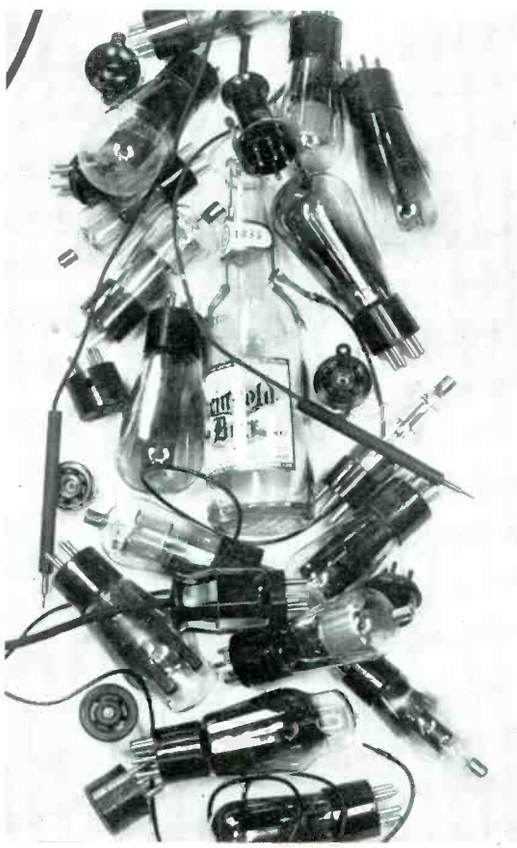
SERVICE

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE



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APRIL
1933

WE'RE PLAYING *Santa Claus*

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The Regular Subscription price for SERVICE is now $2.00 per year.

You, no doubt, know many other Service Men who would like to receive SERVICE every month. Probably several other Service Men in your acquaintance are already subscribers.

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John F. Rider Publications, Inc.

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WODX	WAAT
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WJAS	KTSL
KGFL	KVOS
WPCH	WDGY
KGCX	WEBR
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No. 2033

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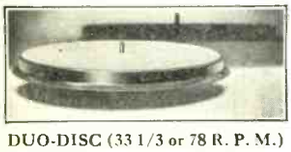

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Service men

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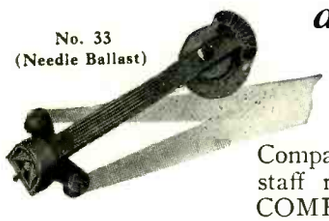

No. 33
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IN answer to scores of letters from Service Men received in the past few months. . . . YES, this Company cordially invites you to consult our engineering staff regarding your problems, and to order AUDAK COMPANY parts direct from our factory.

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Order your AUDAK COMPANY requirements through us and make your full margin of profit. (The best money in SERVICE today lies in SALES, anyway.) Call upon our skilled engineering and technical counsel for solution of your acoustical problems. Shorten your path to perfect installations by using the facilities of this Company freely.

This is the way we feel about you now . . . and always did.

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Profit - - Service alone is not enough today; you've got to get orders for merchandise . . . high grade parts that not only do as you say they will, but pay you a real profit. Remember, installing AUDAK CO. products enhances your own reputation, besides paying you a full profit.

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"Creators of High Grade Electrical and Acoustical Apparatus since 1915"

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

APRIL, 1933
Vol. 2, No. 4

EDITOR
John F. Rider

MANAGING EDITOR
M. L. Muhleman

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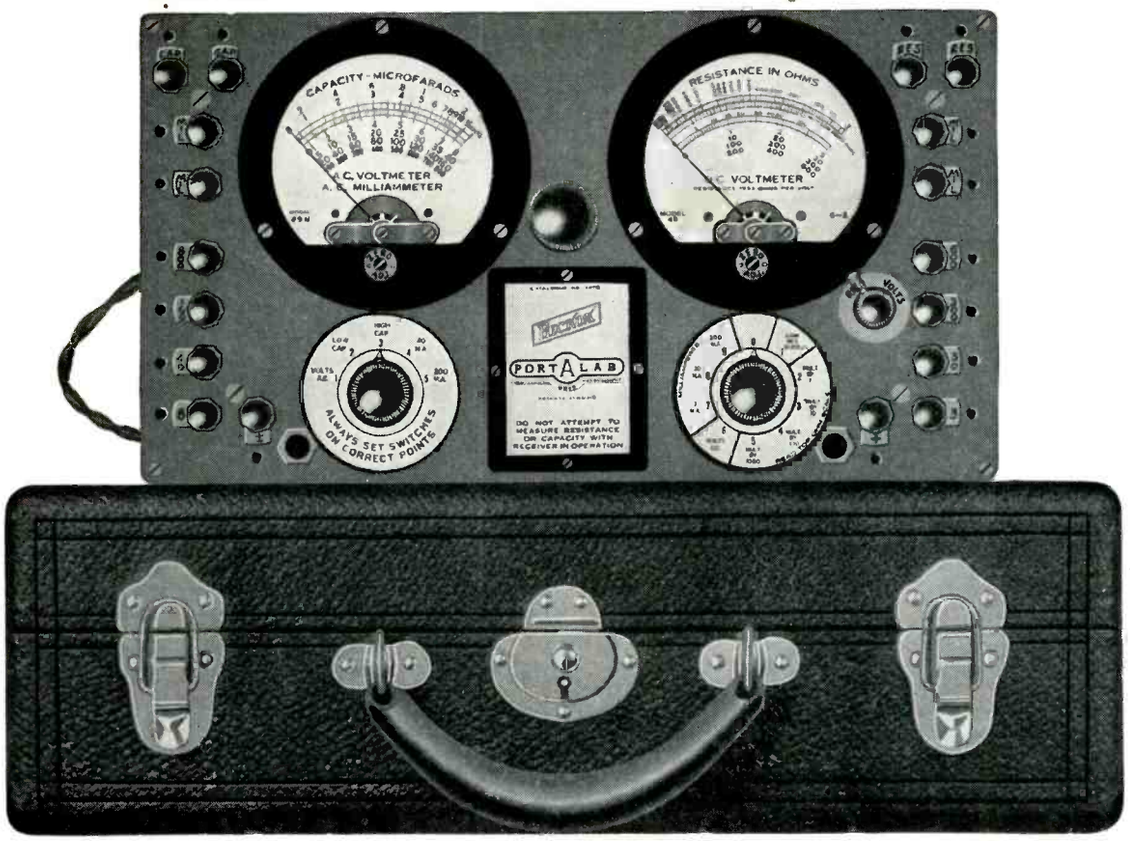
PORT A LAB
INDIVIDUAL UNIT MEASUREMENT

Patents Pending

TWENTY RANGE
POINT TO POINT
NEW---RADIO SET TESTER



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Special Size (4¼ Dia.) Easy Reading Meters — Highest and Lowest OHM Readings
Ohmeter Not Battery Operated — No Rectifiers in A. C. Meters

A PLAIN STATEMENT OF FACTS CONCERNING THE PORT-A-LAB AND THE HICKOK METHOD OF INDIVIDUAL UNIT MEASUREMENT

This method is Imperative with today's Receivers and definitely Supersedes all previous methods of testing, requiring a Service Instrument having:

WIDE RANGE OF APPLICATION TO INDICATE HIGHEST AND LOWEST POSSIBLE OHMS — ¼ OHM TO 20 MEGOHMS—MICROFARADS—HENRIES—A. C. AND D. C. MILLIAMPERES AND VOLTS. ALSO FRACTIONS THEREOF.

The unit SHOULD NOT BE BATTERY OPERATED, NOR EMPLOY RECTIFIER TYPE METERS, as the former run down and the latter wear with use, resulting in loss of meter calibration.

The Port-A-lab employs neither. The Ohmeter operates with TUBE TYPE RECTIFIER (tube mounted inside case), NO BATTERIES. The A. C. Meter contains NO RECTIFIER TO CHANGE IN VALUE AND LOSE CALIBRATION. Attachment is made to A. C. Line. Voltage Adjuster for precise Calibration, always independent of Line Fluctuation. A HICKOK DEPENDABLE FEATURE.

Extreme Visibility and Extra Large Meters with Special Length Scales, Easy to Read — are essential, as in the Port-A-lab, to read ALL FACTORS and MINUTE FRACTIONS THEREOF, to meet TODAY'S SERVICE DEMANDS.

The Port-A-lab is the result of Extensive Research and Practical Application in the field of Service to provide:

SPEED — ACCURACY — GREAT TIME SAVING — TRUE REPAIR ESTIMATES — NO ERRORS — SIMPLIFYING OF SERVICE PROBLEMS — ENHANCED PROFITS AND INSURED CUSTOMER CONFIDENCE.

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The Sum of These Facts Merits Ownership and the Immediate Adoption of the Hickok Method of Point to Point Radio Set Testing as Embraced in the PORT-A-LAB, STATI-K-TESTER and COMPACT-A-LAB

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List Price, Model 4953, Complete.....$125.00
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West Coast Prices Slightly Higher

THE HICKOK ELECTRICAL INSTRUMENT CO. **10514 Dupont Ave., CLEVELAND**

THE ANTENNA...

IS SERVICING DOOMED?

AGAIN we hear the cry that the present-day independent Service Man is doomed—for that matter that *all* servicing is doomed. Not in so many words, but by intimation, for after all is said and done, no one wishes to profess clairvoyant powers. Prophecies have so often proved wrong. This time these prophets say it is to be caused by the low list prices of radio receivers.

It is humorous to note the classification of Service Men and service work in the minds of some people. The very close association between sales and service in any mechanical field seems to be beyond comprehension. We find it difficult to reconcile the attitude of certain merchandisers and merchandising periodicals. They continually believe that the service branch of the radio industry is the "fixer" branch. To these people we say "get that idea out of your head." The industry cannot survive without service work. Not because "fixing" is required, but because this "fixer" is also a merchandiser. Try to remember that when the Service Man repairs a radio receiver he maintains that receiver manufacturer's name in good standing.

Certainly, he repairs the receiver and as such prevents the sale of a new receiver at that time. Is this not the normal course of events? Is this condition any different in any other field—the automotive field—vacuum cleaner field—refrigeration field—electric motor field—washing machine field? Try to remember that he also sells merchandise. We claim that the Service Man is of tremendous importance in the sale of tubes and even in the sale of radio receivers. Tens of thousands of radio receivers sold each year are purchased at the recommendation of the service field, and this number is growing daily.

The present crop of low-priced "cigar-box" receivers will decrease the amount of service work upon these receivers. However, it does not mean the downfall of the service industry—not by a long shot. First, because even these receivers are being serviced. Strange as it may seem, the writer has had more calls for service data covering these receivers within six months after the sale of the receiver than for data covering higher-priced receivers within the same period after their initial sale. Second, the demand for service upon a receiver does not come until about four, five, or six months after the sale, perhaps longer. Service Men operating today are servicing the receivers sold prior to the advent of the "cigar-box" variety. They have about 17,000,000 of these receivers to service. We grant that there are too many Service Men for this number of receivers, but the industry itself is not going to seed because of the low-priced receiver.

Third, higher-priced receivers; those justifying service will come back. They must come back because it means the success of the radio manufacturing industry and the success of the merchandising industry. No one involved in the sale of a $25.00 receiver for $10.00 is making any money on the deal. How long can they continue the sale of such receivers and stay in business?

Fourth, these low-priced receivers lend themselves to sale by the service group in a manner far superior to that ever thought of by the radio dealer. The Service Man who calls at a home to repair a receiver can sell these sets. Call this "peddling" if you like—but the sales continue just the same. Bear in mind that the Service Man with his minimized overhead can operate with much less profit than the dealer who maintains a large establishment. As a matter of fact, that Service Man is a more dependable dealer than the man who has a large store and sells refrigerators, vacuum cleaners, typewriters, etc. The dealer with a large store handling more profitable items other than radio is certainly going to devote his attention to the sale of the most profitable items. Low-priced radio receivers certainly are out of this category.

The Service Man is a combination service technician and salesman. His merchandising activities are increasing daily. He is rendering service with his sales. He will sell low-priced receivers during their existence and render service on the more expensive rceivers. When the life of the low-priced "cigar-box" receiver has come to an end, Mr. Service Man will still be in business because his service activities have kept his name before the eyes of his customers; because he has become a better merchandiser and because he will be ready to render service on the more expensive receivers.

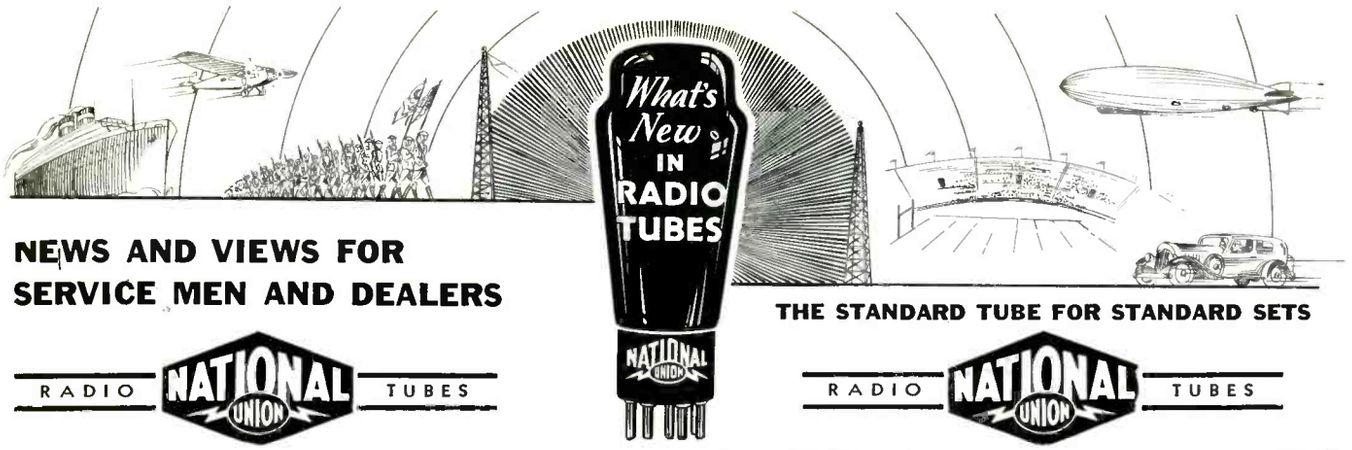
• • •

WE received a very interesting phone call a few days ago. A Service Technician called and asked the reason for the inclusion of the parts and price list in some of the "cigar-box" radio receivers. This information is a part of the operating instruction bulletin furnished to the customer by the manufacturer of the radio receiver. Frankly, we can find no logical reason and we hope that some such manufacturer will be kind enough to tell us the reason.

We can appreciate the need for the operating instruction. But of what use is the replacement parts list and the list prices of these parts? Just what purpose does this information serve? If it is for the benefit of the customer, with respect to his relations with the Service Man, more harm than good is done. It is true that it prevents overcharging, as far as the list price of replacement parts is concerned. However, it also creates a situation which is not beneficial to the service group or the radio industry at large.

In view of the low price of the receiver, the list price of the replacement parts is likewise low; as for example 10 cents for certain resistors and between 10 and 15 cents for certain by-pass condensers. It is quite natural for the customer to register a complaint when the Service Man quotes a service charge of from $1.00 to $2.00 for the servicing of that receiver when all that is needed is the replacement of a 15-cent condenser. The service charge does appear exorbitant, yet such a call is no different than a similar call upon a two-hundred-dollar receiver. In many cases the servicing of such a receiver is more complicated than that of a larger receiver, because of the increased operating difficulties.

John F. Rider.



NEWS AND VIEWS FOR SERVICE MEN AND DEALERS

RADIO NATIONAL UNION TUBES

THE STANDARD TUBE FOR STANDARD SETS

RADIO NATIONAL UNION TUBES

N. U. 84 AIDS AUTO RADIO PERFECTION

Current Supply Problems Solved By National Union Development

The production of an automobile radio receiver that would perform satisfactorily under the strenuous operating conditions unavoidable in this type of installation was retarded to a great degree by the problem of suitable power supply.

"B" battery installation did not provide a practical solution. The installation of a motor generator presented difficulties as yet not surmounted.

The generation of alternating current by means of a vibrator, transformation to the proper voltage, rectification into pulsating current, then smoothed out into high voltage direct current seemed to be an ideal answer.

This method, however, necessitated the production of a rectifier tube which would necessarily have greater efficiency than a rectifier used in the stationary A C set. Such a rectifier would be required to meet certain requirements.

First—It must have a filament voltage of 6.3 volts so that it could be operated directly from the storage battery.

Second—It must be a heater type, since the cathode potential is above the cathode potential of the rest of the tubes.

Third—The voltage drop across the rectifier must be as low as possible (efficiency).

These requirements led primarily to the production of a small mercury-vapor rectifier with indirectly heated cathodes. Under certain conditions this tube is found to work efficiently in the proper eliminator and gives a smooth, direct current of about 180 volts. The only drawback to this tube is that, unfortunately, the voltage drop depends upon the mercury vapor pressure, which rises and drops with the temperature. It has been found, for instance, that a tube which gives 0.125 amps plate current with only 10 volts drop at room temperature when cooled to about 40° Fahrenheit showed a drop of 30 volts. This condition placed a limitation on the tube with regard to completely satisfactory operation in cold weather.

As soon as the limitation was recognized, experimentation was begun on the influence of temperature upon some inert gas—such as argon—but without success.

National Union engineers then turned to the idea of producing a vacuum rectifier tube, with low voltage drop. It was found that such a tube required extremely small cathode plate distance. The manufacture of such a tube would be extremely difficult and in addition the excessive heat, radiated from a nearby cathode upon a plate with such small diameter, produced the danger of secondary or back-emission in the period, when the plate becomes negative. This idea was then discarded as impractical.

Theoretical investigations, however, showed that in a vacuum tube the plate current will not change, if a properly designed grid is put in the position of the plate, the plate made much larger and the grid and plate tied together. There is no unsurmountable difficulty in employing grids with comparatively small diameter, and the form and material of the grid can be selected so that there is no danger of back-emission. This situation permits the plate to be made large enough to avoid all the difficulties originally encountered.

Having worked out the details of these principles, the National Union laboratories produced a tube using a filament which consumes 0.4 amps and 6.3 volts and with a voltage drop of less than 20 volts when drawing 50 milliamps plate current. Since the average current consumption of an automobile receiver is about 40 milliamps, the voltage drop of this tube is practically ideal, even when the battery voltage drops below 6 volts during the course of fluctuation. The eliminator, originally designed for the mercury-vapor rectifier is found to deliver 180-185 volts, when used with this later tube development.

The number NU-84 has been assigned to the tube. It is sealed in an S12 bulb and has a small five-prong base, 2 prongs for the filament leads, one for the cathode and two for the two plates. Between the filament and cathode a high grade insulation is used which withstands the heater cathode bias of 300 volts even when the filament voltage reaches high values at times when the automobile is traveling at high speed.

NU-84 might be called a space-charge-grid tube, in which the space-charge-grid is connected with the plate.

This National Union tube is being used as standard equipment in United Motors radio sets for Chevrolet, Buick, Pontiac and Oldsmobile.

ASK YOUR NATIONAL UNION JOBBER

Tube stocks of National Union jobbers are always complete and up to the minute. Whatever type of tube the service man or dealer needs he can get it in a hurry from his National Union distributor. Old types and new types always ready for prompt delivery.

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Date Mar. 10, 1933
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For Tonester
This is to certify that the undersigned in consideration of the above named dealer having carried out the conditions of an agreement between the parties on his part to be performed, does hereby bargain, sell and convey to the above named dealer the instrument above named and which has heretofore been delivered to him.
WITNESS our hand and seal this 10 day of ... 19 33
NATIONAL UNION RADIO CORP. OF N. Y.

One of these documents is supplied to every dealer and service man covering every piece of equipment given to him by National Union. Immediately upon completion of all National Union contracts a Bill of Sale given by National Union makes the equipment the absolute property of the man who has used it during the months allowed for contract completion. National Union equipment costs the service man nothing. Can any live service man afford to ignore the easy, cost free National Union way of owning fine shop equipment?

MR. LABOISSONNIERE APPRECIATES

I just have to write you a line to tell you how much I appreciate what you are doing for us service men. You certainly are helping us out. When I bought my first lot of National Union tubes, I received your wonderful Service Manual and from time to time you have sent me some valuable information on tubes. I have received your Tube Base Connection Finder and how it does help you to remember different tubes.

Again I thank you and will continue to use the best tube on the market to-day—NATIONAL UNION. Yours, I remain,

Louis Laboissonniere.

OWN METERS, MANUALS FREE!

Why don't you join the thousands who are getting fine equipment for their service business, Free, the easy National Union way? Service men who tie up with National Union profit through the sale of tubes whose high quality stands undisputed and at the same time procure valuable business assets in meters and service manuals at no cost. Let's get together. Send Coupon.

TWO SERVICE MANUALS: by John F. Rider. Free with small tube purchase. No deposit.

READRITE TUBE TESTER: Free with small tube purchase. Small deposit.

OSCILLATOR AND OUTPUT METER: Free with small tube purchase and small deposit.

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TUBE BASE CONNECTION FINDER

This handy dial chart, printed in four colors, coat pocket size, tells you pin connections quickly, simply. A twirl of the outer dial and the data appears. Send six (6) National Union carton tops or 25c in stamps for your copy!

This is the National Union carton top.

NOW! THE UNABRIDGE!

A genuine bridge adapted to radio range .1 to 10 megohms. Designed as the ideal answer to the problem of testing radio receivers by the point to point resistance method. Supplied in sturdy black leatherette covered carrying case. A precision instrument accurately calibrated. Complete with two probes and 7 prong socket plug with rapid change adapters for 4, 5 and 6 hole sockets. FREE with deposit and tube purchase.

Note: All offers subject to withdrawal without notice. Send coupon NOW!

NATIONAL UNION RADIO CORP. OF N.Y.
400 Madison Avenue, New York City

Sirs: I am interested in following equipment: Readrite Tube Tester ☐ Oscillator & Output Meter ☐ Volume I ☐ Volume II ☐ Unameter ☐ Ohm Capacity ☐ Bench Kit ☐ Unabridge ☐ S4

NAME .....

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FREE

Partial Contents

¶ Chronological and descriptive catalog of all nationally advertised and American manufactured radio receivers produced between January 1921 — January 1, 1933 —78 pages. ¶ Complete technical specifications of all standard tubes, including the very latest. ¶ Circuit continuity in receivers. ¶ Operation of automatic volume control circuits. ¶ Elementary principles of short-wave converters and superheterodynes. ¶ Continuity testing as applied to receivers. ¶ Trouble shooting in complete receivers. ¶ Minimizing electrical interference. ¶ Loud speakers and pickups. ¶ Set analyzers. ¶ Vacuum tube data and tables. ¶ Service Data on Broadcast, Auto-radio and Short-wave receivers (All sizes and Universal AC-DC)—Combination short and broadcast - wave receivers, Kit receivers, Centralized radio systems, Remote control arrangements, Public address systems, Power amplifiers, Power packs, "A" and "B" eliminators, Chargers, Short - wave adaptors and converters, Tube and set checkers, Ohmmeters, Oscillators, and all the complete, detailed information you need to service any type of receiver.

SIMILAR BOOK FOR RADIOTRON

BIGGEST OFFER IN RADIO HISTORY

JOHN F. RIDER'S
Perpetual Trouble Shooter's Manual

THREE BIG VOLUMES IN ONE

Vol. No. 3, now appearing for the first time, contains a wealth of new and unduplicated radio information never before published in this form.

Every radio engineer and service man knows this omnibus of radio technical information by reputation. *Now everyone can own it.* The most complete, the most authentic, the most indispensable collection of radio and radio tube data in existence. Written and edited by the man famed for his encyclopaedic grasp of radio facts and principles.

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Information on each manufacturer presented on continuous pages — not scattered.

