and tone fidelity are necessary. Feedback is reduced 35% to 40% by the use of infinite baffle speakers.

The crystal microphone and wide range amplifier combine with the high fidelity speakers to give tonal qualities of exceptional depth and richness and a wide-range frequency response. In fact it has everything—including a new and attractive price—for easy selling and renting.

Write for complete details and specifications.

## SPECIFICATIONS

Power Output—20 watts.  
Overall Gain—112 D. B.  
Frequency Response—within 2 D. B. from 35 to over 10,000 cycles.  
Circuit—4 stage, class A, resistance coupled.  
Tubes—Two 6F9G, Two 6N7G, Two 6N6G—One 5V4G.

## JOBBERS

Write for details and territory information on Bell's complete line of P. A. equipment and communicating systems.

## CHECK THESE FEATURES

Heavy duty infinite baffle speakers—Dual in-put channels—Ultra wide range crystal microphone—High gain amplifier—Octal series tubes.

# BELL

**SOUND SYSTEMS, Inc.**  
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COLUMBUS, OHIO  
Export ) 308 W. Washington  
Offices { Chicago, Illinois



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## ATR REPLACEMENT VIBRATORS

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A COMPLETE LINE  
FEATURING

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- Precision Construction
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*Backed by More Than Six Years of Experience in Vibrator Design and Research, Development and Manufacturing.*

Insist on ATR Vibrators—The Best by Test

Mail the coupon TODAY for your FREE copy of the ATR VIBRATOR GUIDE along with the name of your nearest ATR Jobber.

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St. Paul, Minnesota, U. S. A. Cable Address: "Litex," New York  
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American Television & Radio Co., St. Paul, Minn.

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Please send me a FREE copy of the ATR Vibrator Guide and the name of my nearest ATR Jobber.

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

Check here:  Dealer  Serviceman  Experimenter

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Now at reduced prices.



- 4 mfd.—PV 600 your cost 24c.
- 6 mfd.—PV 600 your cost 27c.
- 8 mfd.—PV 600 your cost 30c.
- 8-8 mfd.—PV 600 your cost 58c.

*Exact duplicates for every radio.*

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

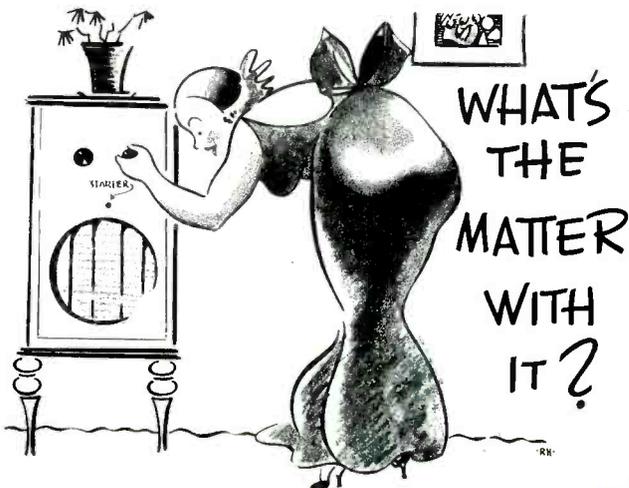
For free catalog and your nearest  
Dumont jobber, write to us.

Manufactured by

## Dumont Electric Co., Inc.

514-516 BROADWAY  
NEW YORK, N. Y.

Paper — Mica — Electrolytics



You should know. It only needs circuit checking and the replacement of burned out parts and the set will be as good as new. And give her a break. Use Ward Leonard Replacement Resistors. They are conservatively rated so give satisfaction. Send for Bulletin 507A which lists units available and gives list price.

## WARD LEONARD ELECTRIC CO.

36 South Street, Mount Vernon, N. Y.

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

Name .....

Address .....

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

Jobber's Name .....

# THE MANUFACTURERS . . .



## KRAUTER PLIERS

Krauter & Company, Newark, N. J., have announced a line of "Hy-Power" diagonal pliers.

The pliers are available in 6, 7 and 8-inch sizes and are provided with a special groove in the diagonal jaws which allows for maximum leverage in removing cotter pins.

The manufacturer will be glad to supply additional information.

