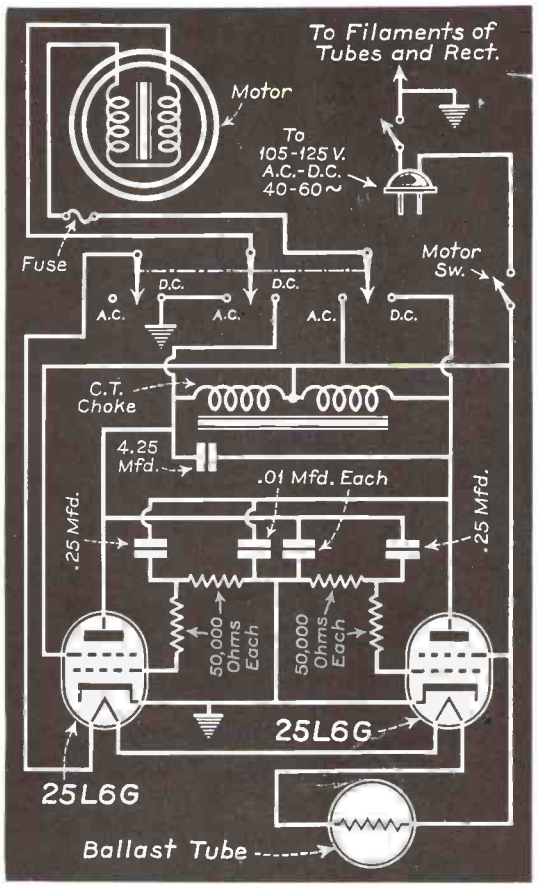
SERVICE

A Monthly Digest of **RADIO** and Allied Maintenance



A-C, D-C Operation of Synchronous Motor

(*See page 22*)

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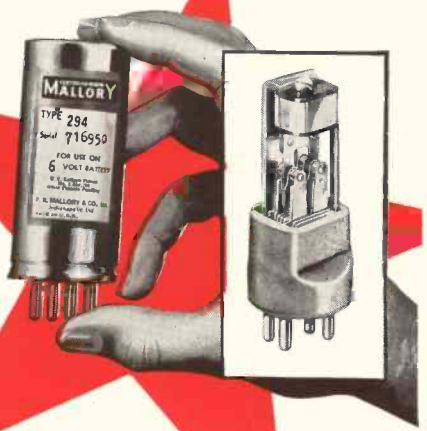

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

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EDITORS

JUNE, 1938 | Ray D. Rettenmeyer | W. W. Waltz | VOL. 7, NO. 6

EDITORIAL CONTENTS

* Indicates that a circuit accompanies the text.

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THE ANTENNA . . .

WELCOME!

SERVICE JOINS WITH over a hundred other exhibitors in welcoming you to what promises to be one of the outstanding radio parts shows in the history of the industry.

Many new things are on display here for the first time and everyone should make a particular effort to get around to the various booths and learn what is being done to help you in your work. The technical sessions are likewise on the "must" list for all Service Men in attendance, and others will find them profitable if for no other reason than the insight which they will give into this—the servicing—angle of the radio industry.

• • •

NEW DAY

THIS IS as good a time as any to lean back and take stock of the past few years and to plan for things to come. New things are in the air—figuratively speaking, of course—and, while we don't intend to predict the coming of television, the fact remains that it is continually becoming better. But the fact that good television is available in a certain and rather limited area doesn't mean that Service Men will be called upon to fix receivers in the immediate future. After all, it's largely a matter of dollars and cents—more of them than most of us can visualize easily. And until that kind of money becomes available, the general use of television will have to be limited.

Of course, there is always the possibility that some hitherto unknown and unsuspected physical phenomena will be discovered which will open the doors to the wide dissemination of television signals. Such a possibility seems to be remote, very remote. But who, in, say 1935, imagined that cold-cathode tubes would be used commercially in 1938?

Yet, that is exactly what has taken place. Just as we go to press comes the announcement by Philco of a remote-control system in which cold-cathode tubes play the leading role. A system of this type was described at last November's Rochester IRE convention and was mentioned as a coming possibility on our December editorial page.

Now, it's here! So, who really dares to say that television is years in the future—or that it is "just around the corner"?

We can probably look to the coming IRE convention for at least a hint or two of what to expect in the next year. According to the convention program, things of especial interest to the Service Man are not many; but, here and there among the papers to be read, will be an item which, properly interpreted, will indicate what the engineers are planning. The editors will be on hand and will report promptly on anything that seems to be particularly "hot."

In so far as taking stock of oneself is concerned, this is also an excellent time (what time isn't!) for some self-analysis. What brings this to mind so forcefully is the article on page 5. For all-around sincerity of purpose, it would be difficult to find a man who has the servicing profession more at heart than does Arthur Rhine. Remember this when you are reading and re-reading his article. Everything he tells you is born of experience, some of it, no doubt, painful. If, by reason of his material, you are helped to avoid some of these experiences, so much to the good. It's a whole lot easier to acquire knowledge from a book than it is from practical experience, but it doesn't stick with you as well unless you make a particular effort to see that it does. In the case of the material covered by Mr. Rhine, it is only discreet to *learn* it—to absorb it so it sticks.

• • •

ANTENNAS

EVIDENTLY the day is fast approaching when a piece of bell-wire and a couple of porcelain knobs (from the 5 & 10!) definitely will not serve as an antenna. We aren't charging the Service Men with this kind of work, but it is quite obvious that plenty of it is, and has been, done. Take a look around at the average rooftop, especially in the apartment house districts!

The point is that far too many people are laboring under the misapprehension that any kind of a wire—just so it's outside—is enough for the kind of reception they expect. True, some receiver manufacturers are selling their sets with an antenna, but that is effective only in so far as that maker's sets are concerned. What of the people who buy other receivers? Are they to be denied the full capabilities of their sets simply because someone in the family once heard that "John Jones gets everything he wants with a piece of lamp-cord stretched across the room under the rug"?

It's a perfect, although highly undesirable result of the so-called word-of-mouth advertising. It seems to us that the same kind of advertising could be used to excellent advantage by the servicing profession; only in this case to sell good antenna installations.

Summer-time is the best of all for work like this. There are no icy roofs to contend with—and doing an aerial job on a nice day ought to be a swell manner to pick up a profit or two.

It will take some selling. And we mentioned above, the idea is widespread that nothing much is needed by way of an antenna; but your talking points are impressive—if used properly. We don't recommend high-pressure methods, but it does no harm to point out the safety features of a correctly-installed antenna—also, the fact that fire-insurance policies *may* be void if no lightning arrestor is used.

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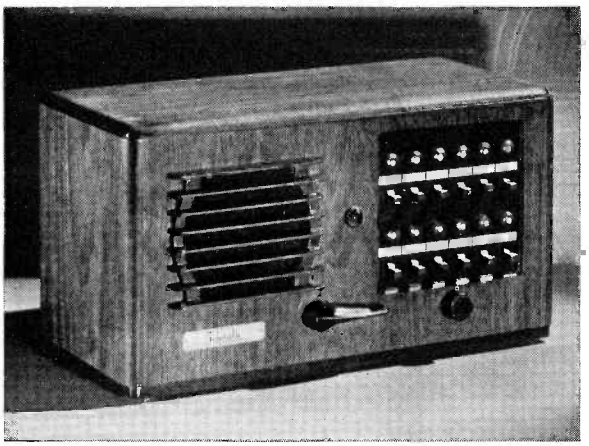

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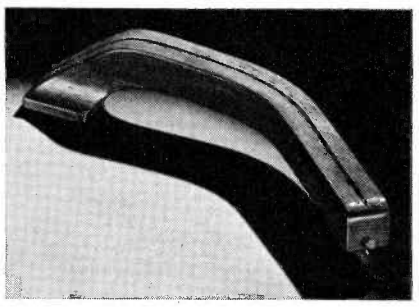

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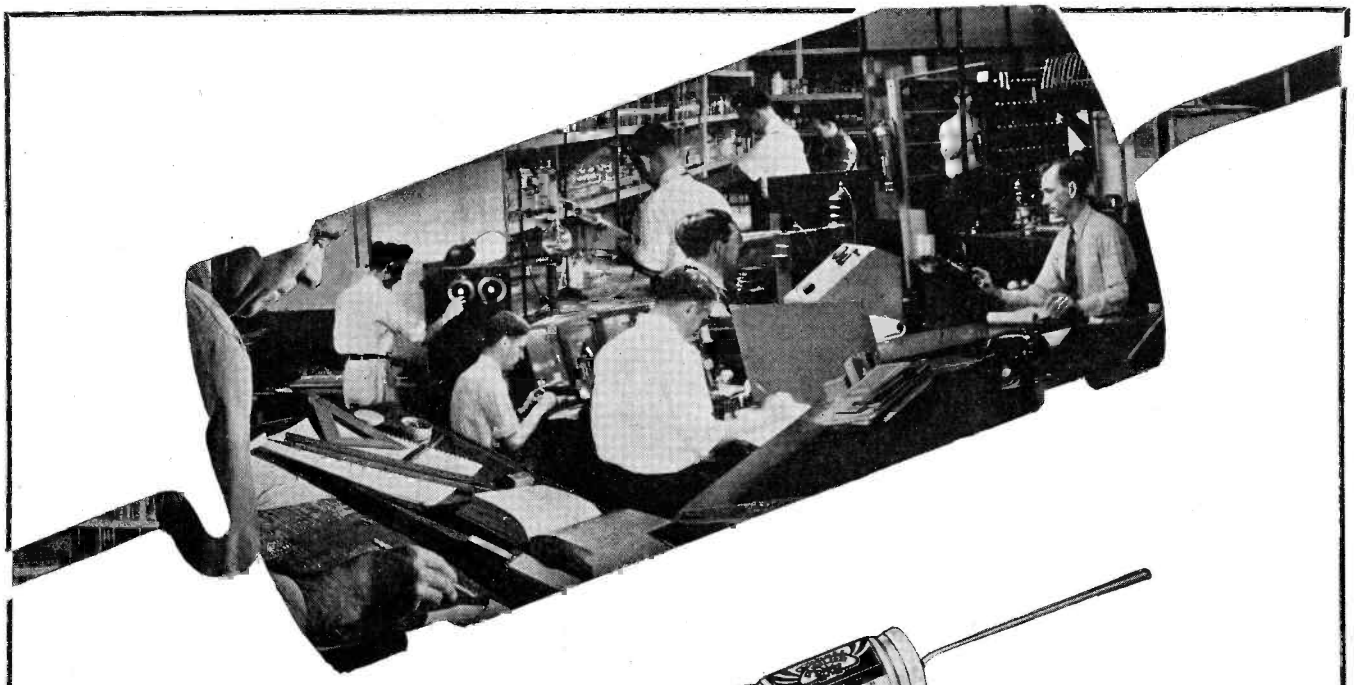

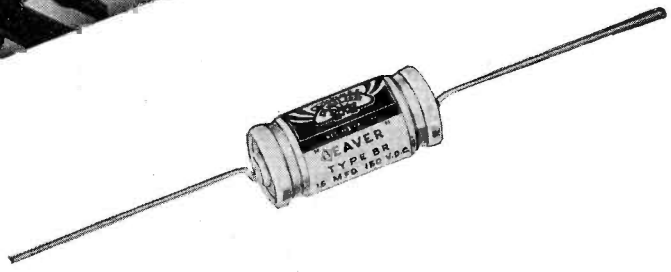

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR JUNE, 1938

MAKING A PROFIT IN THE RADIO-REPAIR BUSINESS

By ARTHUR E. RHINE

MANY SERVICE MEN cling tenaciously to crude business methods against the advice and repeated solicitations of such authorities as John F. Rider, Fred Horman, Alfred Ghirardi, J. Van Newenhizen and others equally as well-known to all. Just why any Service Man should continue slip-shod business methods and haphazard service charges after having read the warning articles written by such eminent and recognized authorities, is a question the Service Man himself cannot answer.