6,000 Diagrams
Charts and Photographs

CONSULT YOUR CUNNINGHAM RADIO TUBE OR RCA RADIOTRON DISTRIBUTOR • • •

ORGANIZE for PROFIT!

PART II

By JOHN F. RIDER

IF AN offending Service Man fails to make good on an incomplete service call then, as previously outlined, the original investigator makes the call and is paid the fee previously determined by the association. The idea behind this move is not to make a profit for the investigator, but to assure a good reputation for the association. One of the most important, if not the most important consideration in connection with all such work is that the public comes first. The reputation of the association is dependent upon the reaction of the public. Personal desires on the part of the members must be subordinated to the welfare of the association, because the strength of the latter represents the protecting wall surrounding the members against outsiders or non-members. Members of associations must remember that protective measures are instituted against non-members or those who violate whatever codes or rules have been created.

Since each member of the association will at some time have an opportunity to do such investigation work, whatever fee is arbitrarily determined, is just and fair to all. The fee paid to the investigator, who now services the receiver, is withdrawn from the adjustment fund. The offending Service Man then is assessed this amount and he must reimburse the adjustment fund.

Disciplinary Measures

Action of this kind will tend to curb cut-price service charge artists who work catch-as-catch-can and class any kind of a job as finished, irrespective of the satisfaction due a customer. It will further curb service operations by unqualified men because they will find it anything but profitable to carry on and continually refund to the association. If the offending member refuses to refund to the association, he is expelled. Once again, such steps may appear harsh, but such action is deemed advisable in order to elevate the service industry to its just status and to create the much desired public confidence. Try to bear in mind that necessity is the driving agent. Graciousness and idealism are excellent modes of action, but there come times in the lives of men and industries when somewhat more forceful steps are needed and badly so.

It is true that the aforementioned method of operation works hardships upon the beginner, but only if the man does not realize that he is a beginner. We do not suggest that beginners be excluded from the association. That would be unfair. What we suggest is that steps be taken to demonstrate to beginners that they must advance out of that class and that they cannot in justice to the years of labor on the part of the more experienced men, attempt to compete on the same basis. In this respect the public is at a definite disadvantage. Mr. John Public has no means of determining whether or not Mr. Service Man who calls on him is capable of satisfactorily completing the service call. It is up to the association to protect the public and at the same time the reputation of the association and its members. The beginner today may be the advanced man of tomorrow. The protection he would ask when that tomorrow arrives is just the protection the advanced men are asking today.

There is nothing to prevent consultation between a beginner and an advanced or more proficient Service Technician, when the former is confronted with a problem beyond his capabilities. Admittedly, it may not be the best thing to admit that a service call is more than can be coped with, but it is far better to consult than to ruin the receiver and the reputation of the service operator. Consultation makes it possible for the beginner to stay in the field, remain a member of the association, advance in normal fashion and still give satisfaction to the customer. In effect this beginner is serving a sort of apprenticeship, which is not such a bad thing in itself. Of course, the more proficient worker is paid for his consultation work, unless he chooses to work for nothing.

Guarantee Cards

At this point you may wonder how it is possible to control the actions of a beginner. In the first place, the identification card furnished to members of the association remains the property of the association as a body and may be recalled at will. Naturally, it will be recalled when such action is justified. Furthermore, further protection can be had by arranging that the financial guarantee cards, stickers or whatever forms are used and furnished to the Service Man, also remain the property of the association and can be recalled in the event of any difference between the individual and the association. If our memory is correct, a Service Men's association in St. Louis, Mo., makes a charge for such guarantee cards or stickers. This charge may be used for the adjustment fund. In this connection, if such a plan were to be instituted in lieu of regular weekly assessments, a nominal charge of, let us say 10 cents, should be made for the guarantee cards, but this money would be recognized as being a service fee for the guarantee rather than payment for the card. Operating in this fashion would show an income from the disposition of these cards, yet the guarantee cards would remain the property of the association as a body.

Wherever a weekly or semi-monthly assessment is made for the adjustment fund, the association would furnish the guarantee cards to be left with the customer. There would be no charge for the cards. The Service Man would be called upon to keep a record of his calls and the disposition of the cards, so that if ever the occasion arose, he could establish the number of cards in his possession, the number disposed of and the places where such cards were left. Whichever of these two systems of disposing of guarantee cards is used depends upon the choice of the members of the association or if some other method of indicating that the service job is guaranteed is used, the important item is that some such system be employed as a protective measure.

These guarantee cards would show the exact price charged for the call, so that in the event of a disagreement between the customer and Service Man, the card would be evidence.

Such a written record would tend to curb cut-price service calls, where the additional charges are tacked on to the labor and materials costs. All of these statements are ideas which can be broken down or modified to suit existing conditions.

Establishing Credit

Now for the subject of credit. We stated that the function of the adjustment fund would be financial guarantee and credit. The item of credit becomes a reality after the association has been in business for a period of time; its members have been reduced to those who are honest in their efforts. Such a state is needed in order that the fund grow to fair proportions. When this condition has been reached, a certain portion of the adjustment fund is allotted for credit. Just what proportion of this fund can be allotted for credit purposes depends upon how active the fund has been in the past; how much is received weekly or semi-monthly from assessments and how much is paid out during a normal period. The ideal condition to be achieved is where the adjustment fund, as far as adjustments are concerned is inactive.

All association members in good standing benefit from or can make use of the alloted portion of the adjustment fund for the purpose of securing credit from various suppliers. Now it is possible that the amount of money available for this credit is not very great. However, whatever the sum, it at least establishes the credit of the members because the association as a body guarantees the credit of its members up to certain specified sums. No matter how small the amount, it serves its purpose. Once credit has been established and the supplier becomes familiar with the paying habits of the Service Man and these habits are satisfactory to the supplier, the required cordial relations have been established.

No doubt some men require more credit than will be guaranteed by the association. It is also possible that these same men have a credit line of their own. Whatever additional credit guarantee they can receive is so much to the good. Where the association guarantees the credit of its members, the members give the association a personally endorsed promissory note for the amount of credit guaranteed. When the Service Man pays for the merchandise he has purchased and shows the receipted invoice to the proper party in the association, his promissory note is returned to him. Inasmuch as the note is made out to the association and the man in charge of the funds is properly bonded there is no fear of harm to the members because of embezzlement, if such would ever occur.

The amount of credit guarantee available to members mounts as the association grows and prospers. At the same time, the Service Man is given an opportunity to purchase merchandise on credit. Credit is what the service industry needs in order to enter the merchandising field. Perhaps this is a slow and tedious method, but tedious as it may be and limited as it may be, it is still better than nothing. It is a start, and there are millions of men in this world who have been asking for nothing more than just a start. Credit is a difficult matter to achieve, but once started and properly handled, it has its compensations.

Credit of this type is required by Service Men for their dealings with jobbers, dealers and manufacturers. Instrument manufacturers have arranged time payment plans, but the down payment of cash is the hindrance. Consignment propositions are satisfactory, but they are not common because of the heavy financial outlay on the part of the consignor. Business is founded upon credit. The Service Men must embark upon a combination merchandising and servicing program. The former is impossible unless credit is established.

We have spoken to tube, resistor and other parts manufacturers. They desire to do business with the service group but lament the fact that the Service Man has no financial responsibility. He has no credit. These manufacturers realize that Service Men and the service industry at large can dispose of a grand amount of merchandise, but they do not have the wherewithal with which to secure this merchandise. If each of 20,000 Service Men were able to establish a credit of from $50.00 to $75.00 per month and have that much turn-over each month with their suppliers, it would mean between $12,000,000 and $18,000,000 per year business to the radio trade.

While it is true that this amount of money cannot be expected at the start, proper handling and concerted effort to succeed should produce several times this much business and the service group will be occupying their just position as Service Technicians and as merchandisers.

Distribution of Credit

The distribution of the credit among the association members requires a good deal of thought and judicious handling. Several methods are possible. One of these assumes that all the members have been members for a like period. If such is true, then the credit portion of the adjustment fund is divided equally between the members, each being allotted his amount. Since the association will be called upon to establish the fact that they are guaranteeing the credit of any one member or a number of members, there exists but a remote possibility that any one member will overstep his bounds of purchase and state that the association is guaranteeing his credit for an amount in excess of his allottment.

Inasmuch as the man is establishing his credit, the supplier will communicate with the association. The latter body apprises the supplier of the amount being guaranteed, and thereby limits the obligation on the part of the association. This obligation in turn is protected in some measure by the promissory note given the association by the member securing the credit. Inasmuch as the association does not exact any charge for this guarantee or attempts to discount the note given by the member, it does not come under the banking or loan company laws. At the same time, it is justified as a body to seek restitution from a member who refuses to recognize his obligations.

It is logical that dealers and jobbers familiar with the operations of the association and with its membership will be more than happy to co-operate in this credit program by recognizing the credit guarantee. I have spoken to men employed by manufacturers of various radio articles and while they felt that this plan was an ambitious program, they felt that an association guarantee of financial responsibility justified recognition.

The important thing in establishing credit is to be able to refer a supplier to some organization with which you have either done business or whose reputation is unquestioned. The association will provide the best kind of reference.

Next month we will review the points already outlined in these articles, and the questions of our readers will be commented upon.

General Data . . .

The New Tubes—and Why

New tubes are still being introduced, and from all indications this steady flow will continue for some time to come.

We have been asked time and again why all these tubes are being brought out. It appears to many that one new tube is hardly more than a duplication of some earlier type. This is not quite the case, but it must be admitted there are a few tubes which merely confuse.

Tubes "To Fit"

What the field has experienced is a partial reversal in the order of things. For years receivers were designed around existing tube types. Today receiver engineers wish to accomplish a certain result with a circuit and request tubes having the necessary characteristics. Thus, today we find that the tubes are being designed to meet the needs of the set manufacturer.

It must also be remembered that for any given design of tube there is most surely going to be one for standard receivers, a second for auto and universal receivers and a third for battery-operated receivers. In some cases there are four, the fourth being similar to the auto tube of the same class but designed for use in a standard receiver wherein the tube heaters operate from a 6.3 volt source. Thus, there is a striking similarity between the type 39 tube and the type 44 tube, the latter having a more remote cutoff. The two are interchangeable.

Then there is the case of the type 47 and 59 power pentodes. These two tubes are quite similar, though not interchangeable. The main difference lies in the fact that the type 59 tube is of the indirectly heated type and therefore has a much lower "hum level." This tube, then, fits in with the requirements of small receivers with but a single power tube, for it permits a reduction of hum.

Then we find that the type 59 tube comes pretty close to being displaced by the new 2A5, which is much the same tube, but has a considerably higher amplification factor. This means that the 2A5 will deliver large outputs with comparatively small inputs. This tube, then, permits the set designer to produce a small set with but few tubes and still get somewhat the same results as obtained with the larger sets. In other words, automatic volume control and diode detection may be used (with reservations) without having to use "booster" tubes after the AVC has robbed the signal of a portion of its voltage.

Of course, the 2A5 tube alone does not permit big set operation in a midget, but it is a part of a chain of new tubes which when used in companionship will produce exceptional results for a small outlay in equipment. For example, there is a new combination oscillator-modulator tube (described later) which is far superior to the usual makeshift tube employed in this position. It actually provides a substantial gain in this circuit where normally there is no gain at all. There is also a new duplex-diode pentode, and a new duplex-diode triode, which will function as half- or full-wave detectors, AVC *and* amplifiers.

These new tubes not only offer big results from small sets but also far superior results from the larger sets.

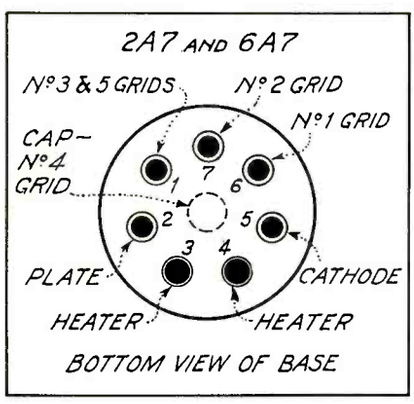

Fig. 1. Base connections for the 2A7 and 6A7 tubes. This is the new small seven-pin base

Pentagrid Converter

This is the new oscillator-modulator tube previously referred to. For standard sets this tube carries the code 2A7, and for auto or universal receivers the code 6A7. The base connections are shown in Fig. 1.

One of the main advantages of this tube is that it permits independent control of the modulator and oscillator circuits. This is made possible by the control of the electron stream from the cathode of the tube. Since there is but a single cathode and the electron stream is the only actual connecting link between the oscillator and modulator elements in the tube, any variations in the electron stream will produce a change in the plate current of the modulator part of the tube. The converter system is, therefore, electron coupled.

A typical circuit arrangement is shown in Fig. 2. Working up from the cathode, the first and second grids function as the grid and "plate" of the oscillator. The next three grids are a part of the modulator circuit, as well as the one and only plate in the tube.

What might be termed a "phantom cathode" appears in the tube between the third and fourth grids, the third grid being at positive potential and the fourth grid at negative potential. The grid at normal negative potential is the control grid of the modulator part of the tube, and any radio signal impressed on the control grid will in turn modulate the electron stream.

Because no inductive or capacitative coupling between oscillator and modulator exists in this electron coupled arrangement, intercoupling effects are practically eliminated. Likewise, the oscillator has greater stability as it operates under no-load conditions.

It will be noted that the control grid of the modulator is shielded electrostatically from the other elements in the tube by grids Nos. 3 and 5, which are tied together. This increases the output impedance and has much to do with the gain of the tube—or "conversion conductance." Grid No. 3 also serves to reduce local-frequency radiation which is fast becoming a very important factor.

The 2A7 employs a heater voltage of 2.5 and the heater draws 0.8 ampere. The 6A7 has a 6.3 volt heater and draws 0.3 ampere. Otherwise the electrical and mechanical characteristics of both tubes are alike, including socket and base connections.

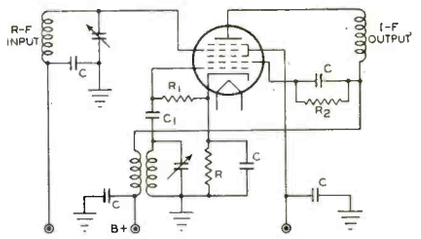

Fig. 2. How a 2A7 or 6A7 is connected up for use as a composite oscillator and mixer in a superheterodyne receiver

The average characteristics of the 2A7 and 6A7 for converter service are as follows:

Plate voltage	250
Screen voltage (grids 3 and 5)	100
Anode-grid (grid 2)	250
Control-grid (grid 4)	—3
Total cathode, ma.	14
Plate current, ma.	4.0
Screen current, ma.	2.0
Anode-grid current, ma.	3.5
Oscillator grid current, ma.	0.5
Plate resistance, meg.	0.3
Conversion conductance, micromhos	475
Conversion conductance at —50 volts on grid 4, micromhos	2

Conversion conductance is defined as the ratio of the intermediate-frequency component of the mixer output current to the radio-frequency signal voltage applied to grid 4.

A more detailed explanation of the actual use of the 2A7 and 6A7 tubes in superheterodyne receivers will be found in the second installment of "The Story of Receiver Design" appearing in this issue.

For those who may wish to experiment with this new type tube, the following values are given for the circuit of Fig. 2: Condenser C has a value of 0.1 mfd.; C-1, 200 mmfd.; R, approximately 250 ohms; R-1, 10,000 to 25,000 ohms when the screen voltage is 50, or 25,000 to 50,000 ohms when the screen voltage is 75, or 50,000 to 100,000 ohms when the screen voltage is 100. R-2 is a voltage-reducing resistor and should have a value of approximately 20,000 ohms when the plate voltage is 250.

Type 6F7

National Union Radio Corporation have brought out the type 6F7 which is also for use as modulator and oscillator in a superheterodyne. This tube consists of a small triode and a remote cut-off pentode both in the same envelope.

The triode elements and the pentode elements are entirely separate except for a common cathode sleeve; the active emitting cathode area for the triode is not the same as the emitting area for the pentode. A 6.3-volt, 0.3 ampere heater is used.

The pentode portion of the 6F7 contains a remote cut-off control grid, thus permitting the output of the first detector or modulator unit to be volume controlled. The triode portion, while small, is nevertheless a very satisfactory oscillator tube.

This tube has a small 7-pin base. More on it later.

Duplex-Diode Pentode

This type of tube consists of two diode units and a pentode unit. It is actually a three-in-one tube, in that it functions as detector, automatic volume control and pentode amplifier. It may be used as a full-wave detector when AVC action is not required, and the pentode unit may be used either as an r-f. or i-f. amplifier preceding the detector, or as an a-f. amplifier following the detector unit.

When half-wave detection is employed, the separate diode unit can be used to function independently as the automatic volume control with the sensitivity and time delay function confined to this circuit—an obvious advantage.

The type for standard receivers is the 2B7 and the type for auto or universal receivers is the 6B7. The 2B7 has a 2.5-volt heater which draws 0.8 ampere, and the 2B7 has a 6.3-volt heater which draws 0.3 ampere. Aside from these differences, both tubes have exactly the same mechanical and electrical characteristics.

A general idea of the construction of the tube can be gained from the circuits of Figs. 3 and 4, which show the tube used in a half-wave and a full-wave arrangement.

One group of operating characteristics for the pentode unit in Class A amplifier connection is as follows:

Plate voltage	250
Screen voltage	125
Grid voltage	—3
Amplification factor	730
Plate resistance (meg.)	.65
Mutual cond. (micromhos)	1125
Plate current, ma.	9.0

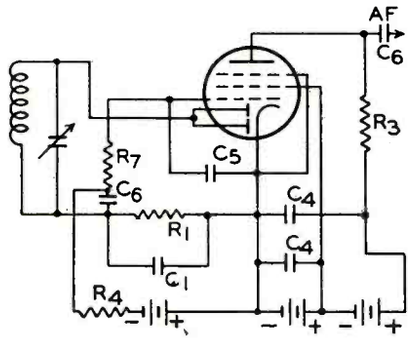

Fig. 3. The 2B7 or 6B7 used as a half-wave rectifier and audio amplifier. The two diode plates are connected together

Cathode current cutoff at grid bias voltage of —3 ..... —21
Screen current, ma. 2.3

The two diode plates are placed around the cathode, the sleeve of which is common to the pentode unit. Each diode plate has its own base pin.

With an applied d-c. plate voltage of 10 volts, the space current per plate with no external load should not exceed 0.5 milliampere. (These details were supplied by RCA and Cunningham.)

Duplex-Diode Triode

A similar tube, but having a triode rather than a pentode unit along with the diodes, has been announced by Eveready Raytheon. This tube is the type 2A6 and is identical to the type 75 tube except for its heater which is designed for 0.8 ampere at 2.5 volts, whereas the 75's heater requires 0.3 ampere at 6.3 volts.

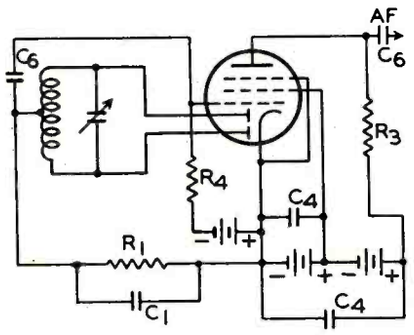

Fig. 4. The 2B7 or 6B7 used as a full-wave rectifier and audio amplifier. In this case the diode plates are used separately

The base connections for the 2A6 are shown in Fig. 5.

The two diode units are independent of each other and the triode unit except for the common cathode sleeve. The diode units may be used either as a half-wave or full-wave detector, or a half-wave detector with the other unit used for delayed automatic volume control.

The operating conditions and characteristics of the 2A6 tube—and incidentally the type 75 tube also—are as follows:

Plate voltage	250
Grid voltage	—2
Plate current	1.2
Amplification factor	100
Plate resistance	90,000
Mutual conductance	1,100

The coupling resistance for the output of the triode section may be any value up to approximately a quarter or a half of a megohm.

Other New Tubes

Other new tubes, on which specific characteristics are not as yet available, are the type 6C6 which is an output pentode for auto or universal receivers, this tube having a 6.3-volt heater which draws 0.3 ampere and may be operated in series or parallel connection.

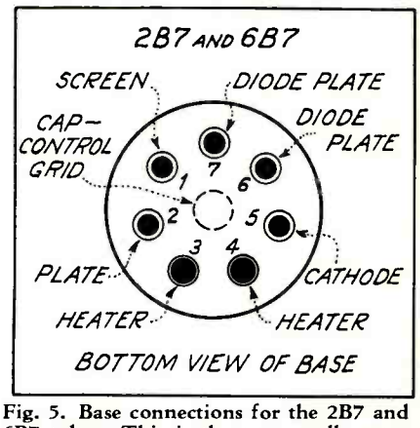

Fig. 5. Base connections for the 2B7 and 6B7 tubes. This is the new small seven-pin base

A companion tube, the 6D6, has similar heater characteristics and connections, but is a variable-mu r-f. or i-f. pentode. These tubes are used in the Belmont receiver described in this issue.

There is also a new full-wave mercury rectifier, the type number of which is 2Y3 (C), the (C) indicating that it is a Canadian tube. This tube has a 2.5-volt filament drawing 1.5 ampere.

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What Next?

As phoney as it may sound, it is now quite possible to build a superheterodyne receiver of no mean attainments having but three tubes. Though no such receiver has yet made its appearance, it is quite possible that some manufacturer will see fit to place such a receiver on the market.

This would hardly be possible if it were not for the fact that high degrees of amplification can be had from the very latest tubes. Therefore, such a tube as the 6A7 could be employed as the mixer and oscillator and one of the many pentodes as a power output detector working at i-f. Or, in the place of such a pentode, one of these double tubes such as the 6B7. Then a 25Z5 or an '80 for the rectifier.

There are already a number of midgets that come very close to this layout, with the exception that they use a stage of intermediate frequency.

Well, it probably won't be long now.

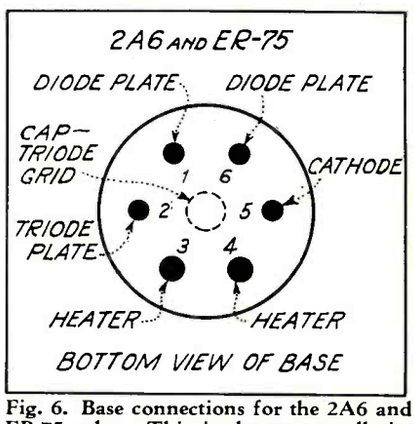


Fig. 6. Base connections for the 2A6 and ER-75 tubes. This is the new small six-pin base

THE STORY OF RECEIVER DESIGN

Part II

LAST month we discussed the radio-frequency amplifier and means of coupling it to both antenna and modulator tube—or, if you don't call it a modulator, then the first detector or mixer. Now we will discuss the next unit of the modern superheterodyne; i. e., the oscillator and modulator. First let us discuss a few common oscillator circuits.

Oscillator Circuits

The schematic diagram of the Colpitts oscillator, with all elements omitted except those involved in the oscillation circuits, is shown in Fig. 1. This simply consists of a tuned circuit with the grid circuit energized by the voltage drop across part of the tuning condenser C1, and the plate coupled to the tuned circuit through condenser C2. With this circuit the effective coupling of both plate and grid circuits decreases as the frequency is increased, due to a simultaneous decrease in the impedance of the condensers. This circuit oscillates most vigorously at the lower frequencies in its range.

Fig. 2 shows schematically a Hartly oscillator. Here the coupling of plate and grid circuits is inductive, and the amount of coupling from plate to grid is determined by the ratio of L1 to L2. This circuit oscillates most vigorously at the high-frequency end of its range.

Fig. 3 shows the Meissner oscillator from which most of the simpler oscillator circuits shown herewith are derived. The oscillation frequency is determined by the tuning of the tuned circuit composed of the coil and variable condenser. This tuned circuit acts much like a flywheel to a mechanical rotating system in that its inertia tends to resist any change of frequency. Such an oscillator, if carefully built, is very stable. Both plate and grid circuits of the oscillating tube are loosely coupled to the tuned circuit.