## AEROVOX OSCILLOSCOPE CONDENSER KIT

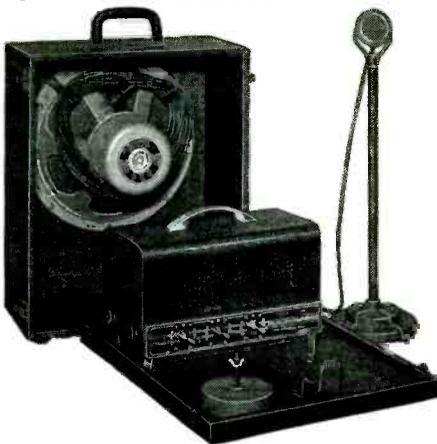
A convenient kit of condensers called for in the construction of the Thordarson cathode-ray oscilloscope, is offered by Aerovox Corp., Brooklyn, N. Y. The kit comprises 18 condensers of various types, capacities and voltage ratings.

## ELECTRO-ACOUSTIC AMPLIFIER

The Electro-Acoustic Products Co., Fort Wayne, Ind., have announced a complete high-gain amplifier for operation with crystal diaphragm type microphones. The amplifier is rated at 15 watts, undistorted and incorporates inputs for microphone and high impedance pickup; three controls for mixing, fading and tone, and output receptacles for two speakers.

The amplifier, speaker, microphone, stand and all connecting cables are completely self-contained in a tray type carrying case.

Additional details can be obtained directly from the manufacturer.



## UNITED SOUND AMPLIFIER

The type 20-E amplifier announced by the United Sound Engineering Co., St. Paul, Minn., is a 20-watt system using 6L6 tubes in the output. Independent faders are provided for use with two high impedance microphones.

Catalog No. 107 gives complete details on U. S. E. sound systems and will be mailed from the factory upon request.

## TURNER HANDSET

The Turner Co., Cedar Rapids, Iowa, announce a new handset. A crystal microphone designed for voice frequencies and a sensitive magnetic receiver are combined in a moulded one-piece unit.

## ARVIN ROLL-AROUND DISPLAY

The Arvin roll-around display demonstrator is designed to help the dealer merchandise Arvin auto radios with the "Phantom Filter." The display has an all-steel spot-welded channel frame with weatherproof display front painted in four colors. The radio chassis, three controls and the "Phantom Filter" fit into die-cut holes.

A special knockout spot permits display



of an overhead or separate case speaker. A steel shelf in back holds the radio and storage battery.

The demonstrator and a kit of display material are offered free, with the Arvin floor plan deal, to the dealer, by Noblitt-Sparks Industries, Inc., Columbus, Ind., manufacturers of Arvin auto radios.

## THORDARSON OSCILLOSCOPE KIT

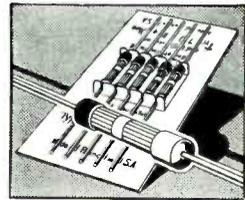
The Thordarson Electric Manufacturing Co., 500 W. Huron St., Chicago, have announced a "build-it-yourself" oscilloscope kit for use with the 913 cathode-ray tube.

The foundation unit, accessories, transformers and chokes can be obtained from Thordarson.

## CENTRALAB INSULATED RESISTOR

Centralab, 900 E. Keefe Ave., Milwaukee, Wis., is introducing their type 710 resistor. The 710 is a completely insulated end-lead half-watt resistor.

The resistor element is the same as is used in the Centralab resistors now in use.



Contact is made to the active resistor element at the extreme ends. An inert ceramic jacket surrounds the conducting core.

Additional information can be obtained directly from the manufacturer.

## MEISSNER WAVE TRAP

The Meissner dual "Universal" wave trap is designed to serve two purposes. A semi-fixed tuned circuit with a Ferrocort core is used to reduce interference in the i-f range and a tunable Ferrocort cored circuit is designed to reduce blanketing on the broadcast band.

A circular describing the wave trap can be obtained directly from the Meissner Mfg. Co., Mt. Carmel, Ill.

## SIMPSON INSTRUMENTS

A new set tester with super-sensitivity has been announced by the Simpson Electric Co., 5216 W. Kinzie St., Chicago. At 20,000-ohms-per-volt the tester has full-scale voltage readings of 2½, 10, 50, 250 and 1,000 for d-c and the same a-c ranges at 1,000-ohms-per-volt. Readings as low as 1 microampere and up to 500 milliamperes are available. A 25-amp range for checking the current consumption of auto-radio sets is also included. Resistance readings range up to 40 meg and tests as low as ½-ohm can be accurately made.