The following is what two of those just named have to say about lack of business ability. They address you in this way: "To the Good Engineer Who Doesn't Make the Money He Should" —then—they ask the following question: "What is the difference between you and the fellow who gets ahead, who has money in the bank, who takes a vacation every year? They continue, and supply the answer as follows: "The answer is simple—he has business ability—you don't. Sounds brutal, doesn't it? Actually, it's not. Some of us can do one thing, some another. The fellow who does everything well hasn't been found. The trick is to admit your limitations and rely on others who know more about the subject than you do. This will permit you to shine all the brighter in your specialty—and enable you to make a real living in the bargain." This was written, incidentally, by our good friends John F. Rider, the dean of radio service engineers, and J. Van Newenhizen, an outstanding authority in the field of radio service accounting. What impresses me more than anything else, when I read things of this sort is that all of you fellows read articles of this kind in practically every issue of every radio service publication, then, after having read the articles carefully, you just as carefully close the magazine and promptly forget all that you have read therein. Is it possible that these important subjects are taken lightly and are considered of no importance? When I read something along the lines of "conduct of business"—or "efficiency in running the business"—or—anything which may serve to improve my business, I study every part of the context pertaining to "profits," "efficiency," or even new methods of conducting the business. Personally, I consider these things of more importance than the review of trick circuits. It is a difficult task for me or anyone else to succeed in waking up all of those who fail to recognize the fact that they cannot make substantial profits in our business, no matter how much businesss they do—unless they radically reform thier notions about conducting the radio service business. However, I am going to try to awaken you. If you will follow what is recommended, you will, before long, feel like millionaires. In spite of the fact that you may be sold on the idea that you cannot make any real money in your business, you will then admit that you were wrong. Do you believe that our friends Rider and Van Newenhizen think that only the men with business ability have a chance for success? They specifically state—I'll repeat—"The trick is to admit your limitations and rely on others who know more about the subject than you do. This will permit you to shine all the brighter in your own specialty (meaning—leave the business problems and their solutions to those who know their stuff—adopt their recommendations—and thereby become standouts in your profession)—enabling you to make a real living."

There are some who may say to themselves, "It's OK for Rhine to spout about how easy it is to make money in radio service. He has the business; he has the trade which is entirely different than my class of trade; I have a cheap bunch of customers; I could never get the prices Rhine does," etc., etc. It is not my purpose to brag or preach—but I will say this—Jesse Owens would never have won a single race if he first sold himself on the idea that he could never beat the other fellows. Personally, I believe that Jesse Owens and others like him stand out because they sell themselves on the idea that they can do things if the other fellow can. The success does not merely lie in the will to succeed. One must not only desire strongly for success, but must try every proved theory of the coach or radio authority, as the case may be. Any man who may enjoy the free advice of the world's best radio brains and who, from now on continues to ignore their coaching, may definitely consider themselves left at the post. Therefore—first—be patient—I'm not an expert accountant. I am a radio service operator and many of you know me. I am not only urging, but really begging you fellows to take stock in all I have written and to believe, unreservedly, all that I have to tell you. You will get more out of patient read-

Don't be misled by the title of this article—it isn't just another of those things that half-heartedly tell Service Men they aren't making enough money. This article is full of well-aimed punches, and if any happens to strike you, well, take it in the spirit in which it is given!

This is just the first of three articles which SERVICE, always in the lead in all matters tending to better the service industry, will present.

The author, Arthur E. Rhine, needs no introduction, especially to RSA members. Those who heard his recent talk before the New York Chapter of RSA were visibly impressed; others, who get his remarks here for the first time, can do nothing better than to follow the New York group in accepting these ideas literally as the new gospel of the service profession.

ing than you could possibly realize from what you have read thus far. Here's what I want as repayment for what I write; I want to hear from you fellows in days soon to come, and to hear you say: "Rhine, I thought I'd try anything once—so I did as you suggested and I'm not sorry, because I'm making money at last!" When I hear stories like that I will feel that I have accomplished something worthwhile. You may ask, "What could all of this benefit Rhine?" I'll tell you—if all good men in this field were prosperous and the standards were to become of a higher order, such general conditions could not but reflect to my benefit as mell. If the railroads were back to normal other industries would be benefitted. If the country were back to prosperity all would benefit. If you fellows start cleaning up it means better profits for me too.

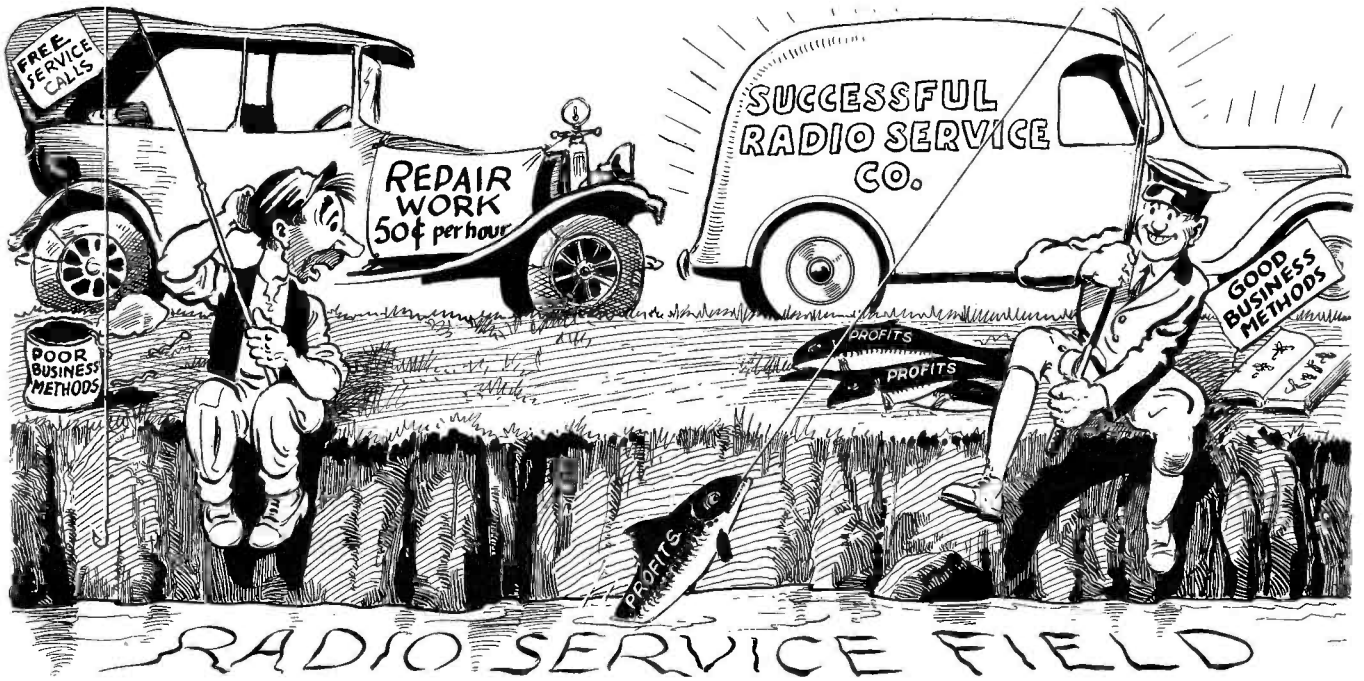
So—be open minded and read carefully. You can really get something worthwhile by earnest study of what is written herein; perhaps some things which others might not have the nerve to say in the blunt manner I intend to say them.

Let's begin by assuming—you know no other business or profession than that of radio service work. The only other job you could fill would be, let us say, that of chauffeur, because you have had no training in any other business. If you but forget that you are in the radio service business until you have finished reading you could qualify to run any ordinary type of business. First, you must learn how to run your own. You do know how to service radios—but you do not know how to run the business. Those who are making and saving money over and above their salaries and expenses are the exceptions. They are among the minority. It is not always essential for the managing head of a business to know all of the fundamentals of the business. I doubt if Mr. Sarnoff could build a radio set. Of course we would believe him if he told us that he could, but he certainly cannot know how to do everything necessary for the manufacture of his product. The money and profits are not made in the factory in Camden. In Camden may be found the means by which the directing heads—the business men—manage to extract their profits. Concede, if you please, that the RCA Company is making money and declaring the evidence of that fact in dividends. Will you agree that—given the same product to sell, given the same factory personnel, given the same market, it would be possible for the RCA Company to actually lose money if the average radio Service Man were to take over the management? Imagine shipping radio receivers which cost the factory $30.00 to build (that is—actual factory cost) and billing them with the addition of some haphazard figure for "labor," let us say $10.00, on the assumption that this $10.00 over the actual cost of making, represented the profit? That's positively silly! Yet—you fellows do that every day. I can almost hear the denials from the very ones who run their businesses that way. Don't deny—you will be merely kidding yourselves. Never mind what I alone now say; the entire radio industry says this is true; has always said so and has been continuing for a long time to get you fellows to wake up to the fact that it is really true! Why should manufacturers, jobbers, writers and others be so anxious that you place your profit houses in order? I will give you a single reason which should indicate to any thinking person that there must be other and still more potent reasons. One reason is, through comfortable profits the radioman may be enabled to study and keep up to date, to do more efficient work, to purchase latest equipment for the accomplishment of that "more efficient work," etc., and therefore spread his prosperity which automatically would reflect back to these manufacturers and jobbers. Don't forget that they make the test equipment and sell it to you. If you make money you advance yourselves by replacing worn-out equipment; buying Rider Volumes and otherwise generally patronizing those who depend upon your prosperity and success.

The author.

Do you, Mr. Reader, know of any business which boasts of no overhead? Did you ever hear of such a business? No? Well—I can tell you of one: the only one I do know of! Right! The radio service business, I'll bet that most of you knew what I was going to say. I wonder why! It must be that you realize down in your hearts that it is true. How many radio Service Men want to be bothered with bookeeping or the computation of overhead costs? Probably one in a hundred. As for overhead costs; they are simply not recognized as an existing condition. Why should we be bothered or troubled with any such thing as that? Replacement of test equipment will have to be made sooner or later; let's admit that to be true; most of our cars are on their last legs; we all know that, too—but—why bring those things up again? What has that to do with taking Mrs. Kelly's radio into the shop to repair for 5, 6 or 7 dollars, or, for whatever we can get? She is not going to pay for our replacements of cars, tools and testers! If we have to charge her six dollars for the repair, we can add another dollar for a tube if necessary, but, we cannot add anything for our equipment depreciation! The only way we can get the money together for those things is to get more business—then—if and when we get the money together—we'll buy some new stuff. We don't cross those bridges until we get to them.

That is the way it goes in your business (that is, most of you fellows). Not so in my business. You overlook a very important detail that I cannot find it easy to just "overlook." You may operate on the theory that you will cross



bridges when you get to them, but, I am wise to the fact that the bridges must be crossed. In order to cross the bridges, the bridges must be there! Did you forget that? Did you ever stop to ask yourself—"who is going to build those bridges?" Well—well—you never thought of that! Mr. Man, nobody is going to make your money for you; nobody is going to furnish the profits (money) which are the bridges which have to be crossed when you get to them—nobody but yourselves! You have to build those bridges yourselves. So—keep right on reading—you will be building—laying the foundations or piers for those bridges right now!

Do you believe me when I say that there was many a job completed by you which you lost money on and never knew it? The very jobs you are surest of having made a profit with may be the ones you have lost money on. How do I know? Is it not better to ask me "How can I know?" That is what you are going to find out herein and never in the future need you have the slightest doubt whether you have made a profit or not because you will know what to charge so as to insure a specific predetermined amount of profit! Does that sound good? Let's keep going to town, let's keep on reading, the trip is not a short one!

Let me give you a very brief picture of the usual way some of you "estimate" a job—a power transformer must be replaced. The customer has announced she will not spend over 3 or 4 dollars to repair the radio. The transformer costs you $3.00 wholesale. Let's say you want $4.00 for installing it. You want $7.00 for the complete job, but will take $6.00 rather than lose the job. If you get the $7.00 you believe you will make $4.00 on the deal. If you can get $6.00 only, you believe you will make $3.00 on the deal. You must believe me when I say that you would lose money on either deal. If you are sceptical at this point in your reading your scepticism will entirely disappear when you have completed this article. It would not be necessary for you to complete the article merely to convince yourself that it is true—you could telephone or write to any one of the men I have mentioned for verification. Every one of them would bear me out. After I have proved this and other examples to be true, you should have forcibly brought home to you the reasons why you have no more money in the bank now than you had one year ago! The $3.00 transformer cost just mentioned would prove to be less than half of the actual cost to you of that particular job. Make sure that you understand the real meaning of that sentence; read it again!