The diagram of Fig. 4 shows a tuned grid oscillator, and Fig. 5 a tuned plate oscillator, both of which are commonly used in modern superheterodynes.

What has been termed an "electron-coupled" oscillator is shown in Fig. 6. In this circuit the control grid and screen grid serve as the main elements of the oscillator and the plate circuit only as a coupling medium. This circuit is usually quite stable because it is independent of other circuits and operates under no-load conditions, the only actual "connection" being through the flow of electrons from cathode to plate.

The "electron-coupled" oscillator has been in use for some time in short-wave superheterodyne receivers and in a few broadcast supers. It is now coming into more general use with the latter. More of this later.

Oscillator Coupling Methods

In order to tap part of the oscillator voltage to feed the modulator, either a weakly coupled coil or a small condenser is usually used. It is important that this coupling be as weak as possible to prevent undue reaction between the coupling circuits and the oscillatory circuits. Thus, it has become common practice to couple to the plate or suppressor grid or screen of the modulator, all of which are of high impedance, so that as little reaction as possible will occur due to coupling. On the other hand, it is necessary that sufficient voltage be available to swing the modulator over its entire characteristic if high efficiency is to result. From this it would seem that best results from an efficiency standpoint would be obtained by coupling the oscillator into the grid circuit of the modulator, since the grid circuit is also of high impedance and only a small voltage is required here to swing the plate current from zero to maximum. Such an arrangement is sometimes used but it has a number of drawbacks. In the first place, there is always the chance that the oscillator will overload the modulator and in the second place the oscillator is not sufficiently attenuated through the radio-frequency amplifier to give good image-frequency suppression. This has resulted in the development of a number of novel image-suppression circuits, some of which were described last month.

Where no stage of radio-frequency amplification is employed, and the modulator tube is coupled to the antenna, then there will be radiation of the oscillator frequency if the oscillator is coupled to the control grid of the modulator. This can be reduced by the use of a resistance pad in the antenna-ground circuit but is a poor method at best. If, in such a case, the oscillator is coupled to, say, the screen of the modulator tube, there should be no appreciable radiation.

The third method is electronic coupling, wherein the plate of the oscillator tube is employed as the coupling medium. This has already been explained.

Coupling Circuits

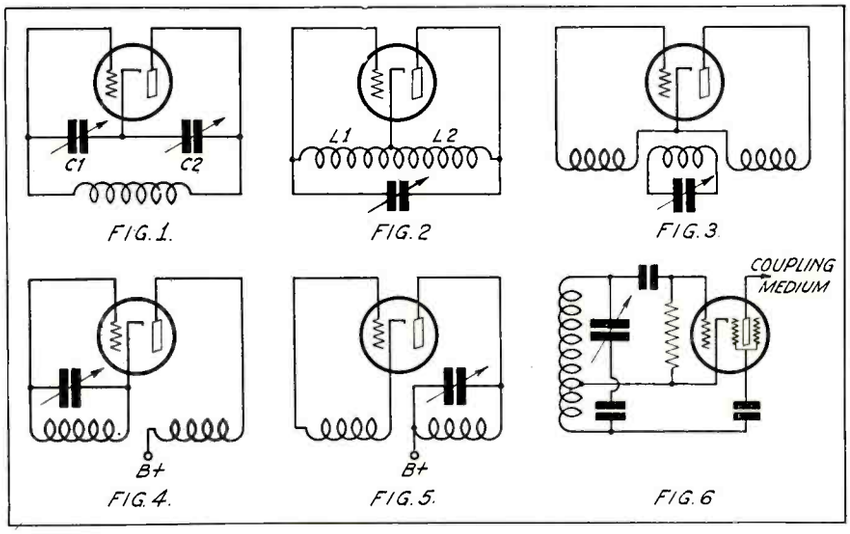
Two general forms of coupling circuits are shown in Fig. 7. In circuit (a) coupling is accomplished by the coil in the cathode circuit of the modulator tube. In circuit (b) the oscillator is coupled to the modulator screen grid through a small capacity, having a value in the vicinity of 5 mmfd.

These circuits are pretty well standard, but, of course, the coupling is not always to the same elements of the modulator tube, as explained before.

Even the same forms of circuits are used when a single tube is made to function as both the modulator and oscillator, except that they often look different. In most circuits of this sort, the cathode is coupled to the plate circuit by a small coil and the whole thing resolves itself into a form of plate-tuned oscillator, such as shown in Fig. 5. An example of this will be found in the diagram of the Philco Model 37, on page 61 of the February issue of SERVICE. At the same time, glance at the circuit of the Crosley Model 148 on page 62 of the same issue. In this receiver the screen grid becomes a part of the oscillator circuit and is coupled to the plate. This can be classed as a grid-tuned oscillator, such as shown in Fig. 4.

The advent of the 2A7 and 6A7 pentagrid tubes makes it possible to successfully combine the oscillating and mixing functions in one tube and still obtain some of the advantages of the two-tube arrangement, plus a couple of new tricks. This tube consists of a triode with a screen mesh plate. Around this plate is built a screen-grid tube. The same cathode thus supplies electrons for both tubes. Now, the inner tube (triode) is used as an oscillator and the electrons escaping through the mesh plate serve as the space current for the screen-grid modulator. Thus, an oscillating space current is supplied to the modulator elements of the tube.

Further details of this tube, together with the sort of circuit which will more than likely be used, will be found elsewhere in



Six different forms of oscillator circuits, most of which are based on the circuit of Fig. 3. Those of Figs. 4 and 5 are most commonly used in superheterodynes. Fig. 6 is an electron-coupled oscillator

this issue. If you will glance at this circuit you will see that the effective coupling between oscillator and modulator is controlled by the screen potential. This type of coupling is referred to as "electron coupling". A more correct term would appear to be "emission coupling".

The Modulator Tube

Let us now consider the modulator tube. It is always desirable to use a tube for this purpose which has a high plate impedance. Let the tube output be considered for simplicity to consist of a voltage in series with a resistance representing the plate impedance of the tube, and the load be represented by a parallel tuned circuit, which would be the primary of the intermediate-frequency transformer.

Now at resonance the load as represented by the tuned circuit will be a high resistance say 50,000 ohms for a good circuit, whereas on either side of resonance frequency it will be a relatively low impedance. If the tube plate impedance is very high, say 1,000,000 ohms, then we have for all practical purposes a constant current circuit, in which the current is practically independent of the impedance of the load. Therefore the voltage developed across the load will be a maximum at resonance and at all frequencies will be proportional to the load impedance. If the tube impedance had been low, say 50,000 ohms, then at resonance the current would decrease and off resonance it would increase. This would tend to broaden the selectivity curve, since the voltage drop across the load off resonance would be increased and at resonance, decreased.

The very simplest way of stating this is to merely say that with a high impedance tube, its resistance as compared to the resistance of the load is so high that the load can have but little effect on it. With a low impedance tube, however, the load impedance would dominate the tube impedance. Then at off-resonance points current would be increased and the resonance curve not only broadened but considerably flattened.

As a mere statement, we would say that a high impedance tube for the modulator will provide a greater amount of selectivity and more gain, or "translation gain" as it is often referred to.

In addition to the above, it is desirable to use a variable-mu tube to prevent cross-modulation by powerful signals not greatly different in frequency than the desired one. This is desirable whether or not the modulator tube is preceeded by a stage of r-f.

On first thought it would seem that a variable-mu tube which had little cross-modulation would also be inefficient as a modulator. Fortunately, this need not be the case. This is due to the fact that cross-modulation is due to the cubic portion of the modulator tube characteristic, whereas desired modulation is due to the squared portion of the characteristic. Variable-mu tubes such as the 58 are therefore well adapted for use as modulators and it will be found that they are commonly used for this purpose in modern supers.

The intermediate-frequency transformer used to couple the modulator plate to the grid of the first intermediate-frequency amplifier tube should present as high an impedance as possible to the modulator. This is to enable the maximum collection of intermediate frequency. For this reason the first i-f. transformer often differs from the rest. Sometimes the primary tuning condenser is entirely omitted and the primary coil resonated with the inherent plate capacity of the modulator tube. In other cases a smaller than normal capacity is used. The impedance of an anti-resonant circuit increases as the inductance is increased and as the shunt capacity is decreased. For this reason the tube plate capacity is used and the coil inductance made as high as possible so that it will present a high impedance in the plate circuit of the modulator and increase amplification. This often makes it necessary to change the coupling between the primary and secondary windings of this particular transformer.

Now it happens that the plate circuit noise of tubes increases as the grid bias is increased. Since the modulator tube operates at a high effective grid bias, the hissing noise produced (Schott Effect) in its plate circuit will make it the noisest tube in the receiver. It sometimes happens therefore that if the gain of the radio-frequency amplifier is reduced either by manual or automatic volume control more than the i-f. tubes, that the noise will increase greatly from the modulator tube and the set will be more noisy than would be expected. The advent of the 2A7 tube brings about a great improvement in this respect for when using this tube as combination modulator and oscillator, the gain of the modulator can be controlled along with the rest of the tubes, not heretofore practical.

In any event, it becomes obvious that if a receiver has an undue amount of hiss, it may be due to an unequal control of gain in the r-f. and i-f. stages.

Oscillator Frequency

Of course, if we have an i-f. amplifier peaked at 175 kc., then the oscillator frequency beating with the signal frequency must always present a resultant signal of 175 kc. or, in other words, the oscillator frequency must always differ from the signal frequency by 175 kc.

The oscillator frequency may be either 175 kc. above or below the signal frequency. The higher value is usually employed, so that for a signal frequency of 1,000 kc. (about 300 meters) the oscillator frequency would be $1,000 + 175 = 1,175$ kc. This throws the second harmonic off the tuning dial, whereas if the lower oscillator frequency were employed $(1,000 - 175 = 825)$ a signal of 650 kc. would also appear on the dial at the same setting, because $825 - 175 = 650$, or to put it the other way, $650 - 825 = 175$ kc., the intermediate frequency.

G. S. Granger.

(To be continued)

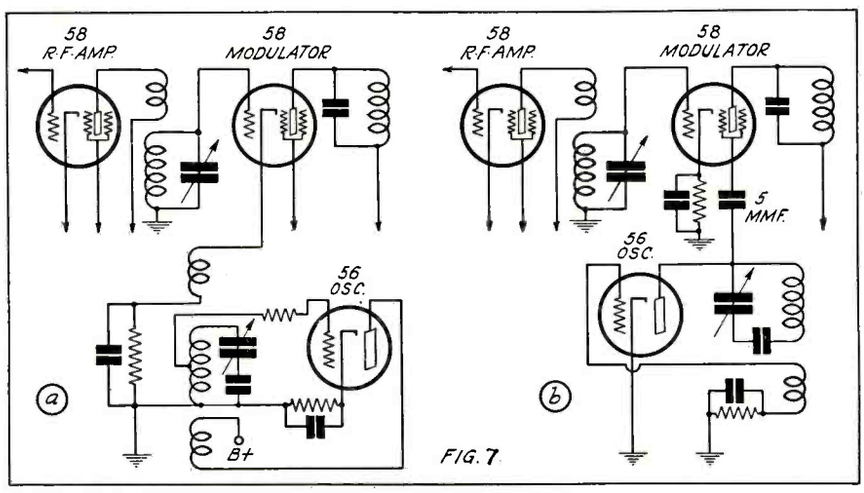


FIG. 7

Illustrating inductive and capacity coupling between oscillator and modulator tubes. These are the forms of coupling most commonly employed

Oscillator Correction

We regret that a slight mistake appeared in the circuit diagram of the "Oscillator for Service Work," appearing on page 50 of the February issue of Service.

A glance at this diagram will show that the coil L2 is connected to switch S1 just opposite to the manner in which coil L1 is connected. Instead of connected as shown, the top of coil L2 should connect to the top terminal of switch S1 and the bottom of the same coil to the bottom terminal of the switch—just opposite to the connections shown.

Kolster K-24 Volume Control

The published circuit diagrams of the Kolster K-24 receiver do not show the volume control. This control has a total resistance of 5,600 ohms. It is shunted across the antenna and ground circuit.

Another Positive Statement Gone Gazook!

Now that Class B systems have come into vogue, we no longer can say that the secondary winding of an interstage audio-frequency transformer cannot carry current.

Belmont Model 525 Super

The Model 525 chassis is for use on a-c. or d-c. This is a midget receiver of the universal type, yet is a complete superheterodyne with full-wave rectification and automatic volume control.

This receiver uses some of the latest in tubes. A type 6D6 is employed as combination first detector and oscillator, another 6D6 as intermediate-frequency amplifier and a type 75 duplex-diode triode as full-wave second detector, automatic volume control and a single stage of audio amplification. The triode part of the type 75 is resistance coupled to a type 43 pentode.

The i-f. in this job is peaked at 456 kc. and both primary and secondary windings of the i-f. transformers are tuned, as indicated in the schematic diagram of Fig. 1 The trimmers are mounted on top of the i-f. coil shields, as shown in Fig. 2.

Note that the volume control is in the grid circuit of the triode portion of the type 75 tube, this being the i-f. circuit.

Now take a look at the power-supply circuit. This shows the heaters of all the tubes connected in series and shunted across the line. The 145-ohm limiting resistor is not in the chassis but is a part of the cord assembly. This keeps the heat created by this voltage-reducing resistor out of the set. Therefore, it should be expected that the supply-cable will get warm during operation of the set. This is normal.

The rectifier tube used is the type 25Z5. It is used in the circuit as a double half-wave rectifier, one section of which supplies the dynamic speaker field winding, and the other section the receiver proper. The filter choke in the receiver section is connected in the negative lead and has a tap to supply the correct negative bias for the type 43 power tube. These voltages are marked on the circuit diagram.

If the set should require rebalancing, the procedure is as follows:

Attach a 456-kc. oscillator to the grid of the 6D6 tube in the back of the variable condenser and adjust the trimming condensers of the i-f. trnsformers for maximum output. While adjusting these trimmers, the variable condenser should be at the maximum capacity position—at the extreme right of its rotation.

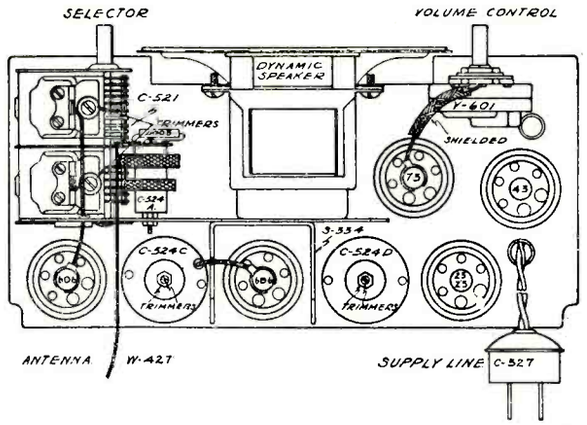


Fig. 2. Top view of the Belmont Model 525 chassis, showing the locations of the tubes, trimmer condensers, etc. The 6D6 tube to the left (as shown here) is the composite oscillator and modulator

Next disconnect the antenna wire and connect the oscillator in series with a 75-mmfd. condenser to the antenna coil. Rotate the gang condenser plates to the minimum capacity position, and adjust the trimmer condenser of the rear section (on top) of the gang condenser to resonance with an oscillator set at 1,725 kc., then adjust the trimmer on the condenser on the front section to resonance in the same manner. Align at 1,400, 1,200, 1,000, 800, 600 and 530 kc., bending the slotted plates of the gang condensers if necessary.

•

Notes on Oscillators

The following notes dealing with the design and desirable characteristics of oscillators for service work were provided by Mr. J. N. Golten, General Service Manager of Stewart-Warner. This data is very timely and should prove of great benefit to all Service Men, as it represents an accumulation of experience spread over a considerable length of time.

Shielding

Many oscillators now being used are inadequately shielded. Because of this the stray field about the oscillator is so intense that the signals are picked up by the extremely sensitive sets now available. Because of this stray pick-up it makes it not only impossible to properly attenuate the oscillator signal but results in a large variation in output meter readings as the Service Man's hand is moved in and about the chassis while endeavoring to align the various stages. In some cases this body effect is so great that only an approximation to proper alignment can be secured.

Attenuation

Many oscillators are sadly lacking in their ability to properly attenuate the signal down to the point it should be reduced for use with a sensitive receiver. Some commercial oscillators are so poorly attenuated that it is necessary to insert some external attenuator to reduce the signal down to the point where it can be used.

If proper attenuation is impossible, the average Service Man, unless instructed to the contrary, will use a signal which is so intense that it will cause the AVC system to function, thus nullifying his efforts to properly align the set.

In order to cut down the effects of this intense signal, some of them turn down the volume control, which in older sets affects the r-f. stages so that again proper alignment becomes impossible.

Per Cent Modulation

Many of the two-tube oscillators are improperly modulated. The per cent modulation is so small that in order to get a proper reading of the output meter it is necessary to introduce such a large r-f. signal that in the newer sets the AVC circuit starts to function, or in the older sets the detector overloads.

Experience seems to indicate that modulation of the r-f. signal should be in excess of 30 per cent. We have tested oscillators in which we believe this modulation to be less than 10 per cent.

Frequency Modulation

Many of the single-tube oscillators are subject to frequency modulation. This is a condition that probably will not be recognized by many Service Men.

What takes place is this: not only is the oscillator r-f. signal modulated by the audio note caused by the grid leak and condenser combination, but the frequency of the r-f.

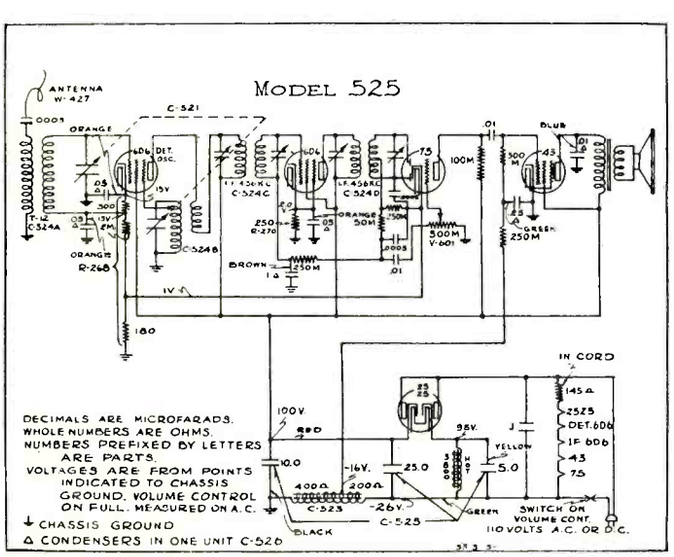


Fig. 1. The schematic diagram of the Belmont Model 525 Midget Super for a-c. or d-c. use. Note that this receiver uses the new 6D6 and type 75 tubes, as well as a 25Z5 rectifier in double half-wave connection

output is also caused to vary due to the action of the grid leak-condenser combination. This gives the effect of a broad signal. In some cases this is so bad that the oscillator signal can be heard over the entire broadcast band when tuned in on a selective superheterodyne receiver.

Calibration Accuracy

Service Men are apt to put far too much faith in the individually-calibrated curves supplied with oscillators. There is no question but what these curves were accurate when first the oscillator was purchased, but variations in tube characteristics, batteries, coil and condenser characteristics are so great that calibration becomes variable to a far greater extent than the average individual would believe possible. Taking an i-f. of, say, 177.5 kc., an oscillator may vary as much as eight points on a hundred-division dial over a period of a week.

Because of these variations, the Service Man must be cautioned to accept calibration curves with a grain of salt and to continually re-check his instrument against better-known broadcast stations. I-f. frequencies, of course, can be checked by beating their harmonics against broadcast signals.

We have hopes that the new electron-coupled type oscillator will be less subject to this variation, but have not had enough experience with this type of circuit to make any comment on it.

Frequency Coverage

Frequency coverage is another matter that should be investigated by the Service Man. Oscillators with fixed broadcast and i-f. frequency ranges may not be adaptable to servicing requirements in the near future, as evidenced by the change in i-f. frequencies that are varied from year to year.

In many locations there are several broadcast stations on or close to the fixed frequency output of the oscillator which cause such serious heterodyning as to render alignment impossible at the frequencies recommended.

Fixed frequencies also prevent the use of the oscillator as a universal instrument which can be adapted to a number of uses.

Stability of frequency should be an inherent characteristic of every well-designed oscillator. Only in the very poorest do we find a lack of this important characteristic.

Output Meter

The importance of the output meter should not be overlooked. Without the output meter the oscillator is almost useless. Hundreds of tests have proven that a radio set can only be very, very approximately aligned by ear, and hundreds of demonstrations have failed to find the Service Man who would come within 50 per cent of properly aligning a set by ear.

For this reason it is believed that wherever an oscillator is mentioned, the output meter should be included. These two pieces of equipment should be inseparable, and frequent attention should be called to this fact.

Output meters, of course, are a story in themselves. There are several types now available, but for general use we believe the dry rectifier type is the one to be most recommended.

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Clarion Model 340 Super

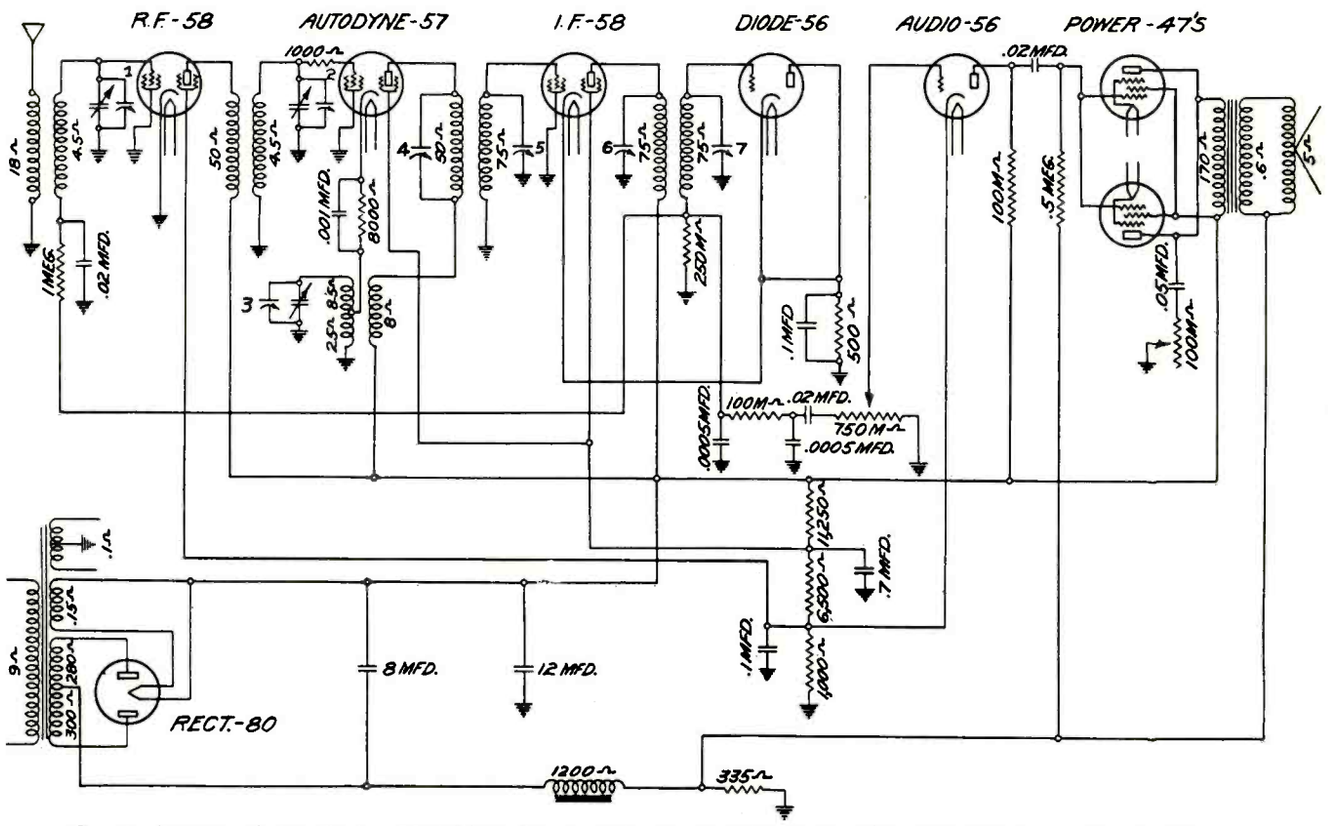
This receiver, as shown in the diagram, employs a 58 tube in a stage of tuned r-f., a type 57 tube as combination oscillator and mixer, a second type 58 as an i-f. amplifier and a type 56 as a diode detector and AVC. A second type 56 is used in a stage of intermediate audio which drives a pair of 47 pentodes connected in parallel.