A line of low-priced panel instruments with bridge type construction and soft iron polepieces has also been announced by the Simpson Electric Co.

## HICKOK NO CURRENT TESTER

The Hickok Electrical Instrument Co., Cleveland, Ohio, have announced their model 4900 volt-ohm-milliammeter-capacity meter. This instrument incorporates a zero current voltmeter for measuring voltage in high resistance networks besides the usual ranges of a-c and d-c volts, milliamperes, resistance and capacity.

The zero current voltmeter has three ranges, 0-10, 0-50 and 0-250 volts at an infinite resistance per volt and will give readings independent of circuit resistance. The meter employs the principle of the potentiometer and contains a builtin power supply to furnish the necessary balancing voltage which is adequately filtered so that the instrument may be connected to r-f grids without disturbing the operation of the receiver.

Complete information on this and other Hickok products will be furnished upon request.

• SERVICE FOR

## MANUFACTURERS—continued

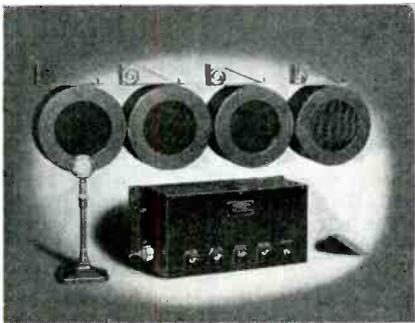
### DUMONT 2-IN. CATHODE-RAY TUBE

The Allen B. Du Mont Labs., Upper Montclair, N. J., have announced the type 24-XH two-inch cathode-ray tube.

This tube is of the high vacuum type with four electrostatic deflection plates, two common, mounted in a glass envelope having a full two-inch fluorescent screen. It is 7 $\frac{1}{4}$ -inch overall in length and a large octal base is used. The heater voltage is 6.3 volts making this tube interchangeable with the 913. From 300 to 600 volts may be used on the second anode. The 24-XH is a practical tube for all routine operations where economy and compactness is essential without sacrificing screen area.

### OPERADIO PAGING SYSTEM

The Operadio Model 111 paging system is supplied complete with a crystal microphone and stand; an amplifier arranged for wall mounting near the microphone tubes; a foot switch for use when talking



and a complement of permanent magnet dynamic speakers in steel wall cabinets.

The speakers are connected in parallel through a two-wire system. The basic system comes with four speakers but additional speakers may be added.

Specifications and additional details may be obtained from Operadio Manufacturing Co., St. Charles, Ill.

### G. E. AUTO ANTENNAS

The General Electric Radio Division, Bridgeport, Conn., have announced a line of auto antennas. Four types are included.

The model KA-10 is designed for mounting on the door hinge; the KA-20 is for over-the-top mounting; the KA-30 is of the rear bumper fish-pole type and the KA-40 is an under the running board hair-pin type. No drilling is required to install any of the four types.

Descriptive literature and prices may be obtained directly from the manufacturer.

### DUN-CHARGER

The Parris-Dunn Corp., Clarinda, Iowa, is offering dealers a plan whereby a check given away with the purchase of their Dun-Charger can be redeemed toward the purchase of a radio receiver.

The Parris-Dunn Corp. manufacture a line of wind driven storage battery chargers.

Additional information on the Dun-Chargers and on the check plan may be obtained directly from the Parris-Dunn Corp.



### TACO WAVE TRAP

The Technical Appliance Corp., 17 East 16th St., New York City, have announced a line of wave traps designed to eliminate interference on the i-f or broadcast bands. Three types are available, the No. 110 covers the range from 450 to 750 kc; the No. 111, from 750 to 1150 kc and the No. 112 from 1150 to 1550 kc.

Descriptive literature can be obtained directly from the manufacturer.

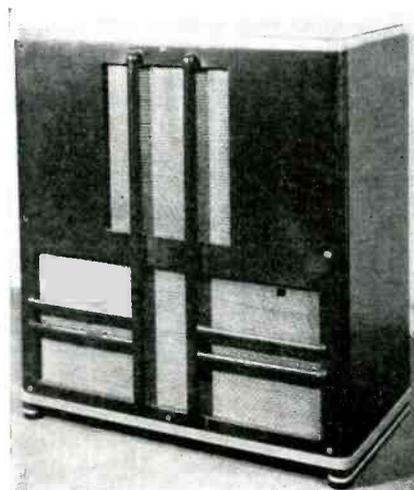
### RCA CABINET LOUDSPEAKER

The RCA Commercial Sound Section has introduced a console cabinet loudspeaker with a substantially uniform frequency response range from 60 to 10,000 cycles.