It will not be necessary for any reader to take a course in night school to find out how to determine what to charge for any job. You will be able to do so correctly when you have read and studied this article. Suppose you were to ask—"if I find out that such a job as just mentioned would cost me $7.00 to repair—how can I get the job if the customer will spend no more than 6 dollars? Am I not better off if I don't know I am losing a dollar or so on the transaction?" We have manufactured a very silly question in this text for a bunch of intelligent Service Men to read. The answer is obvious; "why accept such a job or worry abouts its loss—you should compliment yourself for passing it up." Who wants to repair anything for $6.00 if it costs him $7.00 to do so? That, however, believe it or not, has been the real trouble with your business in the past—you may deny that also, but—again—all of the authorities say it is so! There is only one simple, sane, intelligent and common-sense way to conduct your radio service business, and that is, to know your costs first before you do any more operating. You will have few (if any) sorrows afterwards. Radio men are pretty smart; they have to be. They certainly must therefore have some intelligence other than that used in repairing radios. Use this intelligence to do something about this situation—no one is going to do it for you. We can tell you how, but, you are the only one who can put it into practice for yourself. Take heed—things will be better for you and for all in this field if you do. Base estimates on the solid foundation of a chassis of facts and figures. Discard the old method of founding your estimates on the "bread-board" of "how much will this bird spend?" Not one Service Man in a thousand makes a profit that is consistent with the time, effort, cost of learning, studying, etc., which he has invested. Do you, Mr. Reader, consider yourself to be that "one in a thousand?" If you are not—now is the time for you to bring all of your faculties into the concerted effort to cure some running sore. Build the foundation for the "bridge" we have spoken of. Call it the "bridge to profits" and you will have a most appropriate title.

I am not really taking a long time to get to the point of my little story, but before I do reach that point of "cold figures" I intend to bore you full of machine-gun holes of facts. I want to make you more anxious to read what I have figured out for you. By making this part of the story shorter I could

have made my job much easier, but since I want nothing to go over your heads I want you to bear with me for another column or two.

Many good radio Service Men who are really proficient have voluntarily retired from this field because they could not make enough money to keep body and soul together. They have not been forced out by others who are better informed technically. They have committed business suicide! If you Mr. Service Man, want to stay in this business and to make money out of it and not find yourself out of a job inevitably, the surest way to insure such continuation is to get out of the business of reparing radio receivers now—tonight! Start a new business—the business of selling your radio repair knowledge. When you sell your knowledge, the rendering of service will follow like "duck soup." When you have sold service (or manual labor) you have sold that only, excluding entirely any value which should definitely be appraised for knowledge and capabilities. Your labor cost goes on from week to week and is usually repaid to you through work accomplished, but never, in the past have you tried to extract the cost of gaining the knowledge. The cost can never be extracted unless considered by you as of specific value. Your customer knows that you have the knowledge and benefits by it. You must consider "knowledge" as one of the most important items to be charged for. It is not billed as a specific item, but is part of your time charge; it has to be an unalterable part of the time charge. This knowledge represents something which has already cost you money. In addition you must consider the cost of further knowledge you expect to gain by further study. Any one who knows how to repair radios can—repair radios. Don't be merely a person who repairs radios—get your fun at the movies—it is much better to be one who repairs radios for a profit! If you do not conduct your business on an economically sound basis the result is inevitable. One of two things must happen: either, continuation on a starvation basis, or, desertion of the profession in favor of some other means of making a living. I am sorry to have known of so many good service engineers who have given up and gone into other lines. There is no reason why they, having the requisite knowledge, should not have been able to continue, other than the reason that they did not know how to make money in the business.

One of the first things you must do it to forget your competitor. Whatever you do, do not worry about him. Before you are finished with your plans, he will do plenty of worrying about you. When you put your new plans into action, his business will increase—sure it will! He will immediately get those sets for repair which you will refuse to take losses on. Let him take the losses if he likes that. If his headaches are increased by 50 percent, so will his losses, and, if he does not emulate you, and get his proper profits, he will be out of business much sooner than if you were to have continued as you have in the past.

Remember that opinions as expressed herein are not solely my own, but represent the accumulated knowledge of those we all know. If I learn more and more as time goes on from these authorities, so can you. Those who know me will vouch for the accuracy of any statements of fact or promies made by me. I make a promise now! I promise any man that, if he will rouse himself from a self-sufficient attitude towards his business and follow the general course to be outlined herein, he will soon be making money—making enough to save some of it, and further, he need no longer wish he were in a more profitable business.

Notice that remark in the column to the left—"get your fun at the movies." That doesn't imply that you cannot enjoy radio service work. What it does mean is to quit enjoying it at the expense of your profits.

In line with this thought, look up your January copy of SERVICE and read again the editorial, "The Boy Around the Corner," on page 2 of that issue.

An important part of your progress to profits is the continual education of your customers that you aren't in the radio business just because it's fun!

If just half the total number of Service Men in this town or your own town, were suddenly to go out of business overnight, would that mean your business would be more profitable? It would not make the slightest difference unless those remaining were to start operating at a profit—in fact, if those remaining in business previously failed to profit, the law of averages would command that the losses would multiply in ratio to the increased number of radios serviced. For example, if a loss of $3.00 were suffered in 4 jobs, an increase of double the number of jobs would mean twice the loss. These basic figures are facts—not mere fancy of the imagination, nor are they fancy words!

If any of you were to take a commercial course in any of the institutions which specialize in business training, one of the first things you would learn would be that the knowledge of costs is one of the most important of the requisites for operating a business of any kind—even a bank.

Having had the patience to read thus far you should be prepared for a few pertinent questions. No reader should take offense if any question may seem "sharp." The bitter truth will serve to drive home some very important facts.

Question (for the fellow who charges $1.00 for his time and the one who charges $2.00 per hour and the one who may charge even $4.50. I am one of those $4.50 chargers. That is my charge for the time of two men using one car —per hour).

"How do you know that your rate of charge is sufficient to insure a profit to you?" (Most of you don't know. That is true. You may believe a profit is insured by such a charge but you cannot prove it to yourself much less to me.)

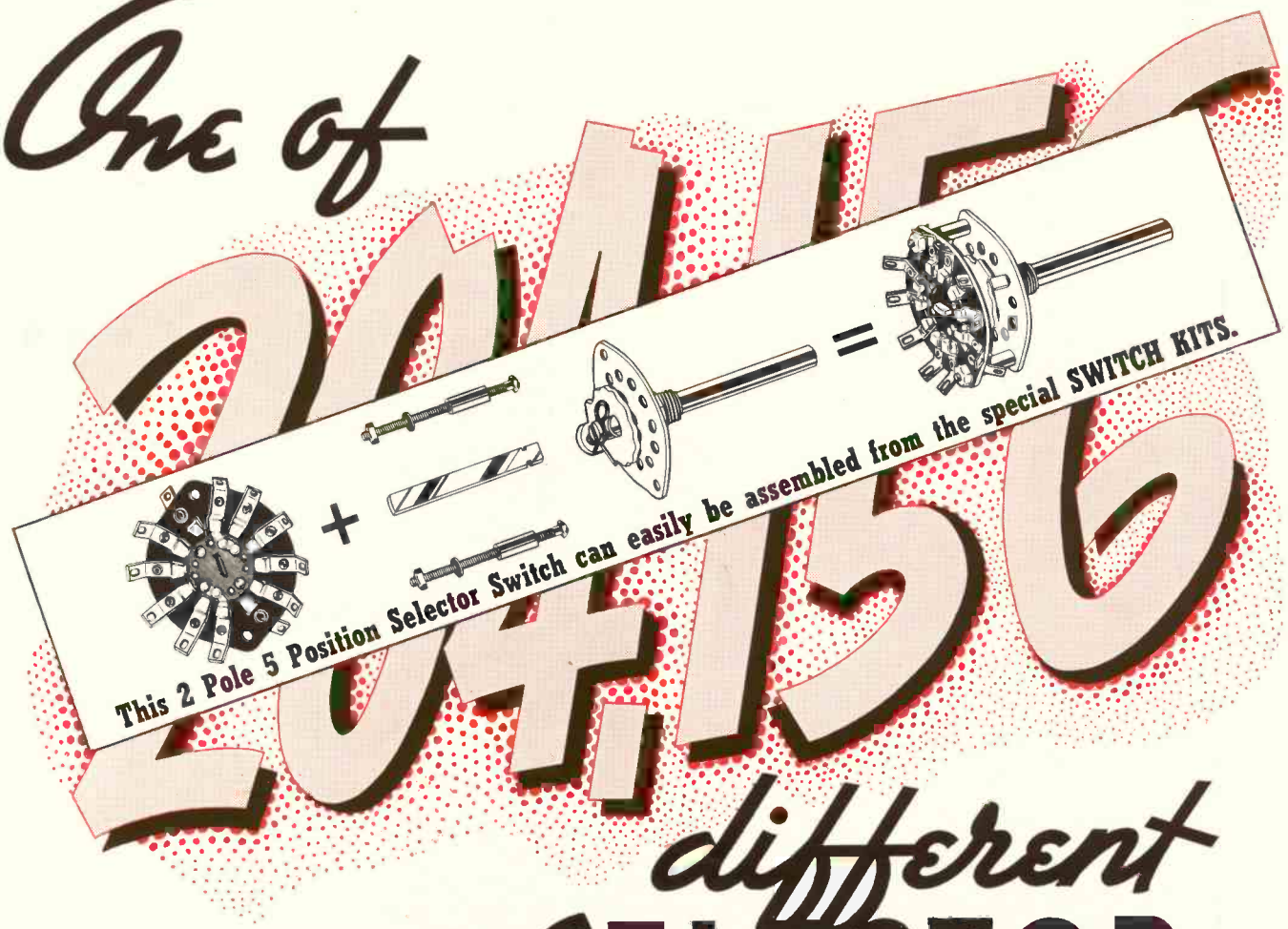
I charge $2.75 per hour for time in my business, so, here's the way I would answer the above questions if addressed to me: "I can prove that I obtain a profit from my basic charge of $2.75 per hour because I can tell you *exactly* what the cost of that hour is to me."

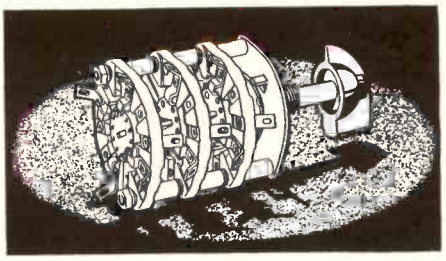
My cost per hour is computed from month to month and of course varies with the general trend of business "up" or "down." For the sake of some charts and examples to follow in the second article, I am going to take the lowest hourly cost figure which I have ever been able to reach so that you may not feel that I am taking some arbitrary or high figure in order to try to make this more impressive. This figure is $1.65 and may be considered as a very low figure. Many a reader will reach this point and say to himself "that's enough. That's just so much bologna (or should we more accurately quote, 'baloney'?)." If you are inclined that way you are one of those who accept certain beliefs of your own without grabbing a pencil and paper in order to determine whether there is truth or fiction to what may seem a mere product of someone's imagination. However, what I tell you is the truth—therefore, taking my peak (low cost) month as a fair example, I can definitely state that, during the month in which my cost was $1.65, my profit per hour was the difference between $1.65 and $2.75 which is $1.10 per hour, and, I don't give any hours away when I know they cost me a minimum of $1.65 each! During that same peak low cost month my cost of the two-man $4.50 hour was $2.70 and my profit therefrom was $1.80 and, I'll still let the other fellow give away free, those hours which cost me $2.70 each!

I'm going to show you why I don't make any free service calls, why I never did, and why I never will. If I cannot afford to—what makes you think that you can? The following is only one of the reasons, but there will be

(*Continued on page 23*)

One of 204,156 different SELECTOR SWITCHES





The *new*

ISOLANTITE
Selector Switch

is creating a great deal of favorable attention because of its low power factor—high efficiency—low dielectric loss—good circuit stability—low moisture absorption and better performance.