All resistance and capacity values are included on the diagram so that it is possible to carry out point-to-point resistance measurements. A complete circuit resistance analysis is given in Table 1 and voltage analysis in Table 2.

Adjustment

The receiver has seven trimmer condensers. The setting must be accurate, with tolerance enough to permit exchange of tubes without ruining sensitivity. Each trimmer is numbered in the schematic diagram, and if adjustment is deemed necessary, proceed as follows:

To adjust the trimmers, connect your 175-kc. oscillator to the type 57 autodyne tube grid cap and then in the following order adjust trimmers numbers 4, 5, 6 nd 7 for maximum output. Next disconnect the 175-kc. oscillator and connect to the antenna binding post of the receiver the output lead from your broadcast test oscillator or tune



Circuit diagram of the Clarion Model 340 Super, with two 47 tubes in parallel. Test data is on the opposite page

in a broadcast signal from a known frequency crystal-controlled station at 1,400 kc.; then reset trimmers 2 and 1 respectively for maximum output. This adjustment will track the first detector (autodyne) and r-f. stage.

To check the calibration of the receiver, whether it be high or low, trimmer 3 (autodyne) oscillator should be reset until a station of known high frequency is brought in at the correct dial marking with peak volume. If your broadcast test oscillator is accurately calibrated, it might be used in place of the broadcast station signal; in this adjustment a signal at about 1,400 kc. should be chosen for the test.

The setting of the trimmers at 1,400 kc. is more critical than it would be at 600 kc. and therefore more accurate.

TABLE 1

Tube	*Grid*	*Cathode*	*Heater*	*Plate*	*Screen G.*	*Sup'sr G.*	*Space G.*
R-F.	Inf.*	0	.1	18,750	1,000	0	..
Auto.	1,000	8,000	.1	18,750	7,500	0	..
I-F.	75	500	.1	18,750	7,500	0	..
Diode	250,000	500	.1	500	..	..	..
A-F.	750,000†	1,000	.1	118,750	..	..	..
Pwr.	500,000	..	.1	18,750	..	..	18,750
Pwr.	500,000	..	.1	18,750	..	..	18,750
Rect.	..	..	18,700	1,800	..	..	..

* Over one megohm.
† Volume control "full on."

TABLE 2

Tube	*Fil.*	*B*	*C*	*Cathode*	*Screen*	*Plate MA.*	*Sup'sr G.*
R-F.	2.4	260	0.4	0.0	12	0.6	0
Auto.	2.4	260	0.0	7.0	90	0.5	0
I-F.	2.4	260	0.0	3.0	90	5.0	0
Diode	2.4	3	0.0	3.0	..	0.0	..
A-F.	2.4	180	0.0	12.0	..	5.0	..
Pwr.	2.4	250	1.0	..	260	20.0	..
Pwr.	2.4	250	1.0	..	260	20.0	..
Rect.	4.8	..	..	..	..	..	..

These readings are taken with 1,000 ohm per volt meter from socket to chassis and volume control full on.

Stewart-Warner 108 and 108-X

The Series 108 and 108-X Chassis is used in Models 10 to 20 inclusive. These receivers may be operated from a 110-volt a-c. or d-c. source, and also from a 6- or 12-volt storage battery and B batteries for use in automobiles, or a 32-volt lighting plant.

The schematic diagram is shown in Fig. 1. The aerial is inductively and capacitatively coupled to a type 39 tube in a tuned r-f. circuit which in turn is coupled in a similar manner to the type 36 detector tube. This tube is coupled through capacity to a type 38 power output pentode.

The 12Z3 tube is used as a half-wave rectifier in the power supply circuit. The heater of this tube is connected in series with the other three tubes, and the heaters so connected receive their current direct from the line through the limiting resistor marked 17

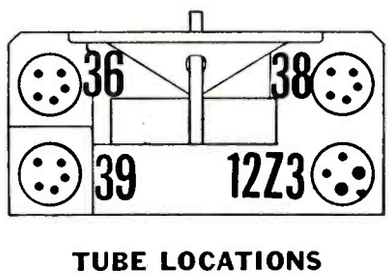
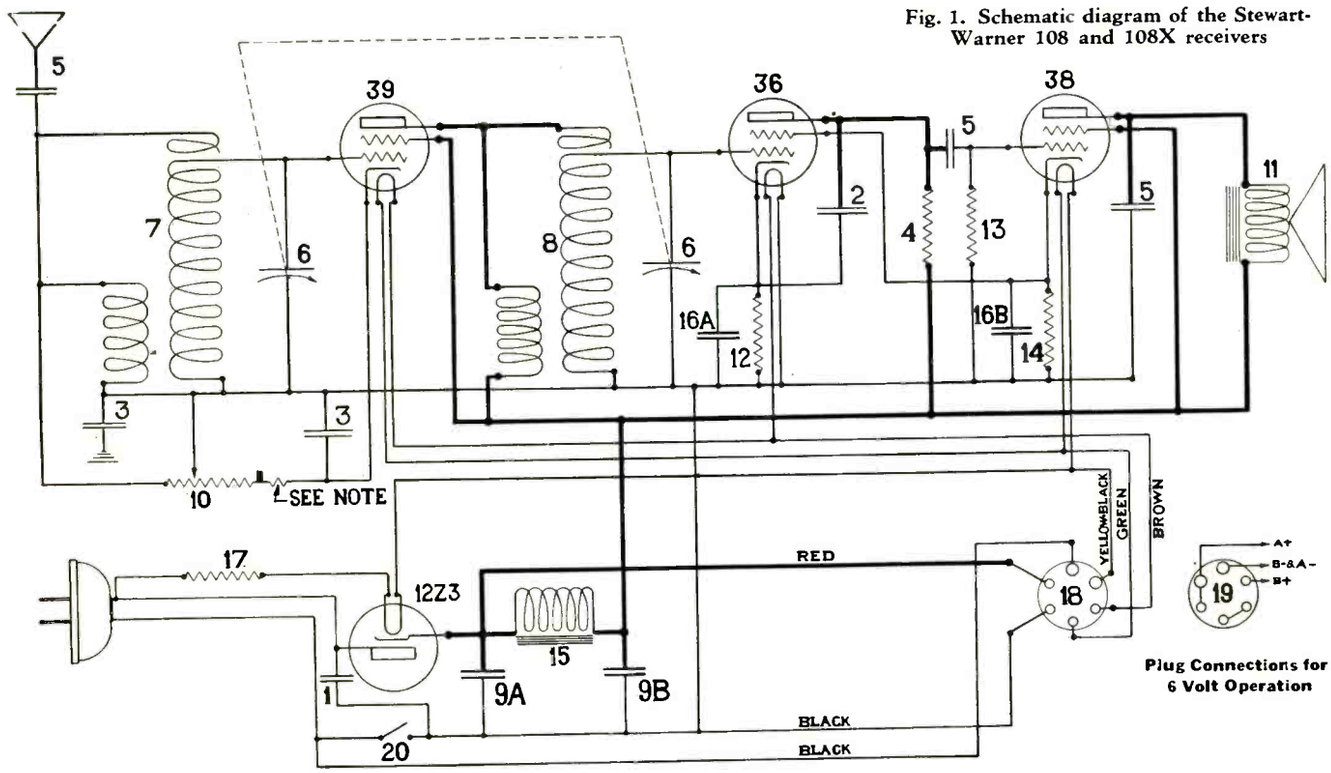


Fig. 2. Top of Model 108 chassis, showing tube locations

Fig. 1. Schematic diagram of the Stewart-Warner 108 and 108X receivers



NOTE: In some receivers, a 140 ohm, ¼ watt carbon resistor, part 81646 is connected in series with the volume control; in other sets this resistor is built into the volume control.

in the diagram. This resistor is not in the chassis but is a part of the power cord assembly. Thus, the power cord heats up slightly under normal conditions.

Fig. 2 shows the tube locations on the chassis, looking from the rear.

Each part in the diagram is numbered, the values of these parts are given in the following table:

1 —.01 mfd., 600-volt cartridge
2 —.0001 mfd. mica
3 —.1 mfd., 100 v. cartridge
4 —2.1 meg. ¼ w. carbon
5 —.003 mfd. mica
6 —Variable condenser
7 —Antenna coil
8 —Detector coil
9A, 9B — 4.0 mfd. 150 v. dry electrolytic (in one unit)
10 —250,000 ohm volume control
11 —Speaker
12 —29,000 ohm, ¼ w. carbon
13 —1.1 meg. ¼ w. carbon
14 —1,600 ohm, ½ w. carbon
15 —Filter choke
16A, 16B — 5.0 mfd., 20 v. dry electrolytic (in one unit)
17 —Power cord resistor
18 —Battery cable socket
19 —Battery cable
20 —Switch on volume control

The voltage data is given in the accompanying table. These voltages will be obtained when the set is operated at 115 volts, 60 cycles a-c. For d-c. operation voltages will be somewhat lower.

All voltage readings should be taken between tube prongs and the variable condenser frame, *not the chassis*. The chassis cannot be used in this receiver as a reference point for voltage readings.

Filament voltage readings will vary widely, depending upon the resistance of the a-c. voltmeter used. With high-resistance rectifier type meters, voltage readings will be approximately 6.3 for the detector and amplifier tubes, and 12.6 for the 12Z3 rectifier. With ordinary a-c. voltmeters, readings will be very much less.

STEWART-WARNER 108

Tube	*Plate*	*Screen*	*Cathode*
R-F.	107	107	1.5
Det.	1.3*	9	1.3
A-F.	103	107	9.0
Rect.	..	..	122

* This reading is obtained with a 30-volt scale, one thousand ohms per volt instrument. Higher resistance meters or higher scale readings will give greater voltage readings.

The battery cable 19 shown in the diagram of Fig. 1 can be obtained for 6-volt, 12-volt or 32-volt set operation.

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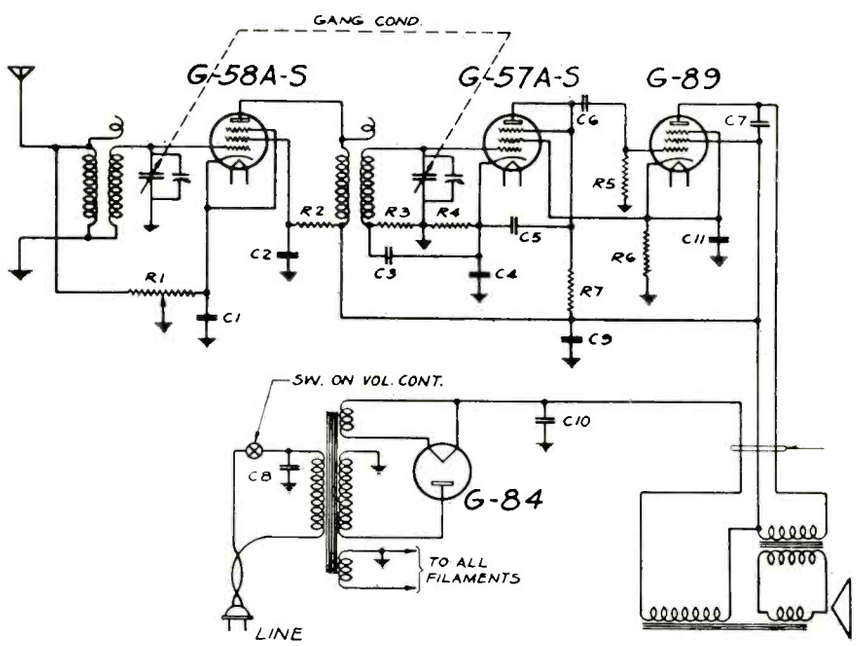
Majestic Model 380 Midget

This is a tuned radio-frequency receiver using a type 58 as r-f. amplifier and a type 57 tube as detector. These particular tubes have 6-volt heaters and are not the same as the standard type 57 and 58 tubes.

CONDENSER VALUES

C1—.05 mfd. C2—.05 mfd. C3—0.1 mfd. C4—0.1 mfd.	R-F. By-Pass Condenser Can
C5—.0005 mfd.	
C6—.03 mfd. C7—.005 mfd. C8—.01 mfd.	Audio By-Pass Condenser Can
C9—4.0 mfd. C10—8.0 mfd.	Electrolytic Filter Unit
C11—10.0 mfd.	Electrolytic



Here is the circuit of the new Majestic Model 380 Midget receiver. This is for a-c. only, with heaters connected in parallel

The type 57 detector is resistance coupled to an 89 power pentode feeding a dynamic speaker.

RESISTOR VALUES

R1—50,000-ohm volume control
R2—50,000 ohms
R3—500,000 ohms
R4—25,000 ohms
R5—300,000 ohms
R6—900 ohms
R7—300,000 ohms

Note that the G-84 is a half-wave rectifier. This should not be confused with the standard type 84 tube which is a full-wave rectifier.

The accompanying tables give the values of the resistors and condensers in the diagram.

•

Lyric Serial Numbers

Listed below are the Model and Serial numbers of the All-American "Lyric" receivers which will serve as a further means of identification when other means fail.

Model	*Serial Number*
D	2,000,001 and up
H	4,000,001 "
K	8,000,001 "
C-6	6,000,001 "
J	6,100,001 "
P	6,112,600 "
DC	7,000,001 "
DC7 (110 v.)	1,600,001 "
DC7 (220 v.)	1,600,001 "
B7	1,500,001 "
B	5,000,001 "
S-6	1,400,001 "
S-7	1,100,001 "
S-8	1,200,001 "
S-10	1,300,001 "
SA 90	2,100,001 "
SA-130	2,300,001 "
B-80	1,900,001 "
SW-8	2,200,001 "
S-63	1,800,001 "
S-65	1,801,000 "
DC-65 (110 v.)	2,400,001 "
DC-65 (220 v.)	2,400,001 "
SW-80	2,600,001 "
SA-91	2,700,001 "
SA-110	2,900,001 "
S-50	3,000,001 "
S-40	3,100,001 "
U-50	3,300,001 "

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Improving Philco Model 76

The Philco 76 can be improved by the addition of a tone control and dual volume control.

To do this it is necessary to remove the local-distance switch by clipping the wires from the local distance switch at the antenna coil. The yellow wire with green tracer must be removed from the long-distance switch and grounded; then remove the switch.

Install tone control (Philco part No. 04787) in its place and run a wire from the terminal of the tone control to the plate of the 27 tube.

For installing the dual volume control, use Philco Part No. 4094. Remove the single volume control and install the dual control in its place. The Philco No. 4094 has a 210-ohm and a 5,000-ohm section which can be found with an ohmmeter. Connect the 210-ohm side exactly the same as the single control was connected. The wiring of the 5,000-ohm side to the antenna system is simple. Run a wire from the antenna post to the right hand terminal. Run a wire from the center terminal to the antenna terminal of the antenna coil. These two wires must be twisted together.

Connect the left hand volume control terminal to ground. Replace the chassis pan and balance the set.

The dual control will give positive control of locals and the tone control will be of value in reducing static and controlling pitch of tone.

J. W. Roberts, Jr.

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Famous Last Words!

"Every part in the set tests perfect, yet the set does not operate as it should" . . .

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Majestic Model 400

The Model 400 chassis is employed in the Majestic Models 411 and 413 receivers. This is an a-c. or d-c. superheterodyne employing a G-57-AS tube as combination mixer and oscillator, a G-58-AS in a stage of i-f. peaked at 456 kc., and another G-57-AS as second detector. These three tubes have 6.3-volt heaters.

The G-43 power pentode used in this receiver has a 25-volt filament which draws 300 milliamperes, the same as the heater in the G-25Z5 rectified tube used. The G-46-A-1 ballast tube dissipates 46.1 volts. This tube is spray shielded in order to reduce glow, but there is no connection to the shield.

It should be noted that the sum of the heater voltages is 115 volts—including the filament of the ballast tube. The heaters are therefore tied in series and connected directly to the line; no voltage-dropping resistor is necessary. The heaters of the rectifier and power pentode tubes are shunted by a 500-ohm, 5 watt resistor, due to the fact that the current required by these heaters is only 300 ma. while the current required by the other four tubes is 400 ma.

The field coil of the dynamic speaker has a resistance of 2,600 ohms and is connected directly across the output of the rectifier tube. In order to minimize hum, there is a hum-bucking coil connected in series with the voice coil. This is shown in the accompanying diagram.

Alignment Procedure

For aligning, proceed as follows:

With the volume control in maximum volume position and the gang condenser completely out of mesh, supply a 456-kc. signal to the grid of the modulator tube and adjust the three i-f. tuning condensers for maximum output.

Then, with the gang condenser and volume control in the same position, supply a 1,730-kc. signal to the input of the receiver and align the two r-f. trimmer condensers for maximum output.

All voltages should be measured from the elements to B minus. When measuring the heater voltages the type of meter used will depend, of course, whether the receiver is operating from an a-c. or d-c. line.

The readings given in the accompanying table are based on a line voltage of 115 a-c.

MAJESTIC 400 VOLTAGE DATA

Tube	*Filament A-C., D-C.*	*Plate D-C.*	*Screen D-C.*	*Cathode D-C.*
Osc.-Mod.	6.3	105	105	13
I-F.	6.3	105	105	3 to 30*
2nd Det.	6.3	18	18	2
Pwr.	25.0	96	105	16
Rect.	25.0	..	..	118
Ballast	46.1	..	..	..

* Varies according to setting of volume control.

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Cathode Bias Condensers

Here is something to remember about cathode bias by-pass condensers, particularly those employed in screen-grid receivers. Shorted or open, oscillation is apt to occur. When it is open, the proper by-passing circuit is not existent. When shorted, the tube is functioning without a negative bias and its mutual conductance is the highest possible. As a result, the amplification is the highest possible, bearing in mind that r-f. tubes are operative without a bias.

•

Air-Cell Battery Receivers

What is to follow may not be true in every case, but it is still valuable information because it is applicable in very many cases. Quite a large number of the air-cell type receivers, that is, receivers which employ the 2-volt, '30 series type tubes, employ a .450-ohm fixed resistor as the filament voltage control unit. At some time or other, it may be desirable to change the type of filament supply to a 2-volt storage battery. If such is the case, short the .450-ohm fixed resistor and connect the 2-volt storage battery to the "A" terminals.

It might be well to remember that such a storage battery should be of the lead-acid type and not the Edison nickel-iron type. Further, the discharge curve of the storage battery should be flat, or substantially so with a final discharge voltage of about 1.8 volts.

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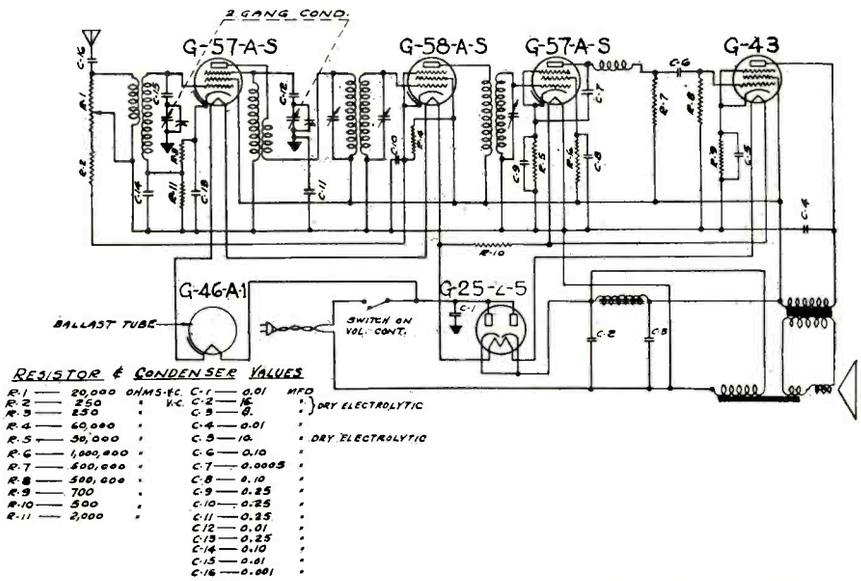
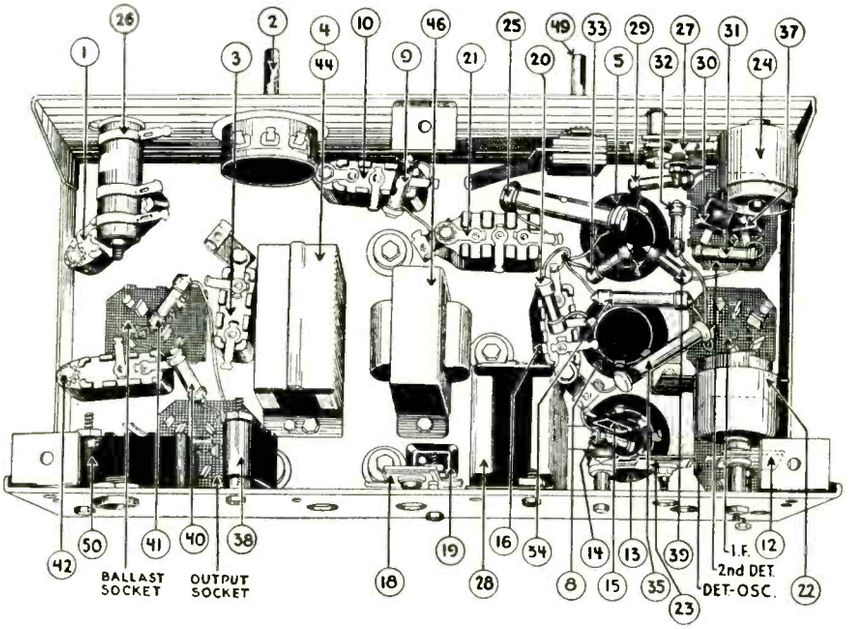
Oscillation and R-F. Plate Chokes

Put this in your pipe. If you are working on a screen-grid receiver which employs r-f. chokes as the load on the plate circuit, and the receiver seems to oscillate uncontrollably over a few degrees of the dial on the upper end of the tuning scale, try changing the position of the leads to the r-f. chokes. All that may be necessary is to shift the position of the leads with respect to the chassis or some other grounded part of the receiver. In certain instances, this oscillatory state is due to a resonance condition within the choke; that is, the fundamental of the choke lies within this band. In such cases, the best thing is to change the choke for one of slightly larger inductance. If the oscillatory state exists over a few degrees of the tuning dial at the lower end of the scale (high frequency) and you suspect the chokes, try chokes of somewhat fewer turns and lower inductance.



The circuit for the Majestic Model 400—also a midget—which has the heaters of all tubes connected in series, including the ballast tube. The first tube is a composite oscillator and mixer



Under-chassis view of the Philco Model 48 D-C. with all units numbered to agree with those in the diagram

Philco Model 48 D-C.

The Model 48 is a four tube, 115-volt direct current operated superheterodyne, designed to cover the band of 540 to 1,500 kc.

This model contains a type 36 screen grid tube for combination first detector and oscillator, a type 44 r-f. pentode tube as i-f. amplifier, a type 36 as second detector, and a type 43 pentode tube as output. A type 9 ballast tube is used for automatic voltage regulation.