The cabinet is acoustically treated, of modern design and is finished in black with aluminum trimming. It is designed for use in music rooms, classes for music appreciation, hotel lobbies and similar installations.

The speaker unit is of the double voice coil electrodynamic type and measures 8 by 8 by 7 inches deep. The power handling ability of the speaker is 10 watts and it has a voice-coil impedance of 15 ohms.

Additional information on this high-fidelity speaker can be obtained from RCA Manufacturing Co., Camden, N. J.



### RADOLEK PREAMPLIFIER

The Radolek Co., 601 W. Randolph St., Chicago, announce a preamplifier designed to adapt lower gain amplifiers to the crystal and velocity microphones.

The preamplifier is a-c operated and uses a 75, a 6D6 and an 80.

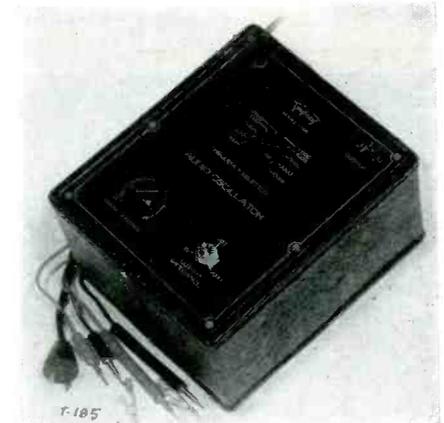
A descriptive circular describing the unit can be obtained directly from the Radolek Co.

### CLAROSTAT TAPPED CONTROLS

A complete assortment of tapped control replacements is offered by Clarostat Mfg. Co., Inc., 285 N. 6 St., Brooklyn, N. Y. There are fourteen units in the kit, or one of each of the types taking care of past and present production of sets. This representative assortment of tapped controls permits the immediate replacement of any defective tapped control, with the assurance that total resistance and tap ohmages satisfactorily match original values, since they have been decided upon only after a survey of existing set requirements. Further details regarding the tapped control, metal-tube resistor, and other exact-duplicate replacement kits, may be had by writing to the company.

### TRIPLETT AUDIO OSCILLATOR

The Triplett Electrical Instrument Co., Bluffton, Ohio, have added the Model 1260



portable audio-frequency oscillator to their "Master Unit" line of test equipment.

The frequency range of the instrument is 100, 250, 500, 1000, 2000, 3000, 4000, 5000, 7500 and 10,000 cycles. The circuit employed is of the feedback type. The impedance matching of the unit is variable.

Additional information may be obtained directly from the manufacturer.

### LAFAYETTE TELE-DIAL RECEIVER

The Lafayette Tele-Dial receiver, distributed by Wholesale Radio Service Co., 100 Sixth Ave., New York City, has 17 station control buttons arranged on the periphery of an 8 $\frac{1}{2}$ -inch dial. For additional flexibility a conventional 5 $\frac{1}{2}$ -inch pointer type dial is included for tuning other stations.

Additional information on this receiver can be obtained directly from Wholesale Radio Service Co.

# JUST OUT!

## The New SPRAGUE CONDENSER Catalog



### FREE!

The handiest, most helpful Condenser Catalog yet produced! Includes a complete listing of famous Sprague Condensers for every radio service and amateur need. Hundreds of exact duplicate replacements—new small size dry electrolytics—new Trimmers, Mica Condensers, Rectangular Transmitting Units, etc., etc.

Don't miss it!

# SPRAGUE

*The Standard of Condenser Quality*

**SPRAGUE PRODUCTS CO.**  
North Adams, Mass.



## Gives DX a Chance

- ★ Tunes out annoying nearby broadcaster and gives weak signals a break.
- ★ Available in 450-750, 750-1150, and 1150-1550 kc bands. Set-screw adjustment tunes to precise frequency.
- ★ Simply connect between antenna lead and set. Only 95c. list. A big seller.

WRITE for data on wave traps, line filters, noiseless antenna systems, master antenna systems, etc.

# TACO

**TECHNICAL APPLIANCE CORP.**

Pioneers in Noiseless Antenna Systems

17 East 16th St., New York City  
IN CANADA: 414 BAY ST., TORONTO

## GENERAL DATA—continued

pointer at the 1500-kc mark on the standard-wave band scale. Retighten the screw.