NOW AVAILABLE IN KIT FORM AT YOUR JOBBER'S . . . your choice of Bakelite or Isolantite.

Jobbers carrying the new Selector Switch Kits are able to offer servicemen, experimenters and hams 204,156 different "combinations."

These kits in the hands of the jobbers offer infinite variations and adaptations . . . and give almost instant service for replacements, voltmeters, ammeters, ohmmeters, decade boxes, analyzers, wave changing and Public Address systems.

See your jobber . . . and ask for your particular need in a SELECTOR SWITCH.

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Centralab

DETERMINATION OF OUTPUT POWER IN AUDIO-AMPLIFIER TUBES

By R. M. PURINTON*

THE SOLUTION of problems relating to audio-amplifier output can often be accomplished graphically, using the plate characteristics of many of the common audio amplifiers of the power types. There are formulas for determination of power output, but in almost every case some reference is made to graphical solution methods in order to check the solution by formula.

Ordinarily the Service Man has no direct use for the analysis of output-power problems, but a thorough understanding of the method may sometimes permit determination where a question arises relating to output power under some conditions not covered by ratings published by the tube and output-transformer manufacturers.

SOLUTION FOR TRIODES

Triodes offer the easiest solution by graphical methods where the plate-load resistance is known. Ordinarily, tube manufacturers suggest certain values of load resistance which will handle maximum power output with reasonable distortion. The manufacturers of coupling transformers and loud speakers build their equipment to conform with tube ratings. Occasionally it may be necessary or desirable to make use of a piece of equipment with a tube not intended for it, and if the impedance of the output device is known, the power output can be determined quickly through use of the plate characteristic curves for the tube which will be represented.

Almost all textbooks contain material on the graphical determination of output power for triodes operating either class A or class B, and for pentodes. Not all go into detail in describing the method; consequently there may be some need for simplification through references which are to follow. Some of the best material on the subject is listed for the Service Man who cares to secure additional information.

In Fig. 1 the plate characteristics for the type 6A3 tube are shown along with the necessary additions to determine the output power from the tube at a given value of plate voltage and control-grid bias. In this diagram, as in the others, there are points of importance which are determined by the manufacturer's rating for the tube—the load line which is drawn in in accordance with the recommendations made by the tube manufacturer, and the intersection of the load line with points on the plate characteristic curves. Before going ahead with an explanation of Fig. 1, it should be understood that the output power determination can be made entirely independent of the tube ratings, although it would be a rather tedious process to determine the best operating load resistance by drawing in a great many lines and selecting the best. All of our power-output tubes today have tube ratings which show the best operating conditions. The Service Man who wants to know what the power output will be when using a definite value of load resistance can start with rating information and work from that point with little or no inconvenience.

Also, it may be worth while to define the load line which appears on Fig. 1 and on other diagrams to which reference will be made. The load line represents the path passing through all of the points touched in the dynamic operation of the tube. In other words, any point on the load line will show what the plate current is, what the instantaneous plate voltage is, and also what the instantaneous grid voltage will be. If the plate load is a pure resistance, as it may be considered to be with a good output transformer feeding a loud speaker, the load line will be straight and distortion will be low. A poorly designed output transformer or any form of inductive load will cause the dynamic characteristic to change from a straight

*Raytheon Production Corp.

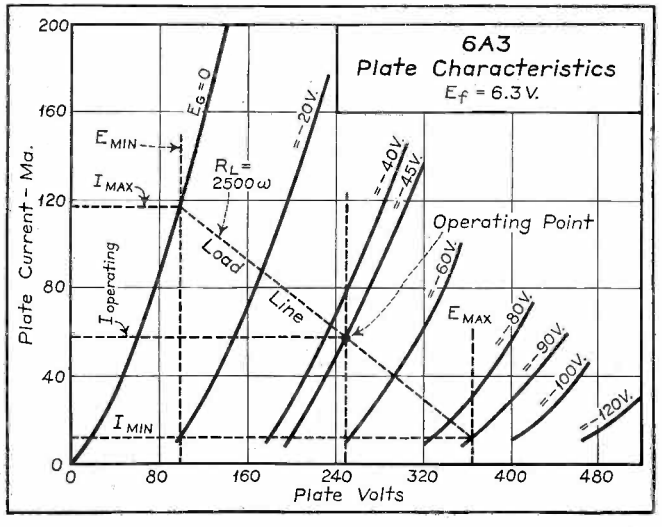


Fig. 1.

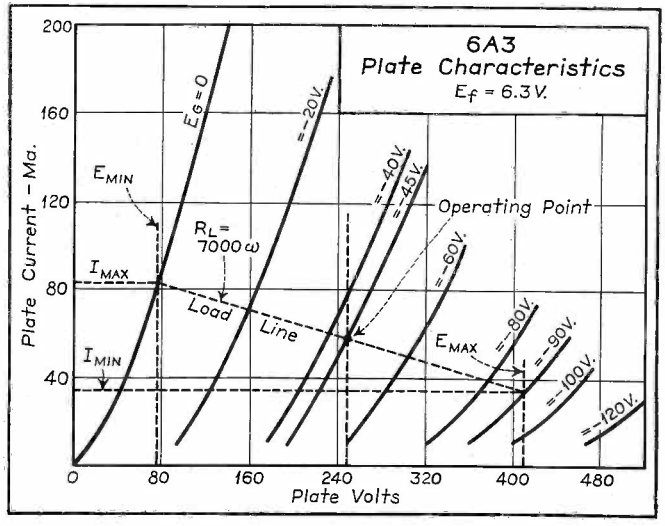


Fig. 2.

line to an elliptical shape with considerable distortion.

The Load Line

The slope of the load line or the angle at which it is drawn in on the graph is determined in a simple manner. Anywhere on the graph a right triangle is constructed with the vertical side representing plate current and the horizontal side representing plate voltage. The horizontal side can be made the length which represents 100 volts on the same scale used on the graph. By Ohms Law, I = E/R. The voltage side or horizontal line represents 100 volts or E. If the desired load resistance, R, is to be 2,500 ohms, than I, by the formula, will be equal to 100/2,500 or 0.040 ampere. This value, 0.040 ampere or 40 milliamperes, represents the proper length for the vertical side of the right triangle and it should be drawn in using the same scale as that used on the graph for plate current. The hypotenuse of this right triangle will have a slope representing 2,500 ohms. The real load line, which must pass through the operating point, is drawn on the graph parallel to the hypotenuse line constructed as above.

The formula for power output in a triode operating class A is

Power Output

$$= \frac{(E_{max} - E_{min})\ (I_{max} - I_{min})}{8} \text{ watts}$$

where E_{max} and E_{min} are expressed in volts and I_{max} and I_{min} are expressed in amperes.

If we substitute in the formula values taken from Fig. 1 for maximum and minimum plate current and for maximum and minimum plate voltage, we will obtain an output power of approximately 3.5 watts which is near the manufacturer's rating for the type 6A3 tube at a grid bias of —45 volts, a plate potential of 250 volts, and a plate load resistance of 2,500 ohms. The maximum and minimum plate currents will be the extreme ends of the swing in plate current and likewise the maximum and minimum plate voltages represent the extremes of potential reached at the plate of the tube in actual operation.

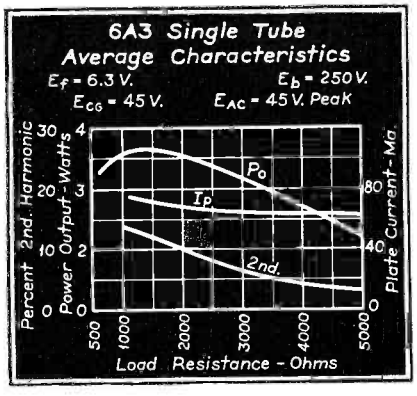


Fig. 1.

Effect of Improper Load

Fig. 2 again shows the plate family for the type 6A3 tube with a load line representing 7,000 ohms drawn over the plate curves. This obviously is an incorrect value, which has been chosen to illustrate the ease with which power output can be determined for load resistance other than the recommended value. Substituting the values for maximum and minimum plate current and plate voltage from Fig. 2 in the power output formula for a triode, it will be noted that the power output is approximately 2 watts, or much less than could be obtained with a proper load resistance of 2,500 ohms in the plate circuit. It will be observed that the effect of a load resistance higher than the normal value is to lower the instantaneous maximum plate current and to increase the peak voltage which appears on the plate of the triode.

Fig. 3 shows power output, plate current, and second harmonic distortion curves for the 6A3 tube under the operating conditions covered in Figs. 1 and 2. Its characteristics are plotted against the load resistance, showing what happens to output and distortion when the load resistance is varied between 1,000 ohms and 5,000 ohms.

While graphical analysis on the plate characteristic curves of a single triode will give most of the information wanted, it is sometimes desirable to know what method to follow in determining the best load resistance for push-pull triodes.

Push-Pull

Fig. 4 gives the plate characteristics of the type 6A3 tube and indicates one method for determining the optimum load resistance for two 6A3 tubes in push-pull. It will be noted that a vertical line has been erected on the graph for the operating voltage E_o which is 250 volts. Another vertical line is erected at the voltage point determined by multiplying E_o by the factor 0.6. The intersection of this vertical line at the 150 volt point with the plate-current curve for zero control-grid bias gives a value for the maximum swing of plate current. From these figures and the formulas below, it will be seen that the optimum plate-to-plate resistance for push-pull operation will be approximately 1,840 ohms and the output power 10.8 watts.

Plate to Plate Load

$$= \frac{E_o - 0.6\,E_o}{I_{max}} \times 4 \text{ ohms}$$

where I_{max} is expressed in amperes and E_o is expressed in volts.

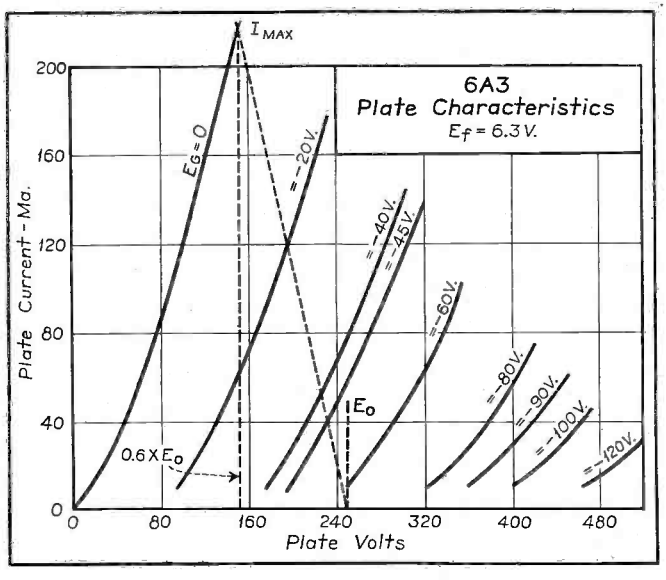


Fig. 4.

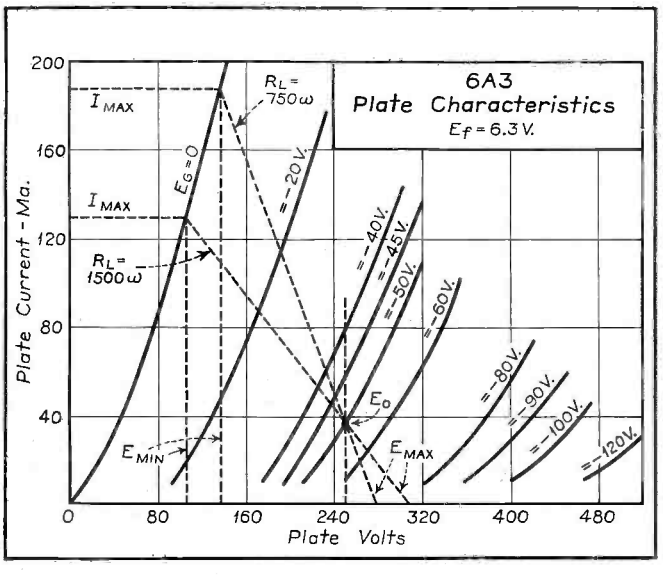


Fig. 5.