The intermediate frequency of this model is 175 kc. The power consumption is 40 watts.

PHILCO 48 CONDENSER DATA

(1)	.01	(28)	No. 1	0.5
(3)	.01		No. 2	.25
(4)	2.0		No. 3	.15
(10)	.05		No. 4	0.5
(15)	.00071		No. 5	0.1
(16)	.05	(38)		.01
(19)	.00071	(42)		.01
(21)	.05	(44)		1.0
(30)	.00025	(50)		.015
(37)	.00025	(43)		.01

Voltage, resistance and condenser data are given in the accompanying tables. The resistance of coil windings, etc., is included in the schematic diagram.

PHILCO 48 RESISTOR DATA

Number	*Resistance (Ohms)*	*Power (Watts)*
(26)	30 & 140	Wire
(21)	250	Wire
(20)	1,000	0.5
(14)	8,000	0.5
(34)	25,000	1.0
(35)	32,000	1.0
(29) (31)	51,000	0.5
(25)	10,000	2.0
(32) (33) (41)	99,000	0.5
(39)	240,000	0.5
(40)	490,000	0.5
(9)	1,000,000	0.5

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Victor and R C A Chassis

The Victor 7-10 employed the Radiola 16 chassis. The Victor 7-11 employed the Radiola 18 chassis and the Victor 7-25 employed the Radiola 17 chassis. The Radiola 18 chassis was also used in the Victor 9-16 receiver. The Radiola 64 was employed in the Victor 9-18, 9-54 and 9-56 models.

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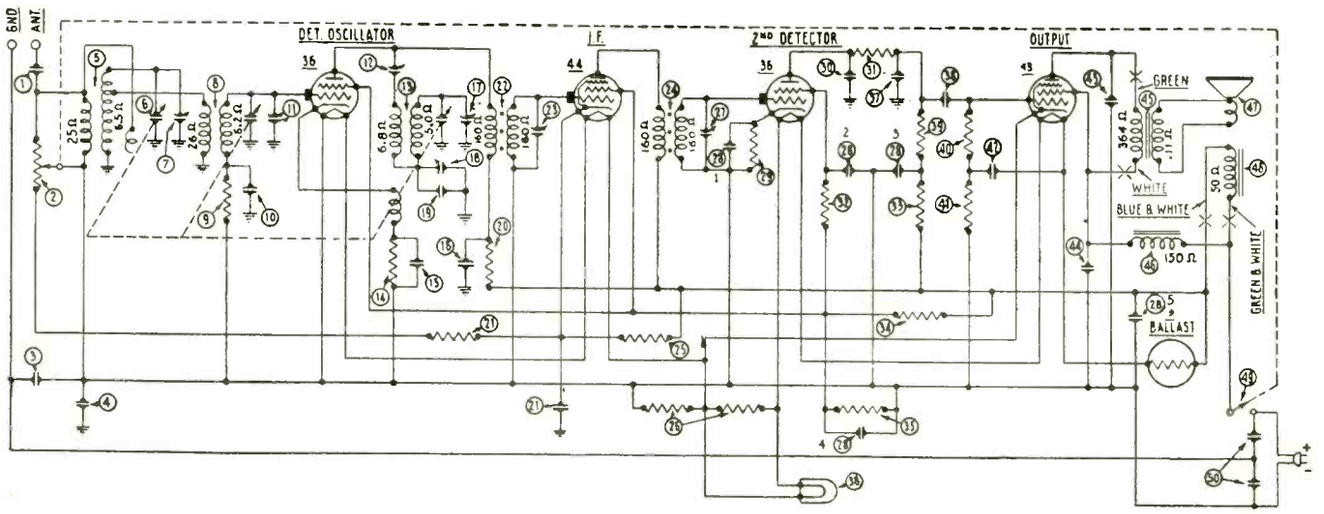
Columbia 920 and 990

These two electric phonograph amplifiers are of the same type. As a matter of fact, of exact design.

PHILCO 48 VOLTAGE DATA

Tube Use	*Fil. F to F*	*Plate P to K*	*Screen SG to K*	*Grid CG to K*	*Cathode K to F*
Det.-Osc.	6.3	100	55	3.0	0.5
I-F.	6.3	70	70	4.5	10.0
2nd Det.	6.3	37	35	3.0	0.5
Output	25.0	100	105	0.4	0.4
Ballast	50.0	..	..	..	..

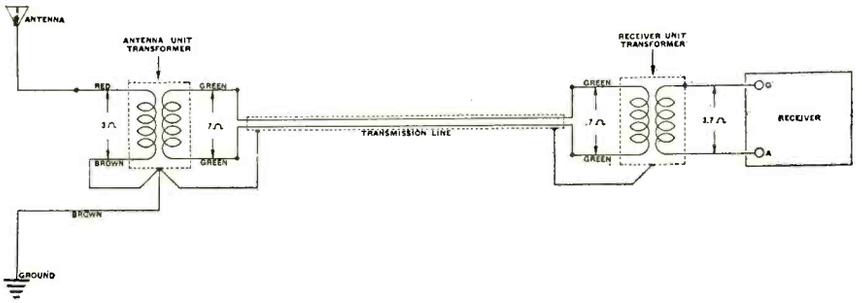


Circuit diagram of the Philco Model 48 D-C. receiver using series heater connection which includes the field of the dynamic speaker

A-K. Type 2-E Interference Eliminator

The circuit connections for the Atwater-Kent noise-reducing antenna system are shown in Fig. 1. It will be seen that the system is composed of an impedance-matching transformer used at the antenna, a shielded transmission line and a receiver impedance-matching transformer.

The system may be readily checked with an ohmmeter as the resistance values are given in the diagram.



Here is the connection diagram of the Atwater-Kent Type 2-E Interference Eliminator for use in connection with broadcast receivers. The resistance values are given

All-American Model U-55

The accompanying schematic diagram is that of the All-American Model U-55 superheterodyne receiver of the "universal" type, designed for operation on either an a-c. or d-c. line. An additional filter condenser is used when the set is to be operated on an a-c. line of 25 cycles.

Note that the type 44 tube, which is of the variable mu type, is used in the positions of combination mixer and oscillator, i-f. amplifier and second detector. A type 43 pentode is used in the output stage.

The heaters of all tubes are connected in series, as indicated by the numbers in the circuit diagram. All resistance and capacity values are given.

Note that the receiver is not directly grounded to the chassis.

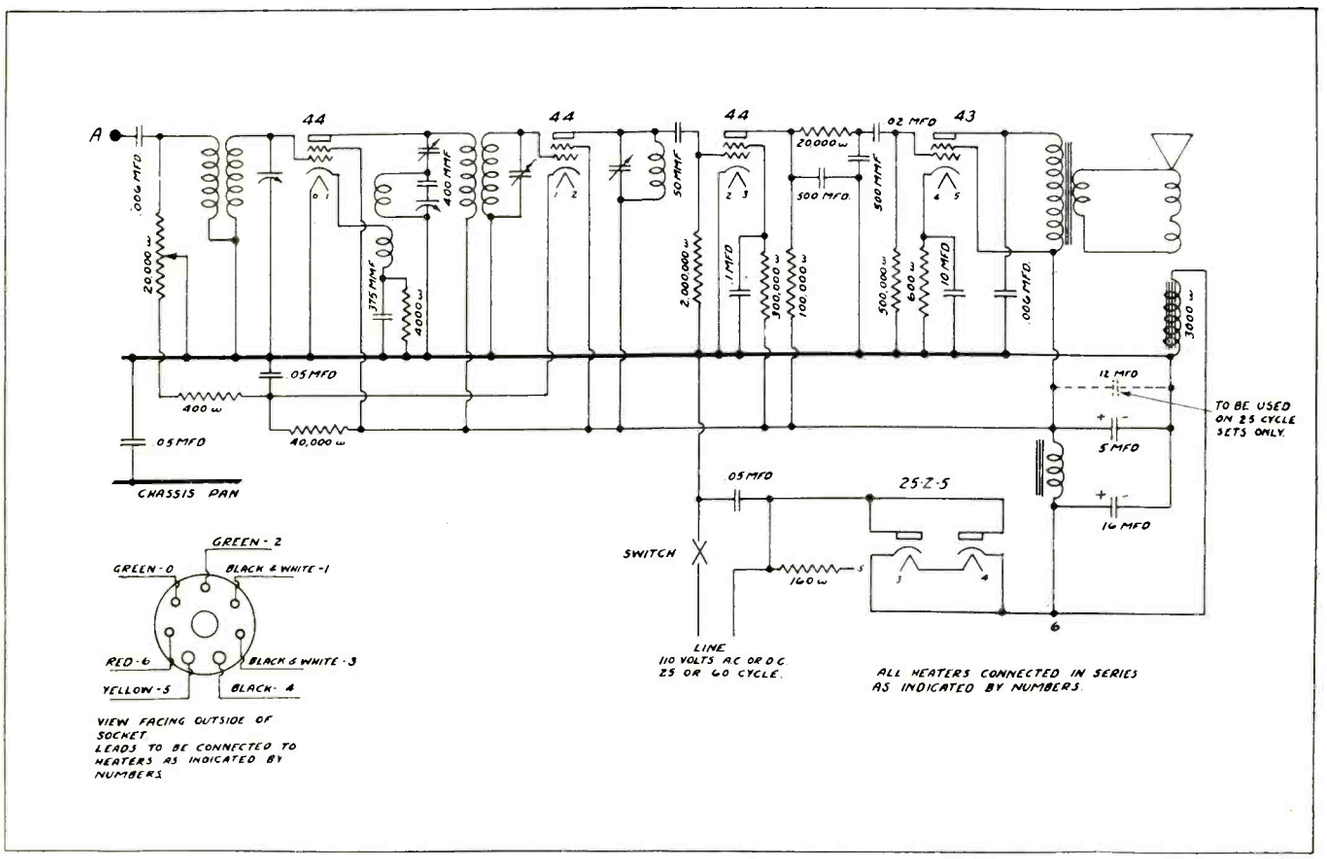
The intermediate frequency employed is 485 kc.

Colonial 31-AC

The electrical values employed in this receiver have been difficult to secure. Here are some of them. The grid circuit resistors in the 1st and 2nd r-f. stages are of 200 ohms each. The condensers connected across the r-f. plate and ground are .003 mfd. The detector grid leak and condenser combination is .00025 mfd. and 1.0 megohm. The detector plate circuit r-f. by-pass is .002 mfd. and the fixed resistor in the detector plate circuit is 10,000 ohms. The 1st a-f. grid filter resistor is 100,000 ohms, by-passed by a 0.1 mfd. condenser. The detector plate a-f. by-pass is 1.0 mfd. The '27 heater center tap potentiometer is rated at 30 ohms. The '26 filament bias resistor is of 70 ohms. The output tube bias resistor is rated at 1,250 ohms. The three filter condensers are 8.0 mfd. each. The voltage divider is a three-section unit, each rated at 37,000 ohms. The r-f. plate by-pass condensers are 0.1 mfd. and the r-f. filament by-pass condensers are 0.5 mfd. each.

Crosley Power Transformers

The power transformer No. W-5898 employed in the Crosley 610 is also used in the Model 31 and 32 receivers. The power transformer No. W-5267 used in the 704-B is also used in the 706. The power transformer No. W-6682 used in the Model 30-S receiver is also used in the early production of the Model 40-S receiver. Power transformer No. W-5120 used in the 704-B is also used in the 42. All of these transformers are of the 60-cycle, 110-volt variety. Power transformer No. 20,150 is used in the 77, 77-1, 84 and 120 models. Power transformer No. GI-24,436 is used in Models 127, 127-1.



Circuit diagram of the All-American Model U-55 midget receiver. The first tube is a combination oscillator and mixer

Public Address . . .

MICROPHONE BUTTON CURRENT

By Albert R. Kahn

Without a doubt, the double-button carbon microphone enjoys the greatest popularity of any type in use at the present time. Notwithstanding the higher background noise and fragility, the low cost, relative high output and portability outweigh the advantages of the other types, in most uses. It is not to be inferred that this is true in all installations. All types have a definite place in present-day practice.

A modern high quality carbon microphone, when operated correctly usually has a flatter and wider frequency response than the speaker and other component parts. However, improper operation can materially ruin the overall response of a fine sound or modulation system. Careful attention given to the pick-up end will well be worth the efforts spent in this direction.

Feed-Back

All public-address operators are familiar with "feed-back," a condition that exists when the sound, leaving the speakers, returns to the microphone either directly or by reverberation, causing an acoustical oscillation. This produces a "howl," the frequency of which is dependent on the distance between the speakers and the microphone. A "ring" on the end of the spoken words is a milder form of this state and is analogous to regeneration in vacuum tube circuits, the "feed-back" being additive to the impressed sound.

Because this is so often encountered in most indoor and some outdoor installations, it is not always practical to have the microphone extremely sensitive. The curves were run on a standard double-button microphone at three values of button current. It is shown that the reduced current affects the high and low ends of the register—the parts of the audio spectrum that have the greatest bearing on quality. It must be remembered that the low frequencies are the ones that contribute to "feed-back" because they are so easily reflected. The high frequencies are absorbed and dissipated and are therefore not bothersome in this respect.

For this reason, a reduction of button current and a consequent lessening of the lower register is sometimes advisable to obtain greater apparent volume, because the power will be concentrated in the middle and high end and produce a greater degree of intelligibility without "feed-back." In certain installations, a reduction in button current of several milliamperes will stabilize the system and not change the response more than .5 db.—an inappreciable amount. All of this depends on individual requirements. "Cut and try" is the best method of solving the problem unless the operator has a great deal of laboratory equipment at hand.

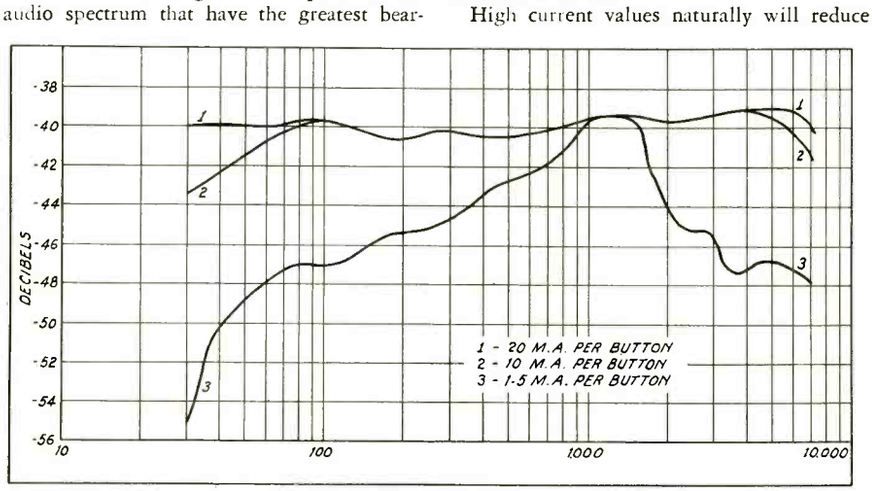
Sound Truck Service

It is common practice in sound truck operation to use a low value of button current as the rough treatment at high current values quickly burns the grains, and being in close proximity to the speakers, "feed-back" is prevalent. In this connection, close speaking is recommended, partially compensating for the lack of lows in the microphone response as a greater proportion of the lows in one's voice will be reproduced. However, extremely low values of current will attenuate the higher register and decrease the intelligibilty.

With present-day engineering, the "hiss" or carbon rush does not rise greatly with increased button current. With the advent of acid treatment of the grains which reduces the ash content, the db. rise of the hiss level rarely exceeds the 2.5 db. during a change from 1.5 to 20 ma.

High current values naturally will reduce the life of the carbon granules, but far greater damage can be done by jarring the microphone with the current flowing through it. Modern design makes long life possible at current values up 20 ma. in most reliable makes.

Any type of shock to the microphone, electrical or mechanical, will shorten the life. It is good policy to provide a means of applying the button current gradually, through a rheostat or potentiometer, rather than by the use of a switch, alone. Current obtained from the a-c. source (d-c. from the filter or the cathode resistor of an input stage) provides gentle application and is recommended wherever practical.



Three curves showing the effects on frequency response of a double-button carbon microphone with changes in button current

Unequal Current

An off balance condition sometimes exists when the resistance of the buttons become unequal and draw different amounts of current. Unless the grains and buttons have lost the polish due to burning, it can be remedied by tapping or shaking lightly *with the current off*. Often a microphone will regain balance when sound is impressed on it and return to an off balance state when not being excited, a condition that is not necessarily harmful. Broadcast practice allows an unbalance of 25 per cent and even wider tolerances are allowable in sound system work before the quality is appreciably affected. A serious out-of-balance condition causes a narrowing of the acoustic spectrum and the introduction of harmonics inasmuch as a double-button microphone is essentially a push-pull device.

Serious consideration given to microphone button current will strengthen one of the most vitally important links in the chain of associated public-address equipment.

•

Improving Push-Pull

In a perfectly balanced push-pull amplifier all even harmonics of the signal contributed by the non-linear action of the amplifier will appear in the common connection of the plate circuits. The even harmonics in the two halves of the primary of the output transformer are equal and opposite in phase, so that they are balanced out in the secondary winding. However, they will be in phase and will therefore add directly in the common plate lead. This is the principal virtue of the push-pull amplifier and the reason for its continued use.

Actual push-pull amplifiers are never perfectly balanced however. In the first place the characteristics of the tubes differ somewhat and as a result each will produce a different amount of even harmonics. In the second place, the plate circuits are never perfectly balanced so that even if each tube did produce the same amount of even harmonics, an exact balance would not occur in the secondary of the output transformer.

The most obvious means of reducing the amount of even harmonics is to limit the even harmonic currents flowing through the two halves of the primary of the output transformer. This can be done by inserting a choke coil in the common plate lead; that is, the lead going to the power supply. If the impedance of the choke coil is much higher than that of the primary, most of the even harmonic voltage will appear across the

choke. Or, to look at the matter in another way, the higher the impedance of the choke, the less even harmonic current will flow. This, of course, reduces the amount of even harmonic transferred to the secondary of the output transformer or, what is the same thing, improves the effective balance. This is the reason that a choke coil is often used in this manner and it is usually quite effective in reducing the even harmonic output of the amplifier. As a matter of fact, it frequently permits the amplifier to operate at a higher level without undue even-harmonic distortion.

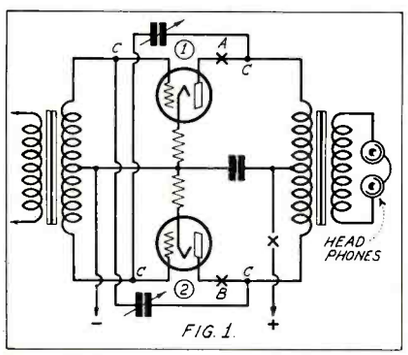
When pentode tubes are used in a push-pull amplifier, the results are not always as gratifying as when triodes are used. The difference lies in the fact that the distortion in triodes (i.e., below overload) usually consists mainly of even harmonics, whereas in pentodes odd harmonics predominate. If a large even harmonic voltage is developed across a choke coil in the common plate lead it may modulate the signal and produce the sum and difference of the two frequencies which are odd harmonics. The odd harmonics produced in this manner may either add or subtract with those produced in the tubes, depending on the relative phase of the two odd harmonic components. Of course, the same thing may occur in triodes, but due to better linearity of triode characteristics very little modulation occurs and this factor is usually unimportant. However, pentodes are better modulators and as a result the additional production of odd harmonics is important.

In general it may be said that push-pull triodes will show better performance with a choke and push-pull pentodes without a choke. However, like all rules, there are some exceptions to this, although it is a good rule to follow when in doubt.

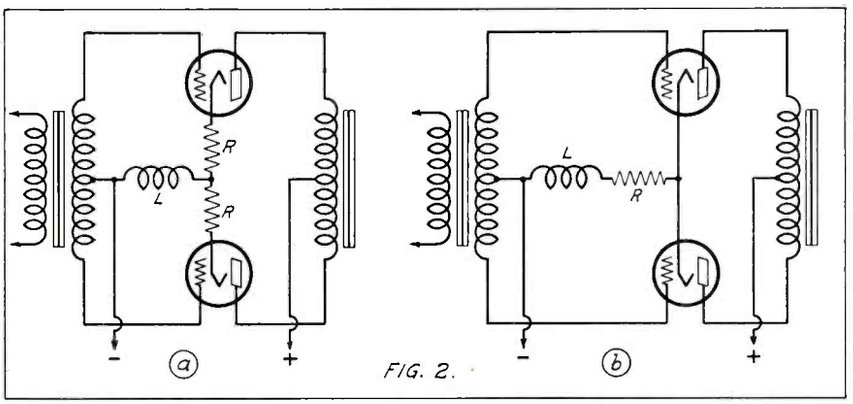
•

Stopping Oscillation in Push-Pull Amplifiers

It sometimes happens that push-pull audio amplifiers will oscillate at frequencies near the upper edge of the band they are intended to transmit. Thus, an amplifier designed to have a flat response characteristic from 30 to 10,000 cycles will sometimes oscillate at or near 10,000 cycles. This is due to resonance between the leakage reactance of the input transformer and input capacity of the tubes. In order for the amplifier to operate, the output transformer must also have appreciable leakage reactance. The coupling between plate and grid circuits is normally through the capacity between plate and grid of each tube.



Neutralizing-condenser method of stopping oscillation in the circuits of a push-pull amplifier



A low-resistance choke coil L connected in the common grid return circuit of a push-pull amplifier is another cure for oscillation. Two methods are shown

This type of oscillation may be eliminated in just the same manner that similar oscillation is eliminated in the power stages of radio transmitters—by neutralization.

Fig. 1 shows in schematic form a neutralized push-pull amplifier. Neutralization is accomplished by the small variable condensers.

The neutralization procedure is as follows: Temporarily disconnect the plate voltage supply and open the plate circuit of tube (1) at A. Now connect a small variable condenser, having a maximum capacity slightly larger than the grid to plate capacity of the tube (these values are given by the tube manufacturers) between the point C and the grid of tube (2), as shown in the diagram. Now, connect a pair of headphones across the output transformer and adjust the variable condenser until no signal is heard. It is necessary during this procedure to supply a signal of about normal level to the amplifier. If a sharp minimum cannot be found, adjust the condenser midway between the two points at which the signal is barely audible in the phones.

Now close the plate circuit of tube (1) at point A, and repeat the procedure for tube (2), this time disconnecting the plate circuit of tube (2) at point B and connecting in another variable condenser as shown.

After the amplifier is neutralized and plate voltage again applied at point X, it may be necessary to readjust both neutralizing condensers slightly if oscillation still persists.

Another method of preventing high-frequency oscillation in push-pull amplifiers lies in the use of a low-resistance choke coil of 50 to 100 millihenrys inductance as a common circuit element in the grid return. This is illustrated schematically in Fig. 2.

The resistance of the choke coil must be taken into account since it carries the combined plate current of both tubes and thus adds to the grid bias. If the d-c. resistance of the choke is small compared to the bias resistors R, as in (a) of Fig. 2, it will have a negligible effect on bias. If a choke of the proper resistance is available it may be used as the grid bias member, or, as shown in (b) of Fig. 2, in combination with a single resistor of the proper size. Such a choke coil, while effectively preventing high-frequency oscillation, will not alter the frequency characteristic of the amplifier.

•

Impedance-Matching Transformers in Parallel

It is sometimes necessary to supply power from a public-address amplifier to two or more loads, each at a different impedance and each requiring a given number of watts. Thus, it might be a case of one or more large speakers in a hall and a small speaker in an adjoining room—or maybe just a monitor speaker some distance from the amplifier.

Now, if there is sufficient power to spare, this can be accomplished by the proper use of resistance pads as described in the last issue of SERVICE. It frequently happens, however, that there is no power to spare and so the resistance pads cannot be used. In such a case impedance-matching transformers of the proper ratio must be used, and in a case such as outlined above, they would be connected in parallel.