Adjust the interstage range B trimmer (C11) and antenna range B trimmer (C4) to maximum.

Do not change the setting of the oscillator range B trimmer.

**600-kc adjustment:** Set the signal generator for 600 kc. Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth, at the same time adjusting the 600-kc trimmer, until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

### RANGE C ALIGNMENT

**Caution:** When aligning the short-wave bands be sure *not* to adjust at the image frequency. This can be checked as follows: Let us say the signal generator is set for 5000 kc. The signal will then be heard at 5000 kc on the dial of the radio. The image signal, which is much weaker, will be heard at 5000 less 912 kc, or 4088 kc. It should be necessary to increase the input signal to hear the image.

**5800-kc adjustment:** Set the signal generator for 5800 kc. Connect the antenna lead of the receiver through a 400-ohm resistor to the output of the signal generator.

Turn the rotor of the tuning condenser to the full open (plates completely out of mesh) position.

Turn the band switch to the range C position (first short-wave band).

Adjust the oscillator range C trimmer (C15) until maximum output is obtained. See Fig. 2 for location of this trimmer.

**5000-kc adjustment:** Set the signal generator for 5000 kc. Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage range C trimmer (C10) and antenna range C trimmer (C3) to maximum.

Do not change the setting of the oscillator range C trimmer.

**1800-kc adjustment:** Set the signal generator for 1800 kc. Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth, at the same time adjusting the 1800-kc trimmer, until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

### RANGE D ALIGNMENT

**18,300-kc adjustment:** Set the signal generator for 18,300 kc. Keep the antenna lead of the receiver connected

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## Chock-Full of Helpful Information



### FREE!

Learn the truth about so-called "bargain" condensers—get the facts about power factor, leakage, etc. This new 1937 Catalog also includes the famous Sprague Tel-U-How Condenser Guide; complete data on Radio Interference Elimination, duplicate replacements, etc., etc. Get your copy today!

# CONDENSERS

*USE SPRAGUES... and Note the Difference*

**SPRAGUE PRODUCTS CO.**  
North Adams, Mass.

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## WILL HELP YOU GET A PROFITABLE SHARE OF IT!

P.A. is Big Business today! LAFAYETTE answers this fact with CO-ORDINATED SOUND SYSTEMS—completely assembled—pre-tested—easy to install—ready for instant and faultless operation. Priced right, they offer a system for every conceivable P.A. application. Send for FREE 116 page catalog now listing in detail all LAFAYETTE CO-ORDINATED SOUND SYSTEMS and component parts. MAIL COUPON NOW!

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BRONX, N. Y. • NEWARK, N. J. • JAMAICA, L. I.  
242 E. FORDHAM RD. • 219 CENTRAL AVE. • 90-08 164th STREET (LINDEN RD.)

**WHOLESALE RADIO SERVICE CO., Inc.**  
100 Sixth Avenue, New York, N. Y.

Rush FREE catalog No. 68-5D7

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Address.....

City.....

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**Triple Check  
FOR SHORTS**  
ONLY ONE OF 15 SRTL<sup>3</sup> FEATURES



ALL short circuits are located with four motions of one switch. The meter reads "bad" on every short. Simultaneously the neon shows shorts at recommended sensitivities while the earphone lets the customer listen while you watch. Three distinct indications—three sensitivities—three times the tube sales.

ASK FOR TOBES

**THE RADIOTECHNIC LABORATORY**  
1328 Sherman Ave., Dept. S  
EVANSTOWN, ILLINOIS

SEE YOUR JOBBER

A Complete Line of  
Tube Test Equipment

**RADIOTECHNIC**

**Improved Tone**

with  **Audios**

**Inputs  
Outputs  
Chokes**



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—fits nearly all circuits.

**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 31.

**GENERAL TRANSFORMER CORP.**  
502 S. Throop St. Chicago, Ill.

GENERAL DATA—continued

through the 400-ohm resistor to the output of the signal generator.

Turn the rotor of the tuning condenser to the full open position. Turn the band switch to the range D position (second short-wave band).

Adjust the oscillator range D trimmer (C13) until maximum output is obtained. See Fig. 2 for location of this trimmer.

**15,000-kc adjustment:** Set the signal generator for 15,000 kc. Turn the rotor of the tuning condenser carefully until maximum output is obtained.