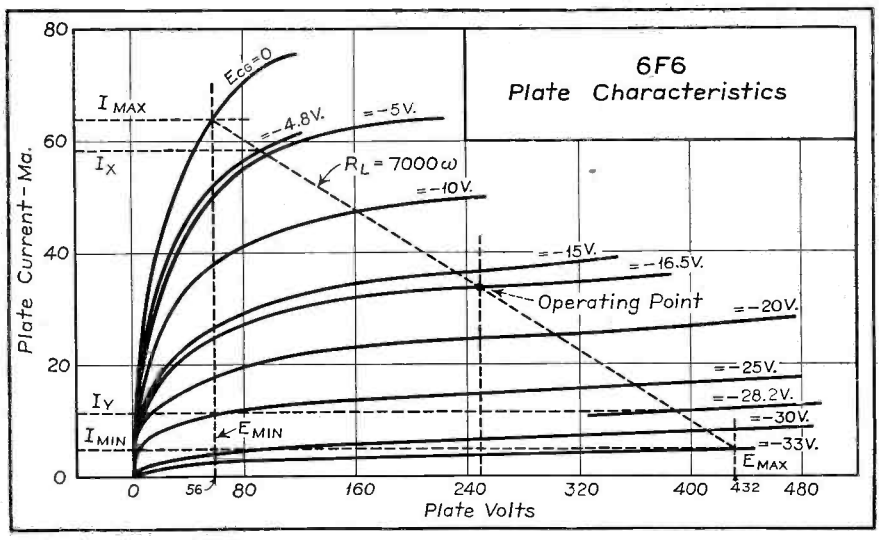


Fig. 7

$$\text{Power Output} = \frac{I_{max} E_o}{5} \text{ watts}$$

with E_o and I_{max} expressed as above.

Ordinarily a higher value of load resistance is recommended for the type 6A3 tubes to reduce third-harmonic distortion. Reference to Fig. 6 indicates that there is a very definite choice in selection of a load resistance which will give suitable power output with the lowest possible third-harmonic distortion. The second-harmonic distortion is of course balanced out in a push-pull stage. In Fig. 5 another rough method for determining output power for a push-pull stage is shown. Here the load resistance is drawn in to represent one-quarter of the plate-to-plate load resistance which will be used. In other words, with an expected plate-to-plate load resistance of 3,000 ohms, R_L would be drawn on the diagram in Fig. 5 for 750 ohms, and for 6,000 ohms load resistance from plate-to-plate a load resistance line with a slope representing 1,500 ohms would be used. If the operating voltage E_o of 250 volts and the maximum plate current swing value are substituted in the formula above it will be found that the output power agrees reasonably well with the values for output power at load resistances of 3,000 and 6,000 ohms as shown in Fig. 6.

Pentodes

Fig. 7 indicates the graphical method for determining the output power from a pentode. It will be noted that the operating point is near the center of the load line which has been drawn in with a slope representing 7,000 ohms. The power output is given by the formula below.

$$\text{Power Output} = \frac{\left[I_{max} - I_{min} + 1.41(I_x - I_y)\right]^2 \frac{E_{max} - E_{min}}{I_{max} - I_{min}}}{32}$$

where E_{max} and E_{min} are expressed in volts and I_{max}, I_{min}, I_x and I_y in amperes.

It will be noted that two new points

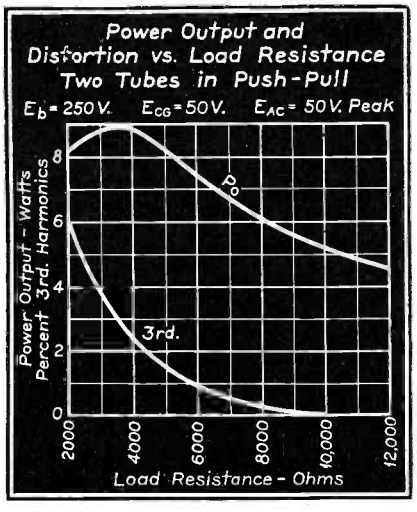


Fig. 6.

appear on Fig. 7. These are marked I_x and I_y and represent values of plate current which are determined by the intersection of the load line with the plate current curves corresponding to grid bases of $0.293 \times E_{go}$ and $1.707 \times E_{go}$ respectively, where E is the value of the respectively, where E_{go} is the value of the grid bias at the operating point. In this case the operating grid bias is —16.5 volts and therefore I_x is determined as the value of plate current at the point where the load line intercepts the plate current curve for a grid bias of —4.8 volts. I_y is a similar value determined at the point where the load line intercepts the plate current curve for a grid bias of —28.2 volts. The correction values I_x and I_y add slightly to the complication of graphical analysis over analysis for triodes. However, substitution of the values obtained from Fig. 7 in the formula for power output for a pentode results in an output power of 3 watts which is in agreement with the published values for the 6F6 operating with a plate voltage of 250 volts, a grid bias of — 16.5 volts, and a load resistance of 7,000 ohms.

Class B

In Fig. 8 the plate characteristics for one section of the type 6N7 tube are shown. The load line has been drawn in to represent a slope of 2,500 ohms which, for a push-pull class-B stage, is equivalent to a plate-to-plate load resistance of 10,000 ohms. The load line starts at E_o which is determined as the intersection of a vertical line drawn at the point of operating plate voltage and the plate-current curve for zero grid bias. From the formula below, it will be seen that the output power depends on how far positive the grid is driven since the maximum or peak plate current is a determining factor in obtaining output power. Two values of maximum plate current and minimum plate voltage are projected on Fig. 8 to indicate output

(*Continued on page* 25)

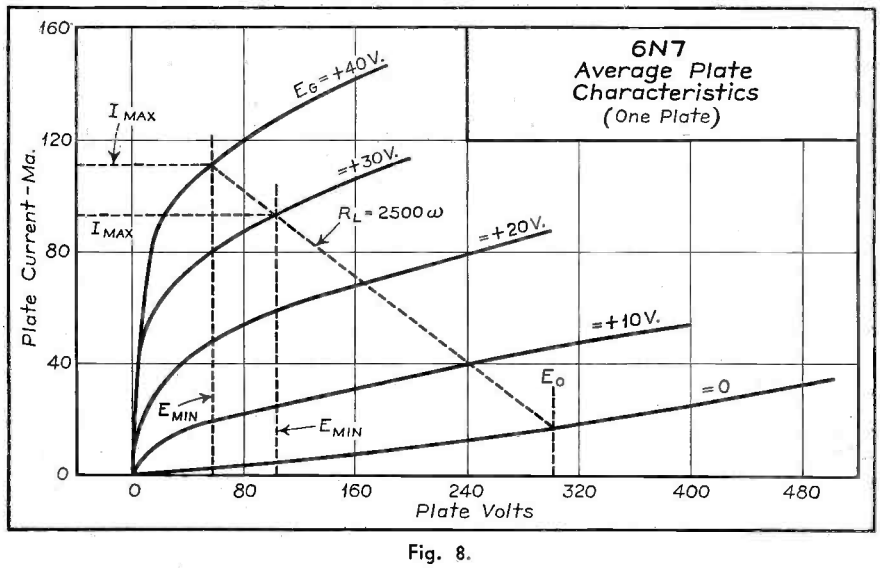


Fig. 8.

MINIMUM SERVICE STANDARDS

By F. L. HORMAN*

SURVEYS AND GOVERNMENT statistics show that the income of many radio Service Men is far below the earning capacity of those engaged in service lines in other industries. Many of these men have had years of experience and thus we can not blame the lack of experience on existing conditions. However, it would appear that since other Service Men with the same background and experience seem to fare so much better, there is some other basic reason for the vast difference in income.

Contacts with individuals whose incomes appear to fall in these lower brackets reveal a number of weaknesses in their general business and technical makeup. Especially is this noticeable when their business practices, and methods of technical reasoning and operation, are compared with that of the other groups of Service Men who appear not only to be financially successful today, but whose business is, and has been for a number of years, on a sound financial basis.

It is the object, in this and articles to follow, to point out what appear to be the fundamental requirements for technical proficiency and which when combined with approved, efficient business practices have resulted in financial stability as demonstrated by a number of successful radio Service Men who have complied with these requirements and adopted them—often in their own peculiar way. These men today look back upon former years and marvel that they lasted as long as they did in business. It is the author's belief that if more men met these requirements and accepted these practices they would meet with equal or even greater success, placing this division of the radio industry on a better financial basis and making it capable of rendering to the public a service so satisfactory as to reflect goodwill not only upon itself, but upon the rest of the industry as well.

To really be in a position to achieve success financially the modern radio Service Man should acquire the following basis for his venture.

Eleven Points To Greater Efficiency

(1) Thorough technical training as a background and foundation on which to build in future years.

(2) Years of experience, both technical and business.

(3) The equipment necessary to determine and locate faults and effect remedies.

(4) The ability to utilize all of the possibilities of the test equipment.

(5) The ability to analyze experiences and recognize those methods which experience has proved satisfactory; then to use those methods to their best advantage.

(6) Determine that minimum of receiver performance characteristics which will enable one to deliver to the consumer a receiver capable of good fidelity of reproduction of present-day programs. Then establish a standard proficiency test and operating procedure which will enable one to be sure that every receiver leaving the shop meets the above requirements, and adopt this as a *minimum service policy.*

(7) Determine the length of time required on the various receiver types to perform those operations necessary in order that all receivers meet the standards set by Item (6).

(8) Study methods of determining operating costs and employ a suitable method.

(9) Determine the cost of maintaining a shop equipped to render this quality of service.

A "jumbo" model of General Electric's new "beamascope". This is an electrostatically-shielded antenna built into the receiver cabinet. The illustration shows the shielding of this huge model cut away to expose the antenna winding—so-called, the acceptor circuit. New G. E. receivers will use this antenna.

(10) Establish rates on the basis of which charges will be determined.

(11) Put into practice the service policy above, based on good business ethics at the established rates. Never deviate from this policy use your head, and work like ——.

Now a word of explanation about each of these requirements.

Technical Training and Background

Probably in no other field of technical endeavor do we find men whose background and training are as varied as that of the radio Service Man. Many of these men entered the industry with only a very sketchy electrical training which in many instances included practically no mathematical subjects. While many of these men as a result of years of endeavor in the industry during its early years were able to assimilate many rule-of-thumb methods of procedure, they nevertheless become increasingly aware, and it is quite evident to others, that unless they make an earnest effort to become more familiar with the basic underlying a-c and d-c circuit theory, and obtain sufficient mathematical training, they are going to find the job of coping with modern receivers even more difficult in the near future than it is today. Men who lack this background are in most cases aware of their deficiency, and their lack of confidence in their own ability to handle a problem is largely responsible for their inability to achieve financial stability. This is due largely to the fact that since they are not able to determine what will be required to put a receiver in first-class condition, they usually sell their services at a loss.

The first step for such an individual is immediately to take steps to obtain the necessary mathematical and technical training in courses given by the leading technical schools; or, if unable to do this, to follow a prescribed outline of study using standard recognized texts or courses at home. The greatest difficulty these men will experience is that of having to forget or "unlearn" some of their erroneous concepts which may be largely to blame for their present position.

Many now engaged in radio service as a business have, of course, had this required background. But every year we find young men starting on a radio service business venture only to find that in from six weeks to six months

(*Continued on page* 35)

*RCA Institutes, Inc.

General Data . . .

Sparton 518, 518-X, 558-B, 558-C, 558-BX, 558-CX, 568, 568-X, 578, 578-X

Tuning: Manual
Ranges: Broadcast; Short wave
Tubes:
1st Det: } 6A8G
Osc: }
I-f: 6K7G
A-v-c: }
2nd Det: } 6Q7G
1st A-f: }
Pwr Amp: 6F6G
Rect: 5Y3G
Power Supply: A-c
I-f: 456 kc
Speaker: Electrodynamic
Field Res: 1500 ohms

Alignment

Connect generator to grid of 6A8G through a dummy of 0.1 mfd. Set generator to 456 kc; receiver band switch to Broadcast; tuning condenser wide open. Adjust trimmers C3A and C3B (2nd i-f transformer), and then C2A and C2B (1st i-f transformer).

Connect generator, still set at 456 kc, to antenna terminal of receiver through a 200 mmf dummy; band switch at Broadcast; tuning condenser closed. Adjust trimmer C22 (rejector circuit) for minimum response.