TWO-LOAD EXAMPLE

As an example, suppose we wish to divide equally the power output of a 500-ohm amplifier having an output of 12 watts, between two loads. Let one load have an impedance of 15 ohms, and the other 500 ohms. Now let's see what's what.

First of all, we know that the output of the amplifier must be terminated in 500 ohms as this is the output impedance of the amplifier and must be matched. Since there are to be two loads and therefore two impedance-matching transformers, the impedance of the two transformer primaries connected in parallel must equal 500 ohms. Likewise, since each is to absorb an equal amount of power, the primary impedance of each transformer must be the same. This means, then, that each primary must have an impedance of 1,000 ohms so that when they are connected in parallel the resultant impedance across the output of the amplifier will be 500 ohms.

But, one transformer will be feeding a speaker or line of 15 ohms and the other a speaker or line of 500 ohms. Therefore, the impedance ratio of one transformer must be 1,000 to 15 and the other 1,000 to 500. Since each is terminated in the correct impedance,

each primary will "look like" 1,000 ohms, even though the two are connected in parallel.

With this arrangement, then, everything will be matched and the power will be divided equally between the two lines or speakers of different impedance.

TWO-POWER EXAMPLE

Now suppose that with the same amplifier we had wished to furnish 8 watts of power to the 15-ohm load and only 4 watts to the 500-ohm load. Quite often just such a requirement crops up. All right—we know that if two resistances are connected in parallel, each will absorb power inversely proportional to its value. That is, if the resistances are equal they will absorb equal power. But if one resistance is twice as large as the other it will absorb only half as much power, etc. So, we use this little prank of nature to our advantage. Like this:

The primary which is to absorb 8 watts is to present only half as much impedance to the amplifier output as the primary which only absorbs 4 watts. Nevertheless, these two primaries connected in parallel must still total 500 ohms so as to match the output of the amplifier. Now, the combined resistance of two resistances in parallel is equal to the ratio of their product to their sum. Let's put this into an equation and use some letters to represent the terms we are speaking of. Here goes:

Let the primary impedance of the transformer supplying the 15-ohm load be represented by Z_1, and that supplying the 500-ohm load by Z_2. Then the statement above will look like this for the product:

$$Z_1 \times Z_2 = \frac{Z_2}{2} \times Z_2 = \frac{Z_2^2}{2}$$

and like this for the sum:

$$Z_1 + Z_2 = \frac{Z_2}{2} + Z_2 = \frac{3}{2} Z_2$$

Therefore the ratio of the product to the sum will be:

$$\frac{\frac{Z_2^2}{2}}{\frac{3}{2} Z_2} = \frac{Z_2^2}{3Z_2} = \frac{Z_2}{3}$$

But this must be equal to 500 ohms. Therefore:

$$\frac{Z_2}{3} = 500 \text{ and } Z_2 = 1500 \text{ ohms}$$

We also know that:

$$Z_1 = \frac{Z_2}{2}$$

to 15 ohms.

Therefore: $Z_1 = 750$ ohms.

The impedance ratios of the two transformers will then be 1,500 to 500 ohms and 750

IMPEDANCE AND POWER RATIOS

It is apparent that there is a definite relation existing between the ratio of the power each transformer is to deliver to the total power available and between the impedance presented by the transformer primary and the output impedance of the amplifier. From the above examples we should therefore be able to deduce the relation defining the impedance ratio of the transformer.

Suppose we define the impedance ratio of a transformer by the ratio of the secondary impedance to the primary impedance. Then we will go into the use of some letters again. Let us designate the load impedances by R_1, R_2, etc., the output impedance of the amplifier by R_0, and the impedance ratio of the transformers by N_1, N_2, etc.

It is already evident that N_1 varies as the ratio $\frac{R_1}{R_0}$. For the second case this ratio is $\frac{15}{500}$. It is also evident that N_1 varies as the ratio of the watts absorbed to the total watts. For the second case above this is $\frac{8}{12}$ or $\frac{2}{3}$. It is immediately evident that the product of these two ratios gives the correct value of N_1, that is:

$$N_1 = \frac{15}{500} \times \frac{2}{3} = \frac{30}{1500} = \frac{15}{750} = \frac{1}{50}$$

Since the transformer must match its load impedance, we have:

$$N_1 = \frac{15}{750}$$

Substituting for the first case to test this product, we have:

$$N_1 = \frac{15}{500} \times \frac{6}{12} = \frac{15}{1000}$$

It would therefore appear that we have the correct relation since it checks for these two cases and further checks will prove that this is so. If we represent the available watts (15 in our case) by W_0 and the delivered watts by W_1, W_2, etc., the formula is:

$$N_1 = \frac{R_1}{R_0} \times \frac{W_1}{W_0}$$

Similarly

$$N_2 = \frac{R_2}{R_0} \times \frac{W_2}{W_0}$$

We may have any number of transformers (say K) in parallel to serve as many loads. Therefore:

$$N_k = \frac{R_k}{R_0} \times \frac{W_k}{W_0}$$

From which we may solve for the correct transformer ratios for any one of a number of transformers feeding separate loads from a single amplifier.

•

Parallel Operation of Amplifiers

In most cases it is not good practice to operate separate audio amplifiers in parallel, because, due to manufacturing variations in amplifiers and tubes, the separate amplifiers are not likely to be identical in electrical characteristics.

Usually the input impedance of an amplifier intended to work out of, say, a 200-ohm line, is higher than 200 ohms; sometimes it is as high as 2,000 ohms. It is to be expected then that the frequency characteristic of an amplifier whose input is paralleled with other amplifiers of the same type will depart somewhat from normal. As a rule, this departure is small if only two or three amplifiers are connected in parallel.

Suppose two identical amplifiers are connected in parallel to the same microphone. Also suppose that each amplifier normally supplies a matched load of 500 ohms. Then, if the outputs are connected in parallel and the gain of the two amplifiers are identical, the volume would either rise or go to zero, depending on the polarity of the amplifier output circuits. If the signal disappeared, the polarity of the output circuit of one amplifier would have to be reversed. Then each amplifier would be working into 250 ohms, since the loads are also in parallel.

Reference to Fig. 1, page 171 of the July, 1932 issue of SERVICE, will show that the impedance mismatch assumed above (i.e., 2 to 1) would result in a loss of 1 db. That is, the power delivered would be 20 per cent less than when each amplifier were to supply its own load.

Now, if one 500-ohm load is removed, the power delivered to this load will be twice as great as from one amplifier, or up 3 db., since the output of each amplifier in this case is matched. Likewise, if two more identical amplifiers were to be added, the power would again rise 3 db. or 6 db. above that delivered by one amplifier.

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The Radio Engineering Handbook

How long have we needed a radio engineering handbook? Years. Got to be just like a thirst, not having one. Then Keith Henney conceived the idea for a special kind of handbook, bigger and better you might say than the one we were thirsting for.

Mr. Henney decided that the whole book should be authentic, and it is difficult to gain such authenticity if a single man does the job—unless he is a "Jack of all phases," and then he is no good, anyway.

The result is The Radio Engineering Handbook, edited by Keith Henney, and made up of specially prepared data by twenty-two specialists! The section on Audio-Frequency Amplifiers is by J. G. Aceves, a man of distinctive achievements who always keeps his right hand on a slide rule. The section on High-Frequency Transmission and Reception is by A. Hoyt Taylor of the Bureau of Standards. Broadcasting by C. W. Horn, Chief Engineer of N. B. C.

Some of the subjects covered are: Mathematical and Electrical Tables; Resistance; Inductance; Capacity; Measuring Instruments; Vacuum Tubes; Radio-Frequency Amplifiers; Receiving Systems; Rectifier and Power Supply Systems; Loudspeakers and Acoustics; Television, etc.

Admittedly, much of the material is highly technical, but fundamentals are not forgotten.

The book has a flexible, red cover and is of a size that permits it to be tucked into one's pocket. There are a total of 583 pages—all for $5.00. Put out by the McGraw-Hill Book Company, Inc., New York, N. Y.

Auto-Radio . . .

Majestic Model 114 Super

This super is provided with automatic volume control, between station noise suppression, a push-pull power stage and a "B" power unit in place of the usual "B" batteries. The "B" supply is of the motor type.

Noise suppression is obtained by the use of the resistor R-5 in the G-85 cathode circuit. There is a voltage across this resistor due to the space current of the triode portion of this tube, hence the ground end of R-5 is more negative than the cathode end, and R-3 is more positive than ground. A certain signal voltage must, therefore, reach the diode plates before the diode plate end of R-3 attains a voltage below ground potential. This is similar to the usual delayed AVC while the condition of no signal exists, the grids of the G-39's tend to be positive, and are prevented from being actually more positive than their cathodes by the fact that they draw grid current through the resistors R-6 and R-1. The fact that these tubes are drawing grid current prevents them from giving the full amplification of which they are capable under proper voltage conditions. When, however, sufficient signal reaches the diode plates to produce three volts across the resistor R-3, the G-39 tubes attain their full mutual conductance and the entire system works as a normal AVC circuit.

Alignment

To align this receiver it will be necessary to use a special chassis container can that has holes drilled in it to permit reaching the aligning condenser with an aligning tool. The bale should be removed before inserting the chassis in the special container can as it covers the two i-f. aligning screws.

Completely connect the receiver as for operation with the volume control in maximum position. It will be necessary to connect the cathode of the G-85 tube to ground to stop the inter-station noise suppression action while aligning the receiver.

Supply a 175-kc. signal to the grid of the G-38 first detector tube and align the three r-f. aligning condensers for maximum output. (Two are located on the first i-f. transformer, and one just below the G-85 tube.)

Supply a 1,500-kc. signal to the antenna post and align the two trimmers on the gang condenser for maximum output.

Turn the gang condenser to approximately maximum capacity position and supply a 550-kc. signal to the antenna post. Adjust the series aligning condenser, which is located just below the first i-f. transformer, for maximum output. For each adjustment of the series alignment condenser there will be a different gang condenser setting which gives maximum output. The combination of gang setting and series condenser adjustment which give maximum output, disregarding setting, is the correct adjustment.

Be sure to remove the ground from the G-85 cathode after completing alignment.

Battery Connection

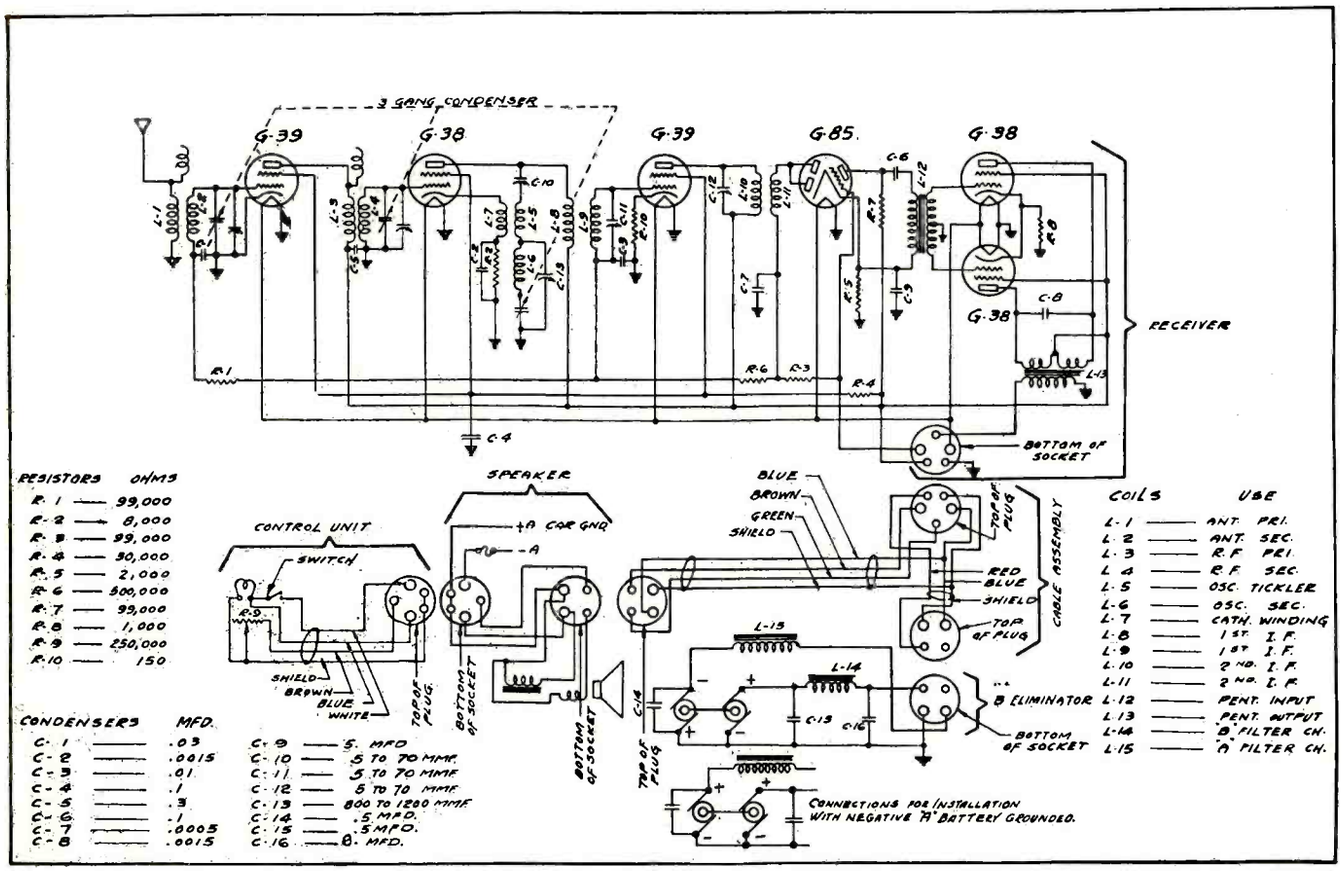
The "B" eliminator on the Model 114 as supplied from the factory is connected for operation in automobiles which have the positive terminal of the battery grounded. When an installation is to be made in a car having the negative terminal of the battery grounded, it will be necessary to reverse the two leads that come out of the generator near the choke and connecting assembly.

When voltage readings are to be taken, use a 1,000 ohms per volt, 300-volt, d-c. voltmeter. Readings should be taken between elements and ground, with the condenser gang fully meshed and no signal. The data is given in the accompanying table.

Majestic 114 Voltage Data

Tube	*Plate*	*Screen*	*Cathode*
R-F.	180	85	0.0
Osc.-Mod.	180	85	15.0
I-F.	180	85	1.1
Det.-A-F.	50*	..	2.0
Pwr.	170	180	17.0
Pwr.	170	180	17.0

* Plate of a-f. part of tube.



The Majestic Model 114 Auto Superheterodyne. This has an AVC and squelch circuit

Auto-Radio Fading

Considerable fading of signals is often experienced in auto-radio receivers while driving through city streets in proximity to buildings of steel construction or while driving under wires or viaducts. This form of fading is normal and does not indicate a defect in the receiver.

•

Police Signals

In certain States it is illegal to make auto-radio installations which are capable of receiving police calls. In tuned radio-frequency sets capable of picking up these signals, the tuning condenser trimmers should be adjusted so that these signals cannot be received.

In superheterodyne receivers capable of reception on the police bands, the same sort of an adjustment of trimmer condensers should be made. If these signals are picked up on the image frequency of the receiver, there is not a great deal that can be done, unless it happens that the image-suppression circuit is out of adjustment.

•

Correction

Mr. George Jehle, of Newark, N. J., was kind enough to call our attention to an error in the schematic diagram of the Crosley Model 95 appearing on page 321 of the November issue of SERVICE. If you will take a look at this diagram you will see that our draftsman got a bit too ambitious and showed the cathode of the combination first detector and oscillator connected directly to ground, thereby shorting the bias resistor and all. Just remove this one direct connection from cathode to ground and the diagram is correct.

Thanks, Mr. Jehle.

•

Mallory B-Eliminators

We reproduce herewith the schematic diagram of the Mallory B-Eliminator, servicing details of which appear on page 174 of the July issue of SERVICE. This diagram provides the values of the condensers and resistors used.

Checking this diagram against the continuity table published in the July issue, the key letters and numbers are as follows on the diagram: 1 is the negative input post, 2 is the positive input post. K is the upper right hand prong of the Elkonode. C and D are the lower left and right prongs respectively of the Elkonode. M is the upper right prong of the tube. E and F are the lower left and right prongs respectively of the tube. H is the terminal of the r-f. choke which connects to the tuned filter.

•

Plymouth and Desoto Radio Installations

Many Service Men have sweated and fretted and perhaps lost religion when making radio installations in the above mentioned cars. One of the leading Service Men in New Orleans recently lost what little religion he had working on such installations and finally in despair made up his mind that he was going to discover just what the trouble was, in order to spare others in the profession such exasperating work.

Mr. J. Henry Blache, Jr., finally discovered the trouble. It so happens that in the new models the motor firing spark is still heard in the loudspeaker regardless of all precautions suggested by the manufacturer. Mr. Blache discovered that this trouble was caused by the "hot" wire running from the ammeter on the dash board to the dome light. This unshielded lead comes near the overhead antenna and feeds the noise to it.

Mr. Blache found that by connecting an 0.5-mfd. condenser from the lead (red) where it makes contact with the ammeter to the ground (frame of car) this trouble was entirely eliminated.

E. T. Jones.

•

Stewart-Warner R-108-X for Autos

When the Model 108-X chassis (details of this model will be found in the General Data section of this issue) is used as an auto receiver, two extra brackets are necessary, as well as a 6-volt adapter cable.

The plug at the end of the adapter cable fits into the socket in back of the radio receiver. To use this cable, clip the yellow lead labeled +A to the positive terminal of the storage battery and the yellow and black wire labeled —A to the negative terminal. For automobile use, in order to reduce motor interference, it is best to connect the A leads directly at the battery terminals instead of the ammeter or other convenient connection.

A potential of 135 volts is required for the B supply. This potential may be obtained either from a B eliminator or three 45-volt blocks of B battery.

If a B eliminator is used, it is necessary to reduce its voltage to 135 under normal load in order to prevent breakdown of the electrolytic filter condensers in the receiver. This may be done by inserting a wire-wound resistor in series with the B+ lead or by using a voltage-divider system.

An approximation to the correct value of resistance which is required is to insert 50 ohms for each volt it is required to reduce the B supply. For example, if the B supply is to be reduced from 180 to 135 volts, it will be necessary to insert $45 \times 50 = 2{,}250$ ohms in the B supply lead.

If the car is not equipped with a built-in aerial, it will be necessary to build one in on the roof of the car or use one of the numerous automobile type antennas that are now available on the market. The antenna, of course, should be as large as possible and be kept as far away from the ignition system as possible. Do not expect reception from an antenna inside the car if the roof contains metal screening which is grounded.

For best results an inside antenna should be kept at least 8 inches from the surrounding metal of the car body if possible. Always keep the antenna wire as near the center of the top as is feasible, but avoid the proximity of the dome light as this sometimes introduces interference.

NOISE SUPPRESSION

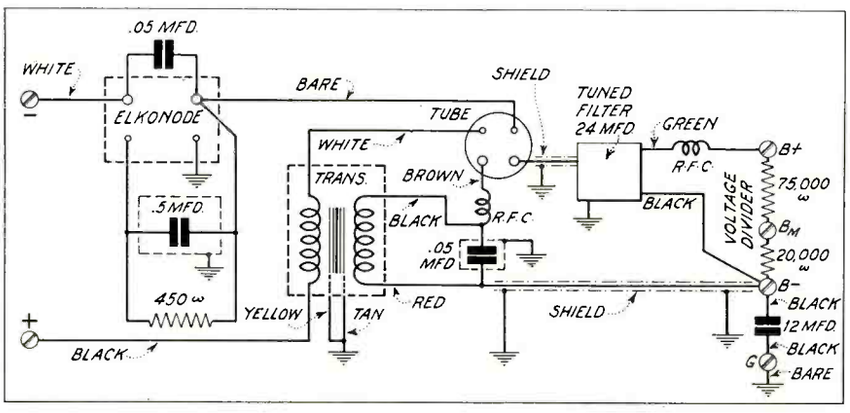
In many automobile installations no interference will be experienced from the ignition system, so that spark-plug suppressors will not be required. However, in a majority of installations some form of suppressor will be necessary.

It is impossible to give any fixed rules as to what suppressors to use in any given model car. This fact may be better appreciated when we state that it has been found that different suppressors will be required for identical cars. The following general rules, however, provide a starting point.

A 2,000-ohm suppressor inserted in the lead from coil to distributor is often all that is necessary.

Where such a single resistor proves insufficient, separate spark-plug suppressors will be required. These will vary in resistance from a minimum of 15,000 ohms to a maximum of 40,000 ohms. However, it is best not to exceed 35,000 ohms. It will be found in the majority of cases that spark-plug suppressors of 25,000 ohms resistance will give the best results. Of course, it is understood that the lowest value of resistance should be used in order to accomplish the amount of suppression desired.

In many cases it will be found necessary to install a 1.0 mfd. condenser across the generator cut-out in order to suppress noises set up by the generator. This condenser should be connected between the cut-out terminal and ground.



The schematic diagram of the Mallory auto B-Eliminator, using the Elkonode

THE FORUM . . .

For the Real Service Man

Editor, SERVICE:

I am trying very hard to control my anger after reading such a narrow-minded letter as that of Mr. Freedman's. How can he assume outright that your subscriptions are falling off without knowing anything about your circulation? If they are falling off, I would like to buy an extra one to have in my shop as well as in my office.

Mr. Freedman says that very little of the "technical radio" is understood by *our average Service Man.* Might I suggest to Mr. Freedman that *his* "average Service Man" is well *below* the average if he cannot understand the simple technical discussions in SERVICE, the best full-blooded, red-meat radio magazine on the market.

If you run the pages he suggests, why not call them "Baby Radio."

Admitted, SERVICE is not for beginners, but for the *real* Service Man who understands theory as well as fact.

Please keep up your present policy of technical discussions and let other magazines teach the beginners.

PORTER H. BUCKMEISTER,
Sedgwick, Maine.

(There has been an increase of 350 per cent in the paid circulation of SERVICE in the past year.—The Editors.)

•

Wants "Technical" Data

Editor, SERVICE:

Upon reading Mr. Freedman's letter, I felt the need of writing you and saying that I heartily disagree with Mr. Freedman, and at the same time to commend and congratulate you upon your viewpoint on this situation.

I have read every issue of SERVICE printed to date, and can find nothing that suits me more and fills my needs so adequately.

I wish you all kinds of luck, and hope you see fit to continue to give us *technical* data as you have done heretofore.

HARRY R. DE LONG,
Philadelphia, Pa.

•

Wants More Explicitness

Editor, SERVICE:

Unfortunately Mr. Monroe M. Freedman is right. Your readers are above the average, but a great majority of them are not college graduates in electricity or radio technique, and therefore do not fully understand your technical explanations. It is education in radio that we want. That is why we read SERVICE. We want the fundamentals of all new developments but to understand fully their operation, the theory must be explained in non-technical language so we who are not college men can understand them.

In order to determine for myself as far as possible as to whether Mr. Freedman is right in stating that SERVICE is too technical, I put the March issue of SERVICE in my pocket and interviewed quite a number of successful Service Men, and their opinions were much the same as mine.