Adjust the interstage range D trimmer (C9) and antenna range D trimmer (C2) to maximum.

When adjusting the interstage and antenna range D trimmers, it will be necessary at the same time to turn the tuning condenser rotor slowly back and forth until the peak of greatest intensity is obtained.

Do not change the setting of the oscillator range D trimmer.

**6000-kc adjustment:** Set the signal generator for 6000 kc. Turn the tuning condenser rotor until maximum output is obtained.

Turn the rotor slowly back and forth, at the same time adjusting the 6000-kc trimmer, until the peak of greatest intensity is obtained. See Fig. 2 for location of this trimmer.

VOLTAGES

Check the voltages at the sockets to see if correct values are being delivered to the tubes. The antenna and ground should be disconnected and the antenna and ground leads from the set connected together. The volume control should be turned to the right or maximum position.

All voltage readings as shown on the circuit diagram are read with a 1,000 ohm-per-volt meter. As high a range as possible should be used. In general, the higher the resistance of the meter, the more accurate the reading will be.

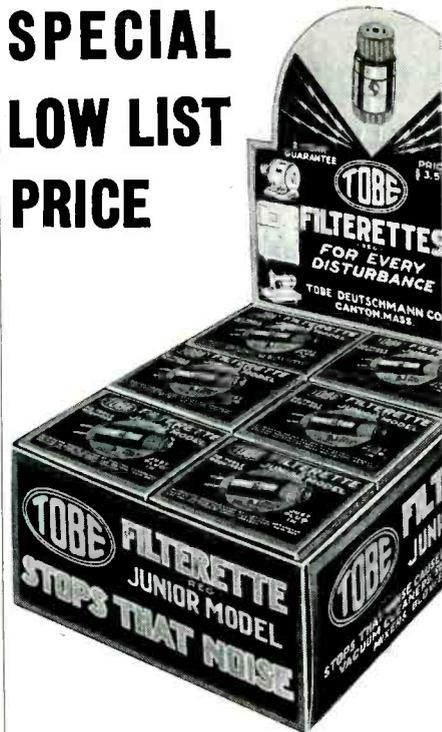
The voltages are indicated with all tubes in, the speaker connected and the set in operating condition. These voltages are typical of the sets but will vary slightly with variations in individual receivers, tubes, test equipment used and battery voltages.

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**Low volume or fading:** Vibration of the speaker will often cause the voice-coil wires to short at the start of the coil. Cleaning the coil and painting it with a quick drying insulating compound will usually remedy the trouble.

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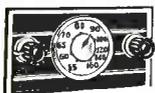
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## AUTO-RADIO—continued

signed to cover the frequency range from 540 to 1500 kc. An undistorted power output of 3 watts is available with a maximum of 5 watts. The total current drain of the HA-6 at 6 volts with one speaker is 7.5 amperes. The sensitivity for 1-watt output is 2 microvolts.

A complete circuit diagram is shown in Fig. 1 with the voltages encountered on the socket prongs listed on the chart to the left. These voltages were measured with the antenna shorted to the chassis, the volume control on full and the receiver in operating condition. A 1000-ohm-per-volt voltmeter was used in making the measurements.

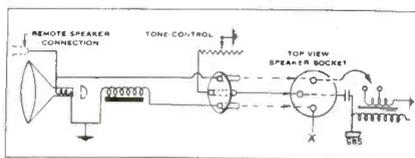


Fig. 2. Howard HA-6 speaker connections.

The d-c supply for the plate, screen and bias circuits is obtained from the 6-volt storage battery by means of a synchronous vibrator, step-up transformer and filter network which are connected in a separate section of the receiver chassis.

Noise interference filters are built into the antenna and A input circuits.

### ALIGNMENT PROCEDURE

Connect the test oscillator output to the grid of the 6L7 tube through a 0.1-mfd condenser and to the receiver chassis. Connect an output meter across the primary of the speaker transformer or across the voice coil.

Turn on the oscillator and the receiver and allow both to warm up for at least 15 minutes before attempting any adjustments.

### I-F ALIGNMENT

Set the test oscillator to 465 kc. Tune the receiver to a quiet point at the low-frequency end of the dial (540 kc). Turn the receiver volume control full-on and adjust the attenuator on the test oscillator so that the indication on the output meter is just readable. The signal in the speaker should be audible but not loud. Throughout the alignment procedure the output should be kept low by means of the test oscillator attenuator with the volume control in full-on position.