With generator connected as above, same dummy, set to 1500 kc; band switch remains at Broadcast; tuning condenser (dial) set at 1500 kc. Adjust C4 (oscillator) and C6 (antenna).

Set generator to 600 kc, also receiver dial. Adjust C5 (padding condenser).

Repeat alignment at 1500 and 600 kc.

Insert a 100-ohm resistor in series with 200 mmf dummy and antenna terminal. Set generator to 18 mc; band switch to Short wave; tuning dial to 18 mc. Adjust C7 (antenna trimmer).

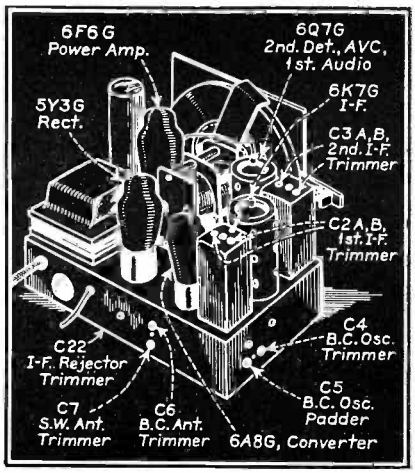
Check calibration and sensitivity at 18 mc. and 6 mc.

Repeat calibration for accurate results.

•

G. E. FD-62, FD-625

Cabinet: FD-62, table; FD-625, console
Tuning: Manual
Ranges: 540-1740 kc; 2.2-7.0 mc
Tubes:
1st Det: 6A8
Ocs: 6A8
I-f: 6K7
A-v-c: 6Q7
2nd Det: 6Q7
1st A-f: 6Q7
Power Amp: 43
Rect: 25Z5
Ballast: BL49C
Dial Lamp: Mazda No. 46
Power Supply: 100-125 volts, 40-100 cycles a-c, and 100-125 volts d-c
I-f: 465 kc
Speaker: P-m dynamic
V-c Imp: 3.5 ohms at 400 cycles



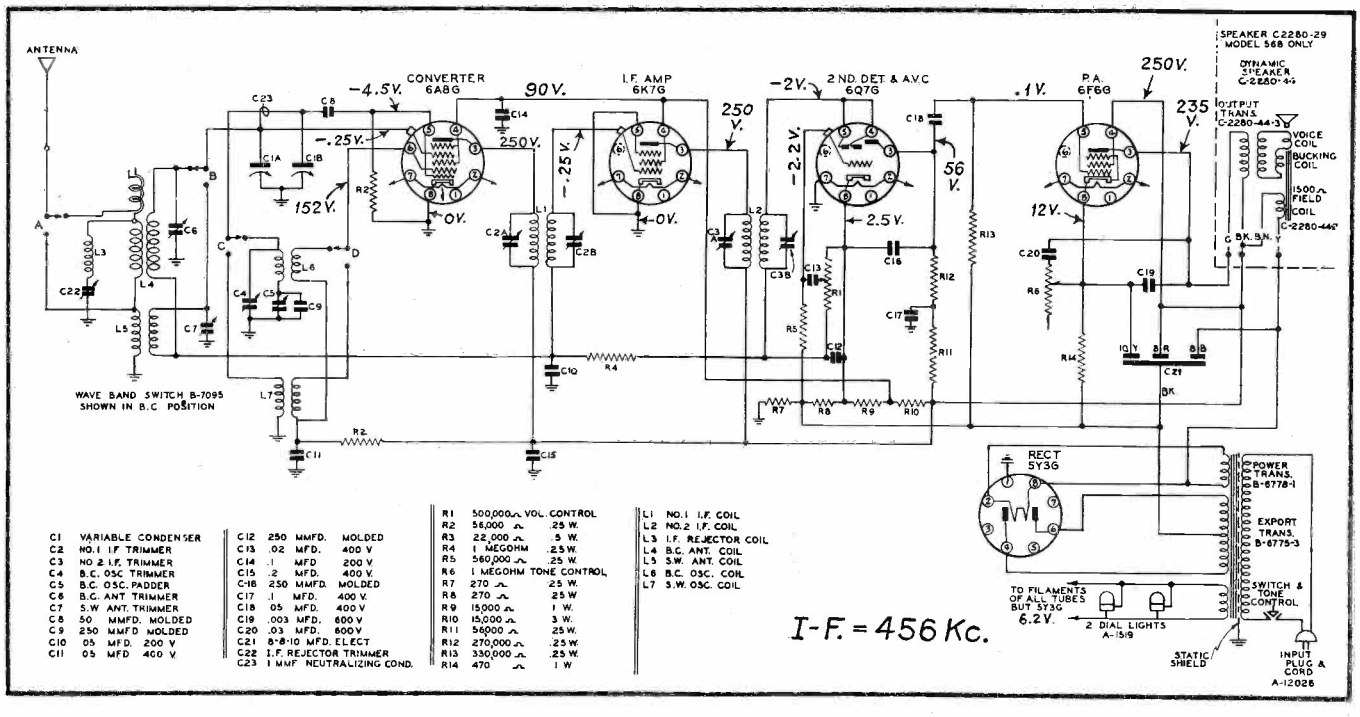
Chassis assembly.

These two-band receivers employ six tubes in a superheterodyne circuit which includes a single stage of i-f, automatic volume control, four-point tone control, wave trap and pentode output.

L1, L2 and L3 are the components of the "B" band antenna coil and are wound on the same coil form. When operating in the "C" band, L3 and a part of L2 are shorted out by the wave-change switch. L4-L5 and L6-L7 are the "B" and "C" band oscillator coils respectively and are wound on the same coil form. The "B" band oscillator grid coil is shorted out by a contact of S1 when the set is operating on the "C" band.

The intermediate-frequency amplifier consists of a 6K7 tube and two transformers, both of which have tuned primaries and secondaries.

The output of this amplifier is applied to one plate of the diode section of the



Schematic diagram, Sparton 518, etc.

6Q7 tube. The diode serves as a detector and source of the automatic volume control voltage.

The audio voltage developed over the resistor R4 is fed through the capacitor C12 to the volume control R5, which is in the grid circuit of the 6Q7 tube. The 6Q7 is resistance coupled to the 43 pentode output tube, which is in turn coupled through the output transformer to the "Alnicore" permanent magnet dynamic speaker.

The 6A8 and 6K7 tubes have a combination of self and fixed bias which is the voltage drop over the resistor R10. The 6Q7 and 43 tubes are supplied with semi-fixed bias obtained from the voltage drop over the resistors R11 and R13 in the B- lead.

One section of the BL49C ballast tube serves as a voltage dropping resistor in series with tube heaters. The second section of the BL49C is a low resistance shunt across the pilot lights. When the tubes reach their normal operating temperature this shunt across the pilot lights has more than doubled in resistance and thus allows the correct voltage drop across the pilot lights.

D-C Operation

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

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

A-C Operation

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

If any hum is noticed when the set is used on a-c reverse the power plug in the receptacle. When the set has not

I. F. ALIGNMENT WITH OSCILLOSCOPE

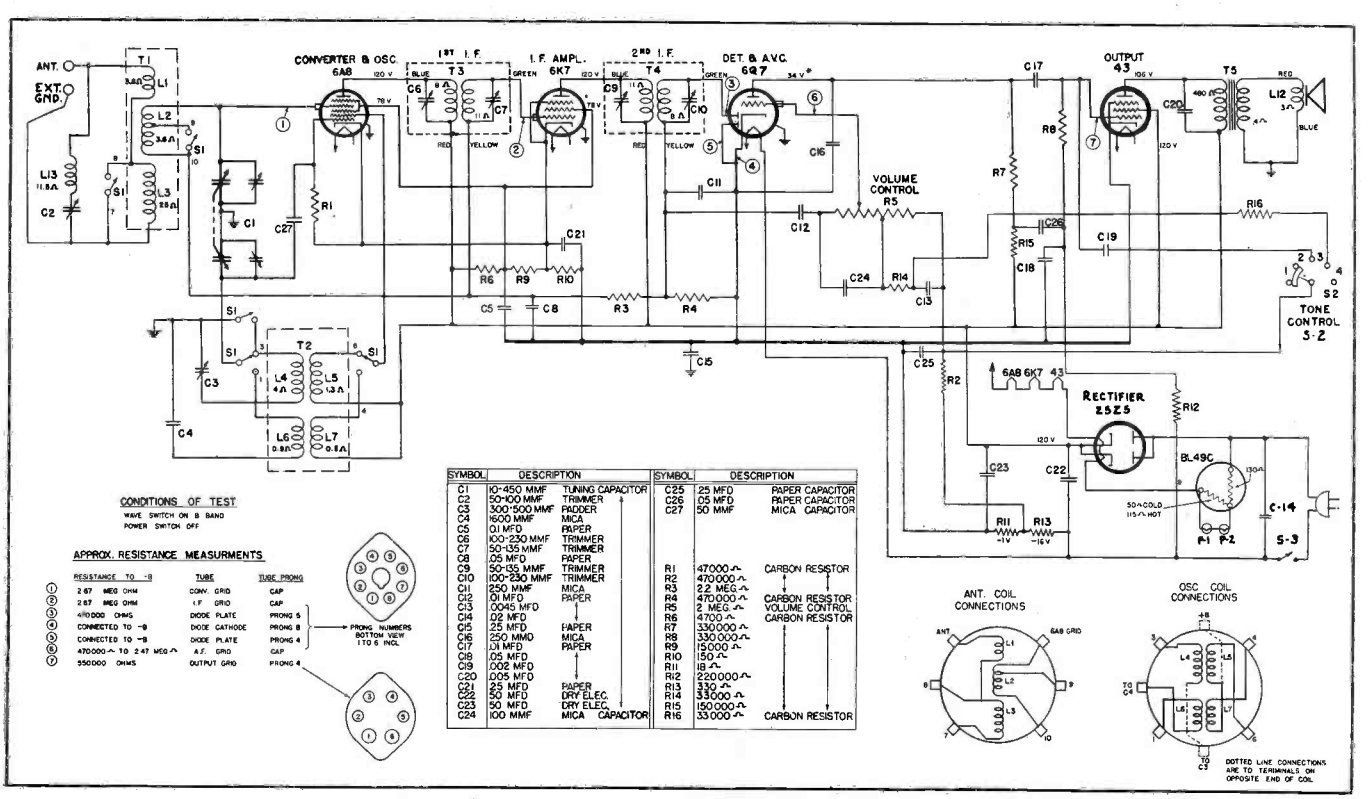
Band Switch Setting	Input Freq.	Point of Input	Dummy Antenna	Trimmer	Comments
1. Band "B"	465 kc. Sweep	I.F. Grid	.05 Mfd. or Larger	2nd I.F. Sec. (C-10) 2nd I.F. Pri. (C-9)	Gang condenser plates wide open—connect input of oscilloscope to B- and to the junction of R-3 and R-4 of the 2nd I.F. transformer—Adjust trimmers in order mentioned for a single symmetrical curve of maximum amplitude.
2. Band "B"	465 kc. Sweep	Converter Grid	.05 Mfd. or Larger	1st I.F. Sec. (C-7) 1st I.F. Pri. (C-6)	
3. Band "B"	465 kc. Sweep	Antenna Lead	250 Mmf. 400 Ohms	Wave Trap Trimmer (C-2)	Adjust trimmer for minimum amplitude.

I. F. ALIGNMENT WITH OUTPUT METER

1. Band "B"	465 kc. with Modulation	I.F. Grid	.05 Mfd. or Larger	2nd I.F. Sec. (C-10) 2nd I.F. Pri. (C-9)	Gang condenser plates wide open—connect output meter across voice coil—keep input signal low and volume control on as far as possible. Adjust all trimmers for maximum output
2. Band "B"	465 kc. with Modulation	Converter Grid	.05 Mfd. or Larger	1st I.F. Sec. (C-7) 1st I.F. Pri. (C-6)	
3. Band "B"	465 kc. with Modulation	Antenna Lead	250 Mmf. 400 Ohms	Wave Trap Trimmer (C-2)	Adjust trimmer for minimum output.