TO OUR READERS

IT is with a certain amount of pride that we print on this page a few of the many letters received supporting us in our contention that SERVICE *should not lower its standards merely to meet the requirements of the screw-driver-mechanic type of Service Man. That our readers do not wish this has become decidedly apparent.*

There is no longer any doubt as to what the majority of you fellows want. We are here to see that you get it. This is our pledge that the standards of SERVICE *shall not be lowered, but rather raised as time goes on.*

So far we have received but one letter *which in any way is in agreement with Mr. Freedman's opinions. A portion of this letter is printed on this page. The author, Mr. G. C. Anderson, does a good job of pointing out some of our shortcomings. But, rather than suggest we run "practical" data, he earnestly requests more explicit information of an educational nature which would assist him in an understanding of the more complicated "goings-on" of modern receivers. In other words, Mr. Anderson is just as anxious to learn as the rest of us, and has no desire to do servicing on a "catch as catch-can" basis. We are with him 100 per cent. Hereafter we will try to do better.—The Editors.*

For instance, in the circuit description of the Stromberg-Carlson Nos. 48, 49, 50 and 51 Supers, you say, "The 57 tube is used as the relay tube in the 'Q' circuit which suppresses between-station noise while the set is being tuned."

Many of us do not understand the fundamental theory of this circuit and just *how* the between-station noise is suppressed. Some of us are also a bit hazy on the "low-level tone compensation circuit which increases the response to bass frequencies and high frequencies in proper amount as the volume level is reduced." And so on.

I like your magazine as it is but would suggest that you explain the more technical statements made in simpler, non-technical language and give us a complete exposition of the theory of all new developments in radio.

GEORGE C. ANDERSON,
St. Louis, Mo.

•

Learn the Fundamentals

Editor, SERVICE:

I most certainly cannot agree with Mr. Freedman regarding SERVICE being too technical for the average Service Man. I cannot believe that subscriptions are falling off, as I have just renewed my subscription and have been a reader of SERVICE since its beginning.

We all know that radio is advancing very rapidly and the Service Man must keep pace if he is going to stay in the game. His technical qualifications must be of a high standard. In fact, I spend about all the money I can possibly spare in buying technical books and expect to continue as long as I stay in the service game.

My advice to any Service Man who thinks this magazine is too technical for him, is to get busy and go back to fundamentals, or take up a good radio course so that he will know what it is all about.

I would like to hear more on this subject.

FRED LANGE,
Fayette City, Pa.

•

Wants Facts

Editor, SERVICE:

I have just finished reading the letter by Mr. Freedman in your March issue and feel that the man who cannot understand service procedure as you outline it should not be called a Service Man.

What we Service Men want is facts. We want to know what causes a part to fail and how to keep that part from failing again.

The service field has too many screw-driver men now.

Keep SERVICE just as it is and I am sure that you will make a success of this great magazine. I take SERVICE as my standard in servicing and am making good. I started with SERVICE and aim to continue as long as it holds up to the standards you have set for it.

R. G. MILLER,
Saltville, Va.

•

Servicing a Profession

Editor, SERVICE:

I wonder if Mr. Freedman gave real thought to his subject matter? It opens up the old question, the viewpoint of servicing as a profession, or just something to do.

Intelligent servicing demands technical knowledge in addition to ability in use of tools.

I believe that Mr. Freedman suggests the wrong principle in servicing. I think that the repairs should depend upon individual analysis of each particular receiver, that is, based upon diagnosis and not upon hard and fast rules. To this end a sound knowledge of fundamentals is essential and should be acquired by all Service Men, for their own interest. We must either keep up with the work or drop out.

I am for keeping SERVICE just as it is.

GEO. E. BACCHUS,
Brooklyn, N. Y.

•

Strictly Service

Editor, SERVICE:

When I paid for a subscription to SERVICE I did so with the understanding that it would be strictly a Service Man's magazine. In order to comply with Mr. Freedman's wishes, you would have to use valuable space which would otherwise contain the dope we need.

I think you have made a pretty good job of it to date.

W. A. SMITH,
Oak Forest, Ill.

(*Continued on page* 150)

ON THE JOB . . .

FIRST PRIZE
REPEAT CALLS MADE EASY
By H. Friend

All people are lazy in some respects—but even so, it is asking a lot of a person to look up your phone number or address when his set kicks up. Of course, if you have a sticker with your address and phone number on it pasted in back of the person's set, that takes the rub out of the hunt-and-find job—but if you are going that far to help your customers, why not go the whole way? Here's the idea:

Go to your local printer and have made up a batch of *Business Reply Post Cards,* the kind with your name and address printed on one side of them and which a person can mail without placing any postage on 'em. Then, on the other side of the card have printed something like this (which is what I have on my cards):

> *My radio needs attention. Please call at my home on.....*
> *preferably in the* MORNING / AFTERNOON
> *Signed* .....

Now, the idea is to tack one of these cards in the back of the set—letting the customer know it is there. Then, when he needs you, he just mails it . . . no stamp needed. And it costs you only two cents for each card mailed.

If you want to make it still easier for the customer, fill in his name for him at the time you place the card in the receiver; you will have his complete address in your own file, so that won't be necessary.

These cards have done a lot for my business and help to keep my old customers on the "live list." These cards also go over big with my dealer customers whom I do service work for.

The idea is not new, but in these times when we fight for our business it is fine for a customer who hasn't a phone and who doesn't want to be bothered hunting for a stamp.

•

SECOND PRIZE
GETTING THE NEIGHBORS
By R. F. Lambert

Business-building ideas! A prime requisite in any business, but in the servicing end of radio receivers, business-building ideas are an absolute necessity. Other things being equal, the Radio Technician, who supplies the most efficient service, is the man who has the largest and the most profitable clientele.

The customer's opinion of you depends to a large extent upon what he thinks of you as you enter his home. If you are prompt, dependable, courteous, and efficient you get the lion's share of the credit; if you are careless and amateurish, few of your customers will be prospects for future service calls.

The sales opportunities which present themselves during practically every service call are known, but does the average Radio Technician appreciate how really golden this opportunity is when worked to the utmost of its possibilities?

I have tried many different business-building ideas in selling "service" and during the last few months I have been successful in obtaining good results, in spite of the depression period we are now experiencing, by sticking hard to the following idea:

Whenever I receive a service call from one of my old customers, and after my work is completed, I ask Mrs. Customer if she happens to know how her friends' and next door neighbors' radio sets are working? It is really surprising to note how easy it is to obtain valuable information from this question, and many times, if you present your case properly, she will actually call them up by telephone, telling them that you are in her home, and that you have just completed work on her radio set to her entire satisfaction. If on the other hand she states that she really does not know, I ask for her kind permission to use her name in connection with a personal call next door. This is seldom refused, and supplied with her name as a recommendation, I venture forth to the next door. In calling I explain that I have just finished working on Mrs. Customer's next door radio set and that I would be glad to look over their radio set and to test the tubes, etc., without any obligation on their part whatsoever, and adding that this service would actually save the cost of $1.50 for a service call.

In mentioning the name of her neighbor it gives me in almost every case entrance to their home, and needless to mention here, there is hardly a set that is over three years old, but what it needs some adjustment or new tubes that will improve the radio reception.

There is actually very little sales effort needed to sell tubes. All I have to do is to test the tubes in the presence of the owner of the set, by explaining the meaning of the instrument readings, because it creates that feeling of confidence in your ability, so necessary as a basis for suggesting a new rectifying tube, power tube, or other tubes. In testing I point out to the prospective customer the tubes that test up weak, adding that before she makes a decision to allow me to replace the weak tubes with new tubes that she will be surprised to hear the difference in the performance of the receiver.

Before leaving the home I always obtain the consent of the owner to place a name plate on back of the cabinet with my name, address and telephone number, being careful to show the exact location of it to my prospective customer, and explaining that cards are easily lost, and by placing it on the back of the cabinet it will be easy to find my telephone number next time any radio service work is required.

I have covered both sides of the street for a whole block, whenever an opportunity like this has offered itself, and by following this method the results have been most gratifying.

THIRD PRIZE
FREE PUBLICITY PLUS
By H. C. Obermiller

There are, no doubt, many Radio Service Shops that attract too little attention from persons passing by. Here is an idea that is sure to make them stop and take notice of the wide-awake service organization, and if done in the right manner, create in the minds of the people the excellence of the work done.

Take the old work bench out of the back room, dress it up and put it in the front show window along with the test panel and tool rack, or at least as much of it as can be accommodated.

Equip the repair man with a doctor's coat, smock, or some type of uniform, and arrange the bench so that he can be either facing or standing sideways to the window.

If one finds it difficult to locate trouble while being looked at, just do the analysis in the back room and take the set to the window bench for the actual repairing, adjusting and most impressive work.

An additional advantage will be found in having plenty of daylight to work by.

This system has proven favorable in at least one instance of which the writer knows.

(*Continued from page* 148)

Complimentary

Editor, SERVICE:

I have just read the letter of Monroe M. Freedman, of New York, as published in SERVICE for March.

I believe that all Service Men would allow me to thank you in their behalf for publication of Mr. Freedman's letter. It undoubtedly is a compliment to at least 85 per cent of the persons engaged in radio servicing as they would be considered far above "our average Service Man."

Unquestionably the few remaining Service Men or "average Service Man," that is, those who cannot read and understand service, should fall into the ranks of screw-driver mechanics.

Congratulations SERVICE.

H. J. HARRIS,
Huntington, W. Va.

•

"Don't Lower Standards"

Editor, SERVICE:

With reference to the letter by Monroe M. Freedman, I appeal to you in behalf of the majority of Service Men NOT to lower the standards of your magazine.

What we want in SERVICE is a book just full of WHAT YOU NOW GIVE US. Your answer to Mr. Freedman's letter seems to cover about everything. It might be well to run a one-page article on ABC radio, but by all means keep up SERVICE to the standards that we have all known in the past.

FREDERIC H. PERAN,
Buffalo, N. Y.

RACON

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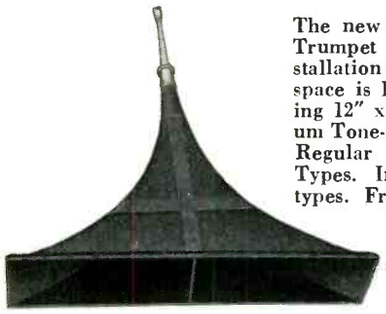

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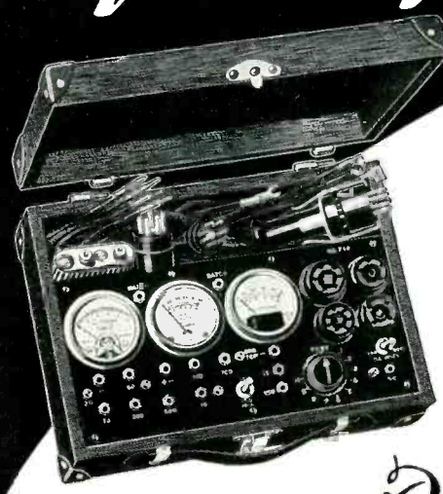

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It is equipped with a practical selector switch for checking all parts of the tube circuit by connecting to the set sockets. It is so designed that selection can be quickly and accurately made for testing voltages of plate, grid, cathode, suppressor grid and screen grid. Plate current, filament volts, line and power supply volts are also measured.

Both A.C. and D.C. filament voltages are accurately measured. Contains new wiring and socket for taking care of new small 7-prong tube as well as larger 7-prong tube. It is equipped with a small diameter plug-adapter for testing in new sockets. Try this amazing tester one day and you'll wonder how you ever got along without it.

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Many times Service Men have asked us how to get individual diagrams of receivers, amplifiers and test equipment which they have been unable to obtain. We have diagrams available for fully 90 percent of all the receivers, amplifiers and test equipment which have been manufactured.

In the past we have supplied local Service Men with individual diagrams, and we are now prepared to extend this service to all men in the field, wherever they may be located.

Realizing the need for quick service, your diagrams will be sent within twelve hours of the time we receive your order—photostats slightly longer. In order to make this possible, we must have the exact brand name and model number of the unit on which you are working.

Individual diagrams, 35 cents, postpaid. (Add 5 cents for foreign mailings).

SERVICE HEADQUARTERS
John F. Rider Publications, Inc.
1440 Broadway New York, N. Y.

HIGHLIGHTS . . .

Engineering Counsel

The best of us get the big headache on occasions when we become hog-tied with some technical problem or marooned from reliable sources of supply. That holds for engineers as well as Service Men.

It is pretty encouraging therefore, to hear that The Audak Company, far-sighted enough and sufficiently "in the know," to realize the lack of coöperation in respect to technical information and quick distribution, have virtually opened their doors to all Service Men.

Audak engineers are all set to take personal care of any and all technical questions and problems which may arise in your work. All you have to do is write 'em. Furthermore, Audak will deal direct with Service Men who are unable to get local satisfaction in the purchase of Audak units.

All of this means that in the future jobs will not be held up because technical details are not available, or because of the inability to obtain units on quick notice.

•

Tube Designations

We have been calling our radio tubes Jimmy and Johnny . . . WD-11 and 254. Why WD-11 or 254? It might have been the page number in the laboratory notebook.

Our family of tubes has grown so large, that it is difficult to remember what kind of a fellow 254 really is. It is therefore not surprising to find that the manufacturers have finally decided to give the various tubes more scientific names.

Have you seen the new system before? Let us recall the system used for the past five years for numbering Amperite voltage regulators. It works like this:

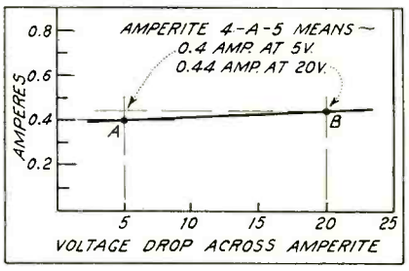
An Amperite 7-A-5 passes 0.7 amperes at 5 volts, and 0.77 ampere at 15 volts. An Amperite 11-A-10 passes 1.1 amperes at 10 volts, or 1.2 amperes at 30 volts.

The part before the A designates the current, after the voltage drop.

In the case of the Amperite, a 10 per cent increase in current causes the voltage across it to triple. The Amperite number, therefore, gives the useful part of the characteristic curve, as shown in Fig. 1. This is an ideal condition, as the name tells you practically all you want to know about the Amperite.

You will note the similarity of the new radio tube numbering. Radio tube 5A4 means it has a 5-volt heater or filament, has 4 outside terminals and is the first of its type. A different letter is used for each type of 5-volt, 4-terminal tube. Rectifier tubes are lettered Z, Y, X, etc. It is, of course, more difficult to give all the tube characteristics in the name—but the new system is a tremendous improvement. We will, at least, know that a 5A4 tube is to be used on 5 volts, has 4 terminals, and therefore cannot be a pentode.

Now, what is the next step? Why not give scientific names to set models? For example,



36T2 would mean:
3—193(3) Model.
6—6 Tubes.
T—(T)able Model.
2—Chassis No. 2 with 6 tubes made that year.

Model 36H1 would mean a (H)ighboy, same year, same number of tubes, but not the same chassis. And similarly, 36C1 would be a Radio-Phonograph (C)ombination, 6 tubes, same chassis as highboy above. For a midget set, M would be used, etc.

Then there would be something in a name.

•

Self-Styled Fixers

On and off we receive complaints from Service Men that some people fix their own sets. The idea seems to be that if set owners were not able to purchase parts at substantial discounts they wouldn't go in for personal fixing.

Maybe a few people *do* fix their own sets, but what of it? You can't blame them if they are really capable of doing it without professional assistance. BUT, when it comes to this sort of game the Hygrade Sylvania Corporation and the gang here have exactly the same idea—and that idea is amply expressed by the accompanying cartoon taken from a recent issue of *Sylvania News*.

The man who tries to fix his own set usually gets into plenty of hot water, and eventually has to call in a Service Man, anyway. And those who are capable of fixing the sets of yesteryear are going to be up a tree with these new double super image diodes with geometric tone values and delayed power . . . or something.

•

RCA and Cunningham Radio Set Socket Layout Guides

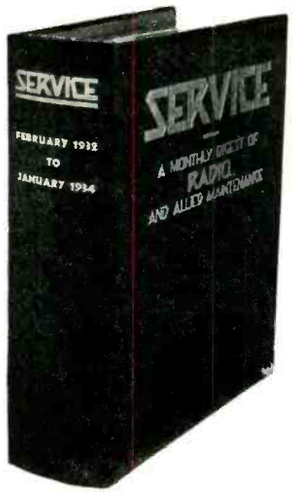
RCA and Cunningham have been putting out Socket Layout Guides for a good number of years, and these guides have proven to be one of the handiest tools for the Service Man as well as the Dealer. For each set listed there is a chassis layout, showing not only the types and the number of tubes used, but also their respective locations on the chassis and their specific functions.

The new RCA and Cunningham Socket Layout Guides contain the data as supplied by the set manufacturers themselves, and all companies are listed alphabetically. They cover all sets manufactured from January 1, 1921, to October 15, 1932.

These Guides are pocket size. If you want one, contact your local distributor.

Courtesy of Sylvania News

Mr. Fix-it saves the price of a service call



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Every issue of SERVICE contains many articles which are not only valuable today but will be worth many dollars to you at some future date. Preserve your copies of SERVICE in this handsome, practical binder. You'll never regret this purchase.

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This handsome, two-tone blue, imitation leather binder is of De Luxe library construction, stamped in gold. It is the most secure method of holding your copies of SERVICE. The individual issues, once bound, cannot fall out or be pulled out and yet it takes less than half a minute to insert or remove the contents.

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Beat these features!

in any Test Oscillator at TWICE this PRICE

1. Operates from any 110 Volt, AC or DC line. No battery weight or expense.
2. New Electronic-coupled circuit assures frequency stability, regardless of voltage fluctuation or output load.
3. Introduces SELECTIVITY TEST for receivers, giving a complete check on overall r.f. performance.
4. 1000 Cycle a.f. output, in addition to r.f. bands, for audio system checks.
5. Full Intermediate, Broadcast, and Shortwave coverage, including the new 456 and 477.5 k.c. bands.
6. Unequalled accuracy—each output frequency sealed at zero beat against a crystal oscillator.

Clough-Brengle Model OA Test Oscillator, complete with three tubes, net. **$29.70**

For a limited time we are making this liberal offer: Send your order direct to the factory for C.O.D. shipment. You may return the Model OA within 15 days if not fully satisfied. Your local jobber will be given full credit for your purchase.

A new STATICLEAR Balanced Antenna System for only $3.00 net.

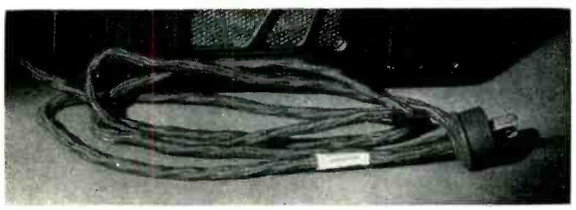
The exclusive advantages of this proven interference eliminating system offered at a new low price. Write for details.

Write for this New Bulletin today!

The CLOUGH-BRENGLE Co.
1140 W. Austin Ave., Chicago, Ill.

Send me complete descriptive literature on the new Clough-Brengle Test Oscillator and STATICLEAR Balanced Antenna System.

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



The "CORDOHM"

(PATENT PENDING)

OPENS A NEW FIELD OF PROFIT FOR SERVICE MAN AND JOBBER.

The CORDOHM is a combination line cord and resistance unit for use on AC-DC radio receiving sets. It is now being used by many manufacturers of these sets and entirely eliminates the *heat from the chassis.*

HERE IS A REAL OPPORTUNITY IN AN UNTOUCHED FIELD!

Over 400,000 sets have been produced having the voltage dropping resistor in the set; many of these become excessively hot and require frequent service because of the effect of the heat on the electrolytic condensers. By replacing the set resistor with the CORDOHM the problem is solved permanently. Merely remove the old resistor and line cord and substitute the CORDOHM. Be the first in your vicinity to tap this new source of business. Use the coupon for further details.

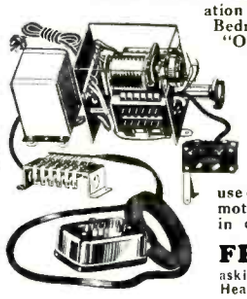
OHMITE
MANUFACTURING COMPANY
636 N. Albany Avenue Chicago, Ill.

Please send me full information about the CORDOHM.

NAME .....
ADDRESS .....
CITY ..... STATE .....
JOBBER'S NAME .....

RCA Victor Automatic REMOTE CONTROL $12.50

SERVICEMEN! Here's an item that you can make a profit from this summer. A full automatic remote control assembly, controlling the entire operation of the radio from the Porch, Lawn, Bedroom, etc. Turns radio "ON" and "OFF." Accurately selects six different stations. Adjusts volume to desired level, all from a distance up to 75 feet from the radio receiver.



It is particularly adaptable in the Public Address Field, permitting the selection of radio programs when desired, through the use of a suitable tuner attached to the remote control assembly, and when used in conjunction with P.A. Amplifiers.

FREE— Our Catalog of 10,000 Radio Bargains is yours for the asking—The coupon brings it from Radio Headquarters.

Rush This Coupon-NOW!

WHOLESALE RADIO SERVICE CO., INC. Dept. S-63
100 Sixth Avenue, New York, N. Y.
Gentlemen:
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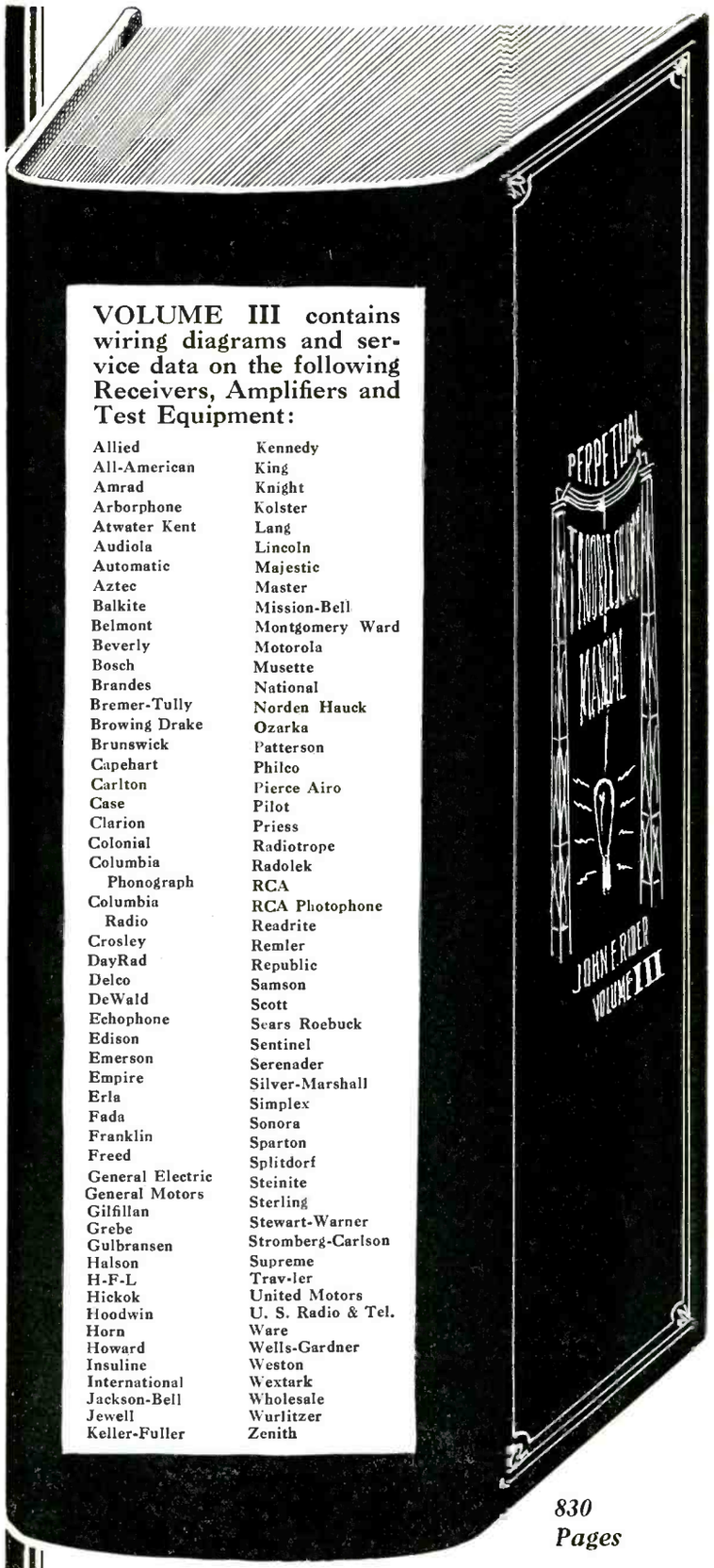
Address .....
Town ..... State .....