Tune the i-f trimmers C31, C32, C33 and C34, in that order, for maximum indication on the output meter.

Repeat the i-f alignment for greater accuracy.

# 6A8G...



... another

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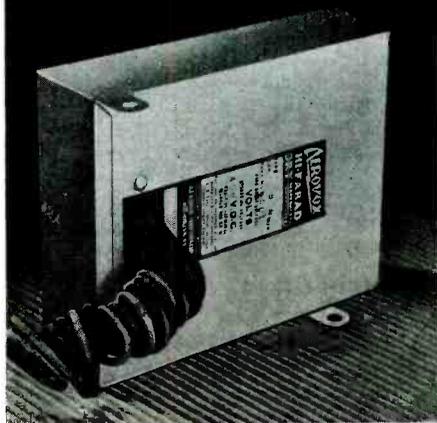
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## AUTO-RADIO—continued

### R-F ALIGNMENT

Change the test oscillator lead from the 6L7 grid to the antenna lead, using a 0.0002-mfd condenser in series.

Set the test oscillator and tune the

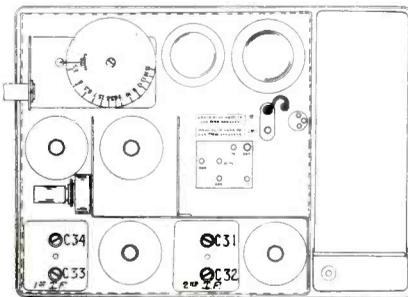


Fig. 3. Parts layout and i-f trimmer locations.

receiver to 1400 kc. Adjust the trimmers C35, C36 and C37, in that order, for maximum output indication.

Set the test oscillator to 600 kc and tune the receiver to the signal.

Adjust the trimmers C4, C5 and C27 for maximum output indication.

While adjusting C4 rock the gang condenser through the signal. The proper setting of C4 is the one giving the greatest output reading as a result of the combined operations.

Repeat the 1400-kc adjustments.

For greater accuracy the r-f adjustments should be repeated.

### ALIGNMENT NOTES

If the receiver has already been installed in a car, it is not necessary to remove the control head and cables from the car in order to align the receiver. There is a dial card on the

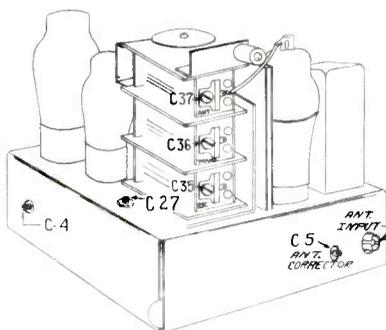


Fig. 4. R-f trimmer locations.

variable condenser that will indicate the alignment frequencies and settings.

It is also possible to align the receiver without removing it from its case. There are small holes in the case for each r-f trimmer condenser. Likewise there is a spring button, which may be pulled out to allow examination of the dial position, on the front cover.



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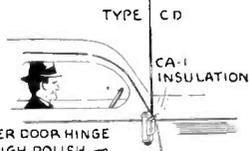


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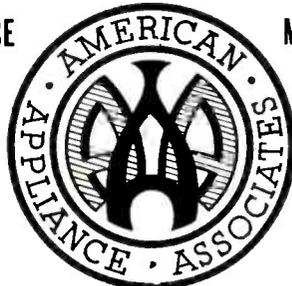
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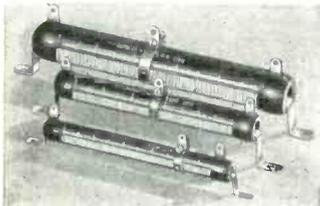
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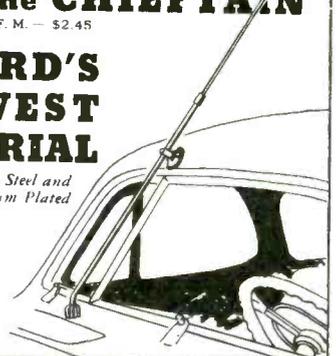
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Not only does this program *teach*—but it offers you the chance to win valuable prizes as well! *See panel at right for details.* Your local RCA tube or parts distributor will tell you what station in your vicinity is broadcasting the program and at what time. Ask him today. Tune in for the next broadcast!

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

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