R. F. ALIGNMENT

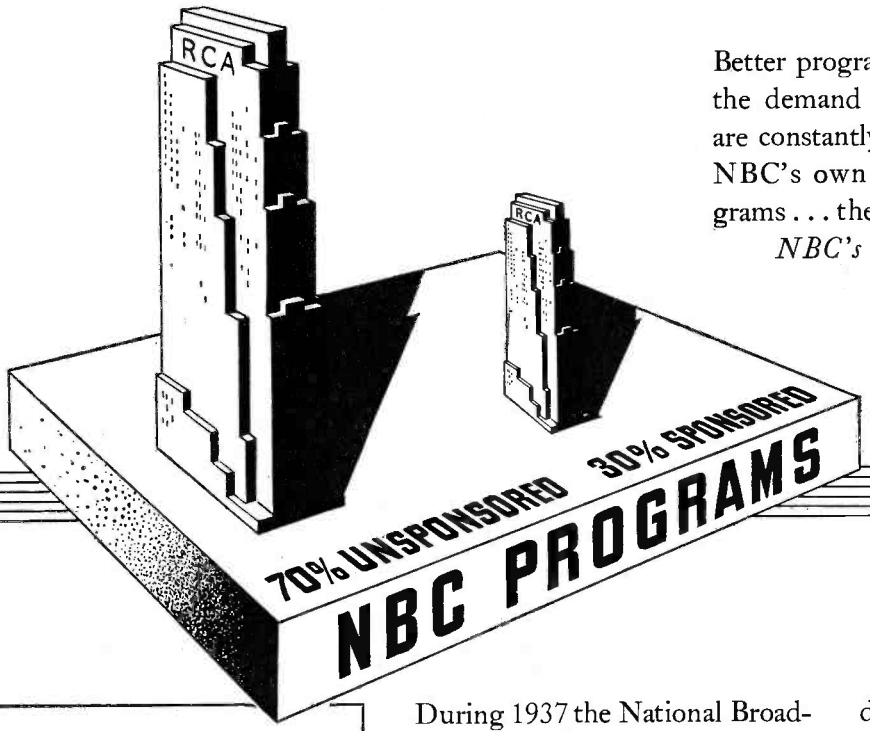
1. Band "B"					Close gang plates—Adjust pointer to first line at left end of tuning scale.
2. Band "C"	No adjustments necessary				
3. Band "B"	1500 kc. with Modulation	Antenna Lead	250 Mmf. 400 Ohms	Osc. trimmer (Front sect. of gang cond.) Ant. trimmer (Rear sect. of gang cond.)	Connect output meter across voice coil—tone control on "bass" position—peak trimmers for maximum output with a low input signal.
4. Band "B"	580 kc. with Modulation	Antenna Lead	250 Mmf. 400 Ohms	Osc. padder (C-3)	Adjust padder for a maximum output meter indication in vicinity of 580 kc. while rocking the gang condenser.
5. Band "B"	Repeat operation No. 3				



SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
C1	10-450 MMF TUNING CAPACITOR	C25	.25 MFD PAPER CAPACITOR
C2	50-100 MMF TRIMMER	C26	.05 MFD PAPER CAPACITOR
C3	300-500 MMF PADDER	C27	50 MMF MICA CAPACITOR
C4	1500 MMF MICA		
C5	.01 MFD PAPER		
C6	100-230 MMF TRIMMER		
C7	50-135 MMF TRIMMER		
C8	.05 MFD PAPER		
C9	50-135 MMF TRIMMER	R1	47000 Ω CARBON RESISTOR
C10	100-230 MMF TRIMMER	R2	470000 Ω
C11	250 MMF MICA	R3	2.2 MEG Ω
C12	.01 MFD PAPER	R4	470000 Ω CARBON RESISTOR
C13	.0045 MFD	R5	2 MEG Ω VOLUME CONTROL
C14	.02 MFD	R6	4700 Ω CARBON RESISTOR
C15	.25 MFD PAPER	R7	330000 Ω
C16	250 MMD MICA	R8	330000 Ω
C17	.01 MFD PAPER	R9	15000 Ω
C18	.05 MFD	R10	150 Ω
C19	.002 MFD	R11	18 Ω
C20	.005 MFD	R12	220000 Ω
C21	.25 MFD PAPER	R13	330 Ω
C22	50 MFD DRY ELEC.	R14	33000 Ω
C23	50 MFD DRY ELEC.	R15	150000 Ω
C24	100 MMF MICA CAPACITOR	R16	33000 Ω CARBON RESISTOR

Fig. 1. Schematic diagram, G. E. FD-62, FD-625.

RCA Continues to Build America's Radio Audience!



Better programs—which increase the demand for better radios—are constantly being fostered by NBC's own unsponsored programs . . . they constitute *70% of NBC's time on the air!*

NBC HIGHLIGHTS

These are but a few of the many fine programs which make up NBC's *70% unsponsored time on the air!*

- ★ Metropolitan Opera Broadcasts
- ★ NBC Symphony Broadcasts
- ★ Music Appreciation Hour
- ★ National Farm & Home Hour
- ★ NBC Radio Guild
- ★ America's Town Meeting of the Air
- ★ The Radio Pulpit
- ★ University of Chicago Round Table

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

During 1937 the National Broadcasting Company, a service of RCA, broadcast more than 50,000 unsponsored programs. Such service accounted for 70% of all NBC time on the air. The variety offered was as wide as human interests.

Through the miracle of radio such programs bring to millions entertainment, information and help which they could not receive otherwise. Through NBC, living rooms become boxes at the Metropolitan Opera. Or they are filled with the sonorous cadences of great symphonies, played by the NBC Symphony Orchestra, conducted by Arturo Toscanini, or some other famous conductor.

Again, it may be current prices of eggs, or pork, or a discussion of books and plays. But whatever the subject, if it is of interest to any considerable part of the public, NBC provides programs which deal with it.

Programs such as these, together with the fine programs sponsored by NBC advertisers, have been largely responsible for the increased sale of radios. And in offering listeners better radios RCA further stimulates America's interest in fine radio programs.

Radio Corporation of America

RADIO CITY, N. Y.

RCA MANUFACTURING CO., INC. RCA INSTITUTES, INC. RCA COMMUNICATIONS, INC.
RADIOMARINE CORPORATION OF AMERICA NATIONAL BROADCASTING COMPANY

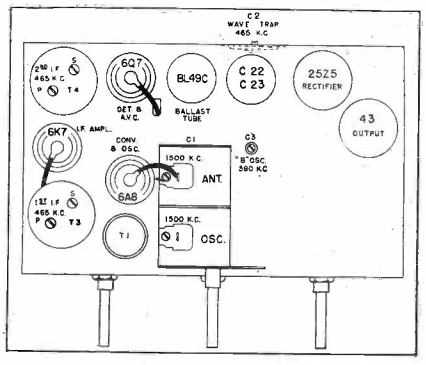


Fig. 2. Top view of chassis, G.E. FD-62, FD-625.

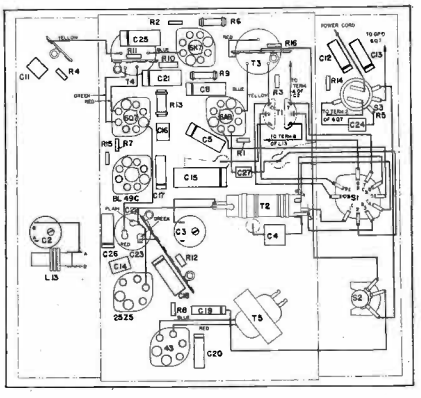


Fig. 3. Underside of chassis, G.E. FD-62, FD-625.

been used for some time, a slight hum may be audible when the set is first turned on. This hum may not immediately clear up upon reversal of the power plug. However, it will probably be eliminated after approximately five minutes operation by which time the anode plates of the electrolytic capacitors will have re-formed.

Tone Control

On the "Normal" position, No. 1 of the tone control bass compensation is obtained by the resistor R14 and capacitor C13 across the lower portion of the volume control. C24 serves to inject higher frequencies at the tap.

The "Bass" position connects C19 effectively across R8, the grid resistor of the 43 tube, thus limiting the high frequency input to that tube.

The "Foreign" position places R16 in parallel with C13 and thus reduces the bass compensation. C19 is left connected across the grid circuit of the 43 tube and again limits the high frequency input to that tube. The result is a middle range response.

The "Speech" position removes C19 from the circuit, so the high frequency response is the same as in the "Normal" position. However, R16 is left across C13, thus removing the bass compensation. This arrangement adds clarity to programs predominating in speech.

Alignment Procedure

In order to align these receivers properly, it is necessary to have the following test equipment:

1. A modulated test oscillator.
2. An output indicator such as an a-c voltmeter with a scale reading of 3 to 5 volts.
3. A screwdriver-type alignment tool.

To realize all the performance built into these receivers at the factory, alignment using cathode-ray equipment is to be preferred. The alignment procedure is given below along with a trimmer location drawing, Fig. 3. The "Dummy Antenna" is the capacitor or capacitor and resistor used in series with the signal generator antenna lead. The grid

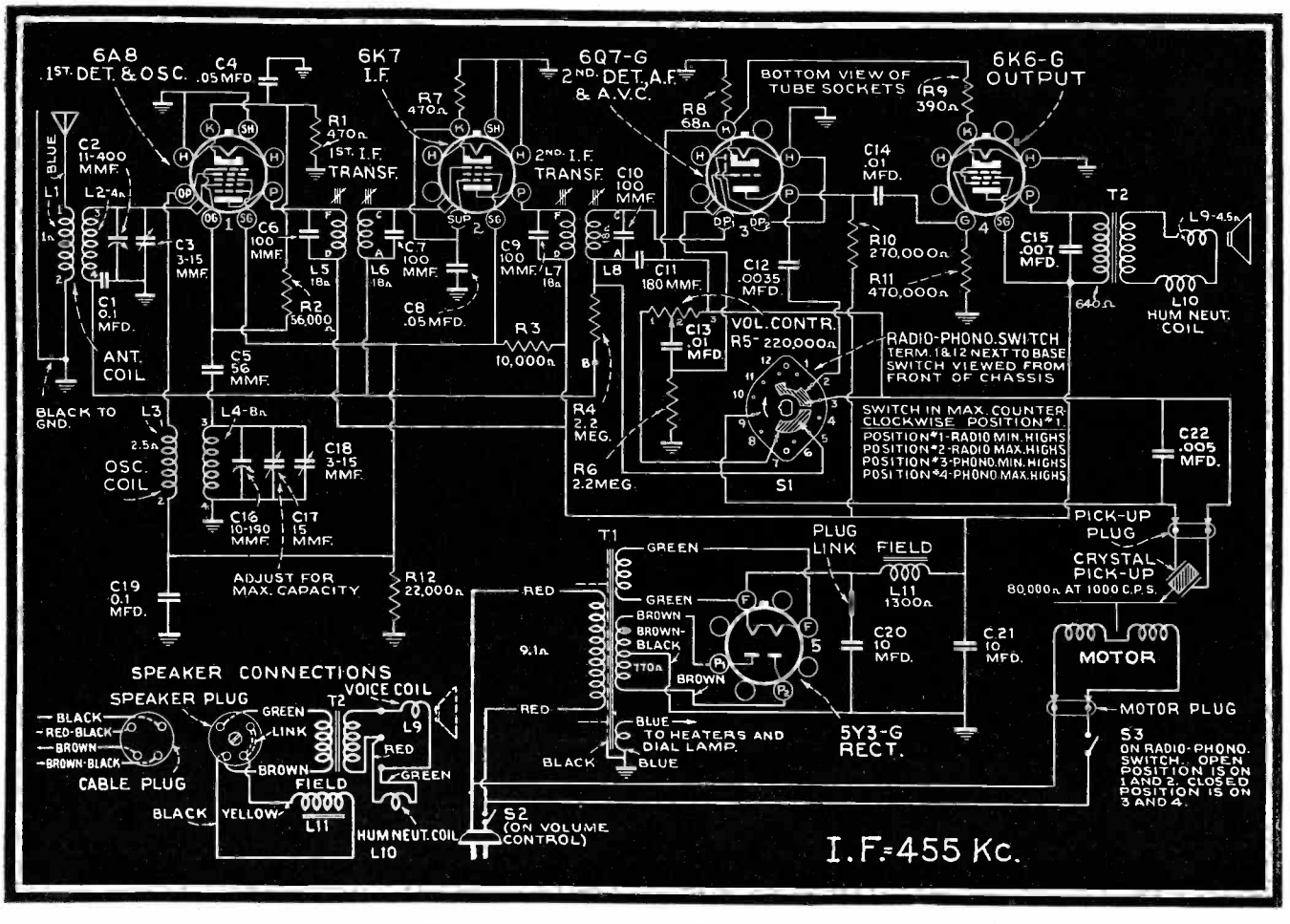


Fig. 3. Schematic diagram, RCA Victor U-III.