VOLUME III contains wiring diagrams and service data on the following Receivers, Amplifiers and Test Equipment:

Allied	Kennedy
All-American	King
Amrad	Knight
Arborphone	Kolster
Atwater Kent	Lang
Audiola	Lincoln
Automatic	Majestic
Aztec	Master
Balkite	Mission-Bell
Belmont	Montgomery Ward
Beverly	Motorola
Bosch	Musette
Brandes	National
Bremer-Tully	Norden Hauck
Browing Drake	Ozarka
Brunswick	Patterson
Capehart	Philco
Carlton	Pierce Airo
Case	Pilot
Clarion	Priess
Colonial	Radiotrope
Columbia	Radolek
Phonograph	RCA
Columbia	RCA Photophone
Radio	Readrite
Crosley	Remler
DayRad	Republic
Delco	Samson
DeWald	Scott
Echophone	Sears Roebuck
Edison	Sentinel
Emerson	Serenader
Empire	Silver-Marshall
Erla	Simplex
Fada	Sonora
Franklin	Sparton
Freed	Splitdorf
General Electric	Steinite
General Motors	Sterling
Gilfillan	Stewart-Warner
Grebe	Stromberg-Carlson
Gulbransen	Supreme
Halson	Trav-ler
H-F-L	United Motors
Hickok	U. S. Radio & Tel.
Hoodwin	Ware
Horn	Wells-Gardner
Howard	Weston
Insuline	Wextark
International	Wholesale
Jackson-Bell	Wurlitzer
Jewell	Zenith
Keller-Fuller	

830 Pages

NEWS!

GOOD NEWS

VOLUME THREE

will be ready the end of May!

Adoption of Volume III in addition to Volumes I and II of Rider's "Perpetual Trouble Shooter's Manual" by

E. T. Cunningham, Inc.
National Union Radio Corp.
RCA Radiotron Company

and other companies, establishes these Manuals as the

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Absolute leadership in the field of service manuals!

Can you find any more representative organizations to prove to you that Rider's Manuals give you the service data you require and that your service business requires these Manuals!

Can you find any more reliable proof that these Manuals are the most complete and authoritative —most accurate!

It is quite natural that these famous manufacturing companies who do business with the radio service industry, would select the finest . . . and when seeking the best and finest . . . choose Rider's Manuals.

Can you do with anything less?

Hickok, Readrite, Supreme, Weston . . . all recommend Rider's Manuals. It is quite natural that such a famous organization as Weston Electrical Instrument Co. who produce testing instruments for Service Men would choose carefully before recommending. . . . They recommend Rider's "Perpetual Trouble Shooter's Manuals." . . . Examine the instruction books which accompany their latest test equipment. You will find the recommendation to be Rider's Manuals . . . and it is exclusive.

Can you be satisfied with any manuals other than those recommended as the finest?

Receiver Manufacturers' service engineering staffs, when selecting manuals for recommendation and approval will naturally select those which are the most accurate . . . most complete . . . best indexed . . . most legible . . . easiest to read and use. . . . They recommend Rider's Manuals.

Rider's "Perpetual Trouble Shooter's Manuals" fulfill all of these requirements.

It pays to buy the best! You get the most for your money.

Volume III with its 830 pages of the most reliable service data as outlined on the next page justifies the trust placed by the famous companies who have adopted and recommended Rider's Manuals.

Announcing

VOLUME THREE

JOHN F. RIDER'S

PERPETUAL TROUBLE SHOOTER'S MANUAL

READY END OF MAY

Volume III is the companion Manual to Volumes I and II. No duplication in the contents of these Manuals.

All NEW material. Volume III picks up where Volume II left off and also contains service data on old receivers, which were not available when Volumes I and II were compiled.

We are enthusiastic about Volume III! We know that it surpassess our own Volumes I and II in the character of its makeup and in the nature of its contents. Here are the contents of Volume III. These are the reasons why we say that it is the most magnificent of them all! These are the reasons why we say "Send your order now so that you may secure your copy immediately upon publication."

- ***830 pages.***
- ***Letter press printed!*** Each page is printed from an engraving. This assures the utmost clarity of reproduction. Everything on each page is clear and readable. Half-tone photographs of chassis views are clear and identification of parts is easy.
- ***A Chronological Catalog and Index*** of all nationally-advertised radio receivers manufactured and sold in the United States between January, 1921 and January, 1933 are contained in Volume III. This list will be of tremendous aid in the identification of receivers for which the model number is not known. It will also be of help in connection with trade-in operations. It is the only index of this kind available in the industry.
- ***Up-to-the-minute.*** Volume III is up-to-date. It includes the very latest receivers, such as RCA R-27, R-28; Lyric U-55; Majestic 400; De-Wald 54; A-K 480, A-K 627, A-K 812; U. S. Radio and Television 3040, 3056; Zenith 400 series and AC-DC, etc. Volume III contains receivers announced up to about May 1st, 1933.
- ***Complete data.*** Service information in Volume III appears in the most complete form. Such information is:

  Schematic wiring diagrams; chassis wiring diagrams; parts layouts; photographic views of chassis; socket layouts; voltage data; resistor values; condenser values; location of alignment and trimmer condensers; alignment and trimmer adjustment frequencies; intermediate-frequency amplifier peaks; alignment and intermediate-frequency adjustment instructions; color coding; transformer connections; point-to-point data; continuity test data; parts list with prices; special notes.
- ***Complete tabulation of tube data*** showing electrical characteristics and constants for all of the tubes employed in radio receivers and amplifiers since 1921. Also a table of interchangeable types.
- ***Complete coverage.*** The service data in Volume III covers the following subjects:

  Broadcast receivers; short-wave receivers; combination receivers; auto-radio receivers; universal AC-DC receivers; West Coast midgets; kit receivers; centrallized radio systems; remote control arrangements used with commercial receivers; ignition systems used in all American automobiles produced during the last two years; public-address systems; RCA Photophone amplifiers; power packs; eliminators for auto-radio installations; car antenna and noise suppression instructional data; short-wave converters; commercial ohmmeters; commercial set testers, analyzers and diagnometers; commercial tube checkers; commercial test oscillators.
- ***A complete table of I-F. peak frequencies*** as used in radio receivers. This list augments the information of this type shown upon the diagram pages. Intermediate-frequency amplifier peak information is very important because quite a few of the manufacturers employ more than one figure in their year's production. A wrong guess on your part means trouble.
- ***Sequence of pages*** is in accordance with the indexing in Volumes I and II. The pages are all in order so that if you wish, you can combine Volumes I, II and III or employ Volume III by itself.
- ***A cumulative index*** covering Volumes I, II and III is contained in Volume III. This is one index in which all of the receivers shown in Volumes I, II and III are indexed alphabetically according to manufacturers and numerically according to model numbers.
- ***Special binder.*** A NEW and special type of "INSTANT-REMOVAL" binder is used, whereby you can remove, add or change any one or a number of pages in Volume III. The mechanism affords utmost ease of operation. No more than a few seconds are required to make the change.

If you are in the service business and want to stay in the business, you need these Manuals. If you have Volume I and II, you cannot do without Volume III. If you do not have Volumes I and II, get your copy of Volume III to give you coverage of the new receivers and purchase Volumes I and II at a later date.

Send your order and remittance today! *Now!!* Be certain to get your copy as soon as the Manual is published, which will be the end of May. *Sold with a Money Back Guarantee.*

SPECIAL NOTE: We invite inquiries from the men who subscribed to the supplements to Volume I and from those who purchased the Atwater-Kent tabulation of electrical values.

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1440 Broadway, N.Y.C.

Here is $7.50. Please rush Rider's "Perpetual Trouble Shooter's Manual," Volume III, postpaid, immediately upon publication, which I understand will be at the end of May. It is understood that this Manual is sold with a Money Back Guarantee and if I am not satisfied with its contents and return the Manual to you postpaid within 30 days after I received it and it is in perfect condition, you will refund my money.

NAME ..... ADDRESS .....

CITY ..... STATE .....

THE MANUFACTURERS . . .

New Triplett Meters

The Triplett Electrical Instrument Company, of Bluffton, Ohio, has just announced the new Triplett line of D'Arsonval Moving Coil Instruments. It is said that innumerable tests have proven the ability of these new Triplett instruments to give fine service, to register accurately, under severe service conditions.

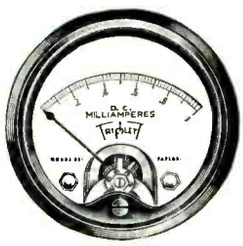
Two sizes of these instruments are made—in three case models. Furnished in low-reading micro-ammeters, milliammeters, voltmeters up to 2,000 volts, milli-voltmeters and ammeters.

No. 321 has a 3½-inch case with 2⅜-inch scale. It is furnished with screws for rim flush mounting. The same size, Model 325, is also available for front-of-board mounting.

No. 223 has a 2-inch case with 1¾-inch scale. It comes with a narrow rim and clamp for flush mounting.

Both the No. 321 rim flush mounting type and the No. 223 narrow rim type are illustrated on this page.

The new instrument fits around a moulded Bakelite plate in which the terminals and assembly studs are firmly anchored. This construction combines accuracy and high insulating qualities. The metal dials are enameled permanently white with black lithographing, resulting in a most durable and attractive finish. The finest sapphire jewel bearings are



used, it is said. The aluminum needle and other parts are ribbed and made unusually strong throughout. The moving coil is light in weight. The scales are extra long, uniform and easy to read. Sealed cases of one-piece construction means strength and absence of foreign materials.

The Triplett Electrical Instrument Company will send a descriptive folder on request.

•

Clough-Brengle Test Oscillator

A test oscillator having the frequency stability of a signal generator, and specially designed for service work, has just been announced by the Clough-Brengle Company of 1134 W. Austin Ave., Chicago, Ill. This oscillator is known as the Model OA.

The usual self-modulated oscillator circuit is not used. The Model OA employs three tubes, the r-f. oscillator stage, a separate modulator stage, and a rectifier tube, for this instrument operates from any light socket, a-c. or d-c., eliminating battery cost and weight.

The "electron-coupled" oscillator circuit gives freedom from frequency variation due to voltage change or input circuit conditions. Complete coverage of all intermediate broadcast and short-wave bands is provided, including the new 456- and 477.5-kc. intermediate frequencies used in the latest Majestic, Stewart-Warner, Atwater-Kent and other sets.

The whole unit is contained in a single steel housing, finished in black crackle. Sturdy construction assures against mechanical damage.

Output frequencies are adjusted to zero-beat against a crystal oscillator, and are sealed while the zero-beat is maintained.

Considering the equipment included, the Model OA oscillator is very moderately priced. A descriptive bulletin has just been issued.

•

Alden Universal Adapter

A number of inquiries have been received relative to the types of tubes that can be tested in the Na-Ald No. 950XYL Universal Tube Checking Adapter described in the February issue of SERVICE. The list follows:

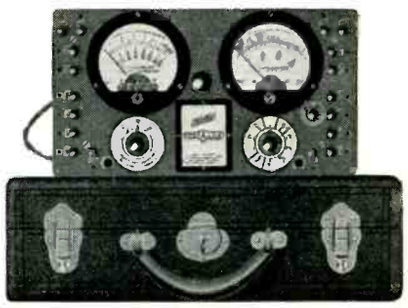
1, 2A5, 5Z3, 12Z3, 14, 15, 18, 19, 29, 33, 36, 37, 38, 39, 41, 42, 43, 44, 46, 47, 48, 49, 52, 55 diodes, 55 triode, 56, 57, 57A, 58, 58A, 59, 64, 65, 67, 68, 69, 70, 75 diodes, 75 triodes, 77, 78, 79, 80, 80M, 82, 83, 84, 85 diodes, 85 triode, 88, 89, 90, 92, 95, 96, 98, 257, 291, 293, 295, 985, 986, AD, AE, AF, AG, C2, C4, ER1, G2, G4, GA, HZ-50, KR-1, KR-5, KR-20, KR-22, KR-25, KR-28, LA, PA, PZ, PZH, T-1, Wunderlich "A" and Auto Tubes.

•

Hickok Port-A-Lab

The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio, who have been decidedly active in development work recently, now introduce still another type of instrument for the Service Man—the Port-A-Lab, here illustrated.

This new job has a high degree of precision and permits readings in ohms, megohms, microfarads, henrys, a-c. and d-c. milliamperes and a-c. and d-c. volts, both high and low scale. Altogether there are twenty different ranges available on the two meters.



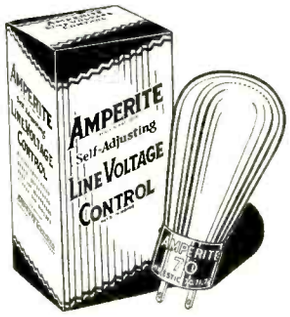
The Ohmmeter is not battery-operated, but is operated in conjunction with a vacuum tube rectifier contained in the case. No rectifier is used with the a-c. voltmeter. This voltmeter works directly from the a-c. line in connection with a voltage adjuster for precise calibration which is independent of line fluctuation.

The Port-A-Lab can be used for regular set testing but was designed particularly for point-to-point work and individual unit measurement.

•

New Type Amperite

A new series of Amperite automatic regulators, with standard flat-prong connections, have been placed on the market. Fitting the standard electrical outlet, this type can be used in all commercial and public-address installations. Radio sets equipped with flat prong ballast sockets can use the improved regulators directly, without extra adapters. For example, the Amperite 70 will plug directly into the regulator sockets of the



Majestic Models 70, 71 or 72; Amperite 90 can be used on the Majestic 90, 91 or 92.

The new and recently improved regulating characteristics are obtained with this ballast. Improving the regulating characteristic means more and better regulation with less wattage. In fact, the wattage consumption of the new Amperite is 40 per cent less than that used by the former types.

The transformer primary current of radio sets (without '50 tubes) averages 0.1 ampere per tube. The current of a 7-tube set is therefore 0.7 ampere and Amperite 7-A-5 is used.

The MODERN TUBE INDEX

goes over big!

● "SHIP ONE HUNDRED IMMEDIATELY!"

A large and well-known manufacturer of vacuum tubes ordered 100 copies for distribution at a sales meeting.

● "GREAT STUFF!"

One purchaser was so pleased that he wrote in for two more. He said, "The Modern Tube Index is great stuff—send two more."

● "MANY THANKS"

Said another purchaser, "A wonderful piece of work, and well compiled. Thank you ever so much."

TUBE DATA— as you like it!

The "MODERN TUBE INDEX" is unlike any other tube table ever published and is a veritable mine of information for the Service Man who has become hopelessly confused by the conflicting tube-type numbers and the various uses of numerous tubes with different filament and heater voltages.

● The "MODERN TUBE INDEX" is the first comprehensive table which enables you to determine at a glance the use of a tube with a certain type number, the type numbers of other brand tubes having the same use, the uses of tubes grouped by filament or heater voltage—and also the general characteristics of each tube.

● This Index will solve your tube problems and prove a great time saver. Price, 15 cents, postpaid. (Add 5 cents for foreign mailings).

●

SERVICE HEADQUARTERS
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SOLVE SERVICE PROBLEMS THE RADOLEK WAY

Your job as a Radio Serviceman will become much easier and *more profitable* if you will keep a copy of the RADOLEK PROFIT GUIDE always handy on your service bench, and *use* it for the selection of your Replacement Parts and other materials. THE PROFIT GUIDE contains over 7,000 Radio Items embracing practically everything needed for the repairing of any standard make or model Radio Receiver. In addition to Parts it also contains the widest selection of Radio Tools, Testing Equipment, Laboratory Accessories, Electrical Devices, etc., ever gathered by a Radio Parts Distributor—all at the LOWEST WHOLESALE PRICES. THE PROFIT GUIDE eliminates many of the worries and uncertainties of your job. When you make a selection from it you can do so with the comforting assurance that what you have ordered will reach you promptly and will be exactly as described.
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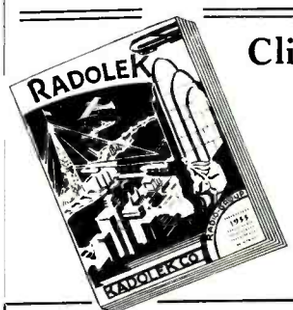

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AUTO-RADIO

Auto-Radio Operating Tests
Taylor and Borst, Radio News, pp 678, May, 1933

Auto-Radio Set Specifications
Radio Retailing, pp 24, April, 1933

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D. Hoyle, Radio-Craft, pp 668, May, 1933

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C. E. Brigham, Radio Engineering, pp 11, March, 1933

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B. Brunn, Radio World, pp 11, April 8, 1933

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G. J. Quick, QST, pp 21, April, 1933

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J. R. Nelson, Electronics, pp 94, April, 1933

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Radio News, pp 686, May, 1933

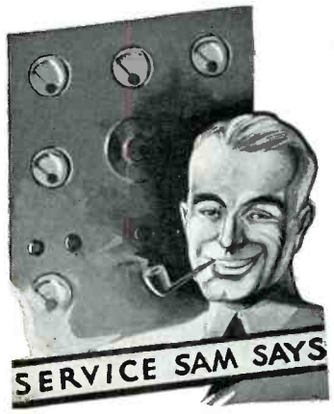
Making Money With Amplifiers, Part V
Shortt and Lester, Radio-Craft, pp 660. May, 1933

Wire Resistance Chart
J. M. Borst, Radio News, pp 666, May, 1933

All articles listed on this page are cross-indexed for your convenience. Titles given are not necessarily the titles of the original articles, but in each case serve to determine the substance of the article. Listings marked with an asterisk (*) are abstracted in this issue. The material in each issue of SERVICE is alphabetically indexed on the Contents Page.

One Piece, Springless Construction—

Low Resistance Contact!



POINT-TO-POINT ANALYSIS

BEING an old timer in the service business, I've learned to watch closely what is going on around me. I've found that it pays to keep strictly up-to-the-minute.

However, I know one man who, until very recently, thought that his intelligence coupled with a voltmeter and a pair of test leads was sufficient for servicing any receiver. He scorned elaborate set analyzers and the like and—well, I don't mind telling you I know just how he felt. . . . A good man *can* do wonders with nothing but a voltmeter and a bit of common sense.

But this fellow forgot that the world always moved on. What happened was that he bumped into a set with automatic volume control and a squelch circuit. And was he stuck!

Now it's always important to know what the manufacturers are doing and also to know the trends in servicing. If your eyes have been peeled, you know that the point-to-point method of resistance analysis is spreading like wildfire. Even service manuals are being made up so as to include the resistance method of servicing. In many cases voltage analysis has been dropped entirely.

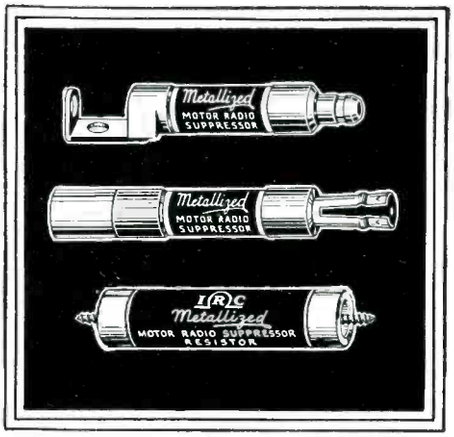
These changes are entirely logical for, as I have said before, modern receivers are getting to be nothing much more than complicated resistance networks. Resistance measurement will be—is, in fact—a necessity in servicing many modern receivers and the service man who is well grounded in the use of the system is the one who stands to profit most.

The matter of tolerances is an important point. You must know how much a resistor may vary either above or below the correct value. Usually the manufacturer of the set will have to supply you with this information but if it is not available you'll have to use your own judgment. Generally it is safe to figure on tolerances of not greater than plus or minus 10%—but when in doubt replace the "off" resistor with one of the correct value. Then you *can't* go wrong.

IRC specializes on resistors that are accurately made in the first place and ruggedly built to maintain this accuracy through thick and thin. You can always rely on them—and when you use IRC's regularly customers will soon learn to rely on you.

Service Sam

Built for Lasting Service on the TOUGHEST NOISE SUPPRESSION JOB



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- DIRECT, LOW RESISTANCE CONTACT BETWEEN TERMINAL AND RESISTOR ELEMENT—*sparking under high voltages eliminated.*
- NO SPRINGS, NO RIVETS, NO STEEL WOOL—*no intermediate parts to loosen or corrode.*
- MOISTURE AND HUMIDITY-PROOF.
- UNAFFECTED BY HEAT.
- LOW CAPACITY — *Extreme noise suppression efficiency.*

Freezing weather, intense heat, vibration—any of the unfavorable elements of motor car operation — hold no terror for IRC Motor Radio Suppressors. Not only are they designed to eliminate *all* motor noise but to do it effectively under *all* operating conditions.

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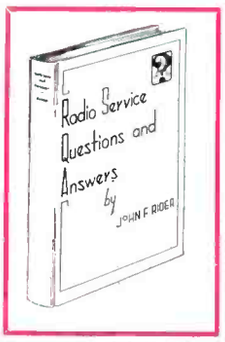

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RADIO SERVICE QUESTIONS AND ANSWERS

Radio Service Questions and Answers is a compilation of radio service problems prepared over a period of years by Rider. Your problems and the solutions, and the problems and solutions submitted by thousands of other Service Men, are placed at your disposal. *Radio Service Questions and Answers* covers all types of radio receivers, speakers, tubes, amplifiers, power packs, public address systems—everything with which you come in contact in your daily work.

Radio Service Questions and Answers contains only practical information—no theory. All the information is boiled down to the essential facts which are clearly explained.

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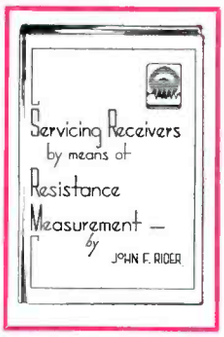

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SERVICING RECEIVERS by means of RESISTANCE MEASUREMENT

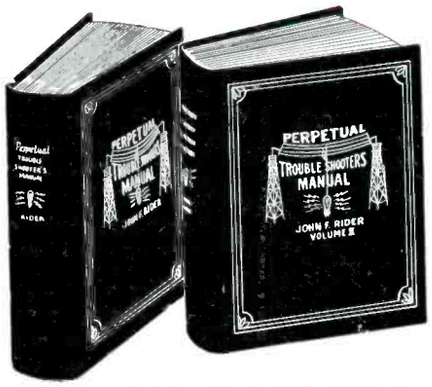
Resistance Measurement offers many advantages as a basis for service operations. The disadvantages of voltmeter and current meter methods are eliminated by the use of resistance measurement. The ultimate test for every radio receiver is resistance measurement. Accordingly, it is logical to employ this method in the first place.

Servicing Receivers by means of Resistance Measurement explains in detail how this method is applied. The usual resistance networks in radio receivers are explained, which gives you the basis for this improved method of servicing.

Resistance Measurement recognizes no limitations. Checking a receiver by measuring the resistance between any two points immediately locates the unit at fault and thus eliminates a waste of time.

When you know how to apply this method you can locate the trouble without removing the chassis from the cabinet.

PERPETUAL TROUBLE SHOOTER'S MANUALS



Volumes I and II of the *Perpetual Trouble Shooter's Manual* cover practically all the receivers produced prior to 1932.

The information you need—resistance values—condenser values—voltage values—wiring diagrams and other service data is found in Rider's Manuals. The accuracy of this information and the great number of receivers included are the factors which have made Rider's Manuals the standard service reference guides for radio sets.

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