CLEAN . . . PROFITABLE . . . REVOLUTIONARY

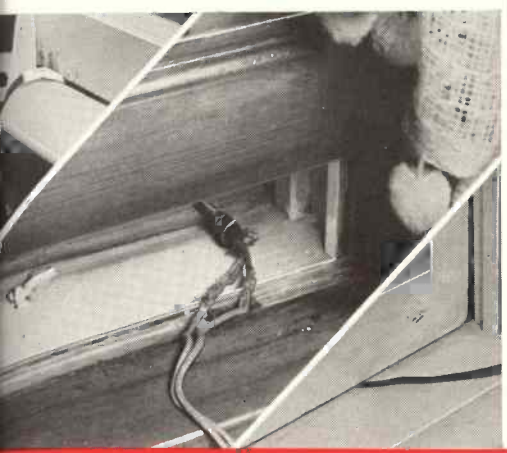
CORWICO presents

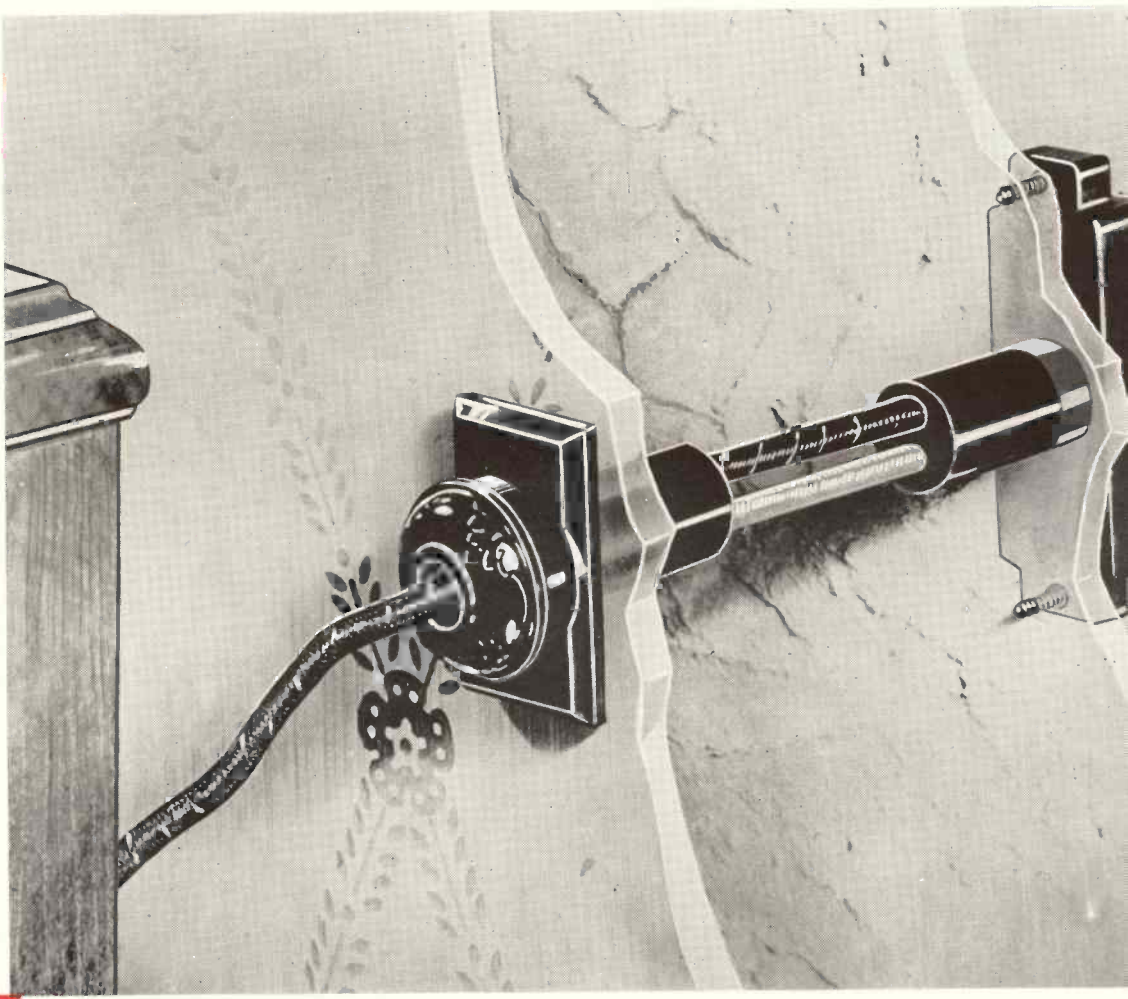
COR-NEX

DeLuxe Connector Between Aerial and Receiver

EASILY INSTALLED

- Bore 7/8" hole through wall or moulding.
- Push lead wires through wall till inside fixture is snug.
- Strip insulation from exposed parts of lead wires.
- Slide arrestor block onto lead wires and in position against outside wall.
- Secure leads on post.
- Tighten 2 small screws on arrestor (to perfect tension).
- Connect aerial and set leads.





GOODBY TO ALL THIS!

You Service men know that the "Boss" of the house hates the unsightly conditions pictured here. Women everywhere will welcome COR-NEX because it eliminates untidy makeshift wiring, banishes the ancient window-strip problem, affords a clean, workmanlike job in keeping with the modern home. Every family is a COR-NEX prospect! Every COR-NEX installation means money in your

THIS is the practical invention of a practical Service man, who realized that the connection between radio set and antenna was a weak link in the reception chain, and set out to find the cure. COR-NEX has been tested on public and private dwellings, under any and all conditions . . . its usefulness is UNIVERSAL (single or doublet). A cinch to install, a real money-maker for the servicing fraternity, and a good-will builder not to be sneezed at in any man's town!

COMPLETE—Lightning arrestor, decorative inside plate with leads and polarized plug with cord.
LIST **$2.50**

Ask your wholesaler

CORNISH WIRE CO., Inc.

30 CHURCH STREET **NEW YORK CITY**

AMPERITE offers "ADJUSTABLE RESPONSE"

(HIGHER OR LOWER PITCH WITH THE SAME MICROPHONE)

. . . made possible by THE ACOUSTIC COMPENSATOR

(pat. pend.)

Here is an improvement of great value at no extra cost! Exclusive with Amperite, the Acoustic Compensator gives you these advantages:

(1) With the flip of a finger, you can now *lower or raise the response of the microphone*—without introducing any peaks or other undesirable effects. (*Not a volume control.* Gradually changes operation of the microphone from constant velocity to constant pressure.)

(2) Permits adjustment of the microphone for most desirable response for close talking or distant pickup.

(3) Makes the system immediately adjustable to any "taste," room condition, or equipment.

MODELS RBHK, RBMk, with Acoustic Compensator. Frequency range 40 to 11000 CPS. Output, -65 db. Complete with switch, cable connector and 25' of cable. . . . $42.00 LIST. Chrome, $43.00 List.
MODELS RBHn, RBMn, without acoustic compensator, $42.00 LIST

IMPROVES ANY "LOW-COST" INSTALLATION ON 4 COUNTS!

P. A. Men, you can improve those "price" jobs by using the popular Amperite Model RAH (or RAL). You will get better results because (1) it is excellent for both speech and music; (2) has flat response without undesirable peaks; (3) reduces feedback; (4) stands up under rough handling, changes in temperature, pressure or humidity. . . . Frequency range 60 to 7500 cps. Output, -68 db.
MODEL RAH (Hi-imp.) with 12' of cable; MODEL RAL (200 ohms) with 8' of cable. . . . . ONLY $22.00 LIST

NEW LOW-PRICED CONTACT MICROPHONE . . $12.00 LIST

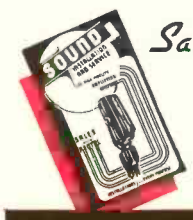
The success of our Model KTH ($22.00 List) has created a demand for a popular-priced Amperite Contact Microphone. The new model listed below can be used on most radio sets made since 1935 and on all P.A. systems. It "makes an ordinary violin sound like a Strad" . . . gives a small piano the tone of a Grand. And yet, there is *no distortion. No unnatural effects. No "fingering noises."* Installation is simple . . . no changes in strings or instruments . . . attached without tools.

Operates with either high or low gain amplifiers. Has frequency response of 40 to 9000 cps. Output, -40 db. 20' of cable.

MODEL SKH (Hi-imp); SKL (200 ohms) $12.00 LIST
SKH or SKL with foot-operated volume control . . . . . $20.00 LIST
Professional Model KTH (or KTL) . . . . . $22.00 LIST

"TOPS IN MIKES"

Station KVOL, of Lafayette, La., writes us, unsolicited: ". . . the Amperite mikes have been in service here for almost three years, and have proven themselves to be "tops" in mikes. They have broadcasted in the rain and in the hot sun. They have even been dropped, but they always came through in fine shape . . ." The *Amperite Studio Velocity Model SR80n now has -56 db output.* Frequency range 40 to 15000 cps. Triple shielded, fitted with switch, (optional), cable connector, and 25' of cable.
MODEL SR80n (200 ohms); $80.00 LIST
MODEL SR80Hn (Hi-imp.). . $80.00 LIST



Sales Aids for the P. A. Man Amperite offers the following co-operation to P.A. Men.

(1.) FREE Window Decal advertising your Sound Service. Size 5¼ x 9¼, finished in 4 striking colors. (2.) FREE Window Display, 11 x 17. (3.) Special Sound Equipment Letterheads. Samples and prices on request. (4.) FREE use of cut for printing business cards, etc.

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

"Better Systems Specify Amperite"

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VELOCITY **AMPERITE** MICROPHONES

lead should not be removed from the tube to which the input signal is applied when aligning the i-f.

•

RCA Victor U-111

Tuning: Manual.
Range: 540-1720 kc.
Tubes:
1st Det: } 6A8.
Osc: }
I-f: 6K7.
A-v-c: }
2nd Det: } 6Q7G
1st A-f: }
Pwr Amp: 6K6G.
Rect: 5Y3G.
Power Supply: 105-125 volts, 60 cycles; 105-125 volts, 50 cycles.
I-f: 455 kc.
Speaker: Electrodynamic.
Field Res: 1300 ohms.
V-c Imp: 5 ohms at 400 cycles.
Phono Pickup: Crystal.
Motor: Synchronous, manual starting.

ALIGNMENT

Cathode-ray alignment is the preferable method. Connections for the oscillograph are shown in the chassis drawing.

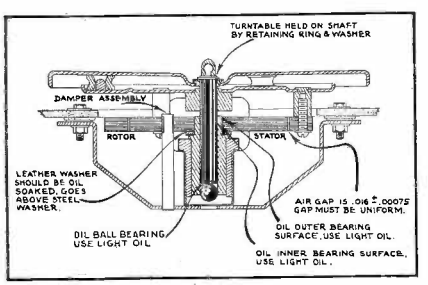

Fig. 1. Motor assembly, RCA Victor U-111.

Output meter alignment. If this method is used, connect the meter across the voice coil, and turn the receiver volume control to maximum.

Test oscillator. For all alignment operations, connect the low side of the test-oscillator to the receiver chassis, and keep the output as low as possible to avoid a-v-c action.

Pre-setting dial. With gang condenser in full mesh, move dial pointer

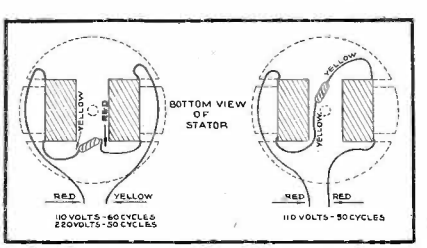

Fig. 2. Motor coil connections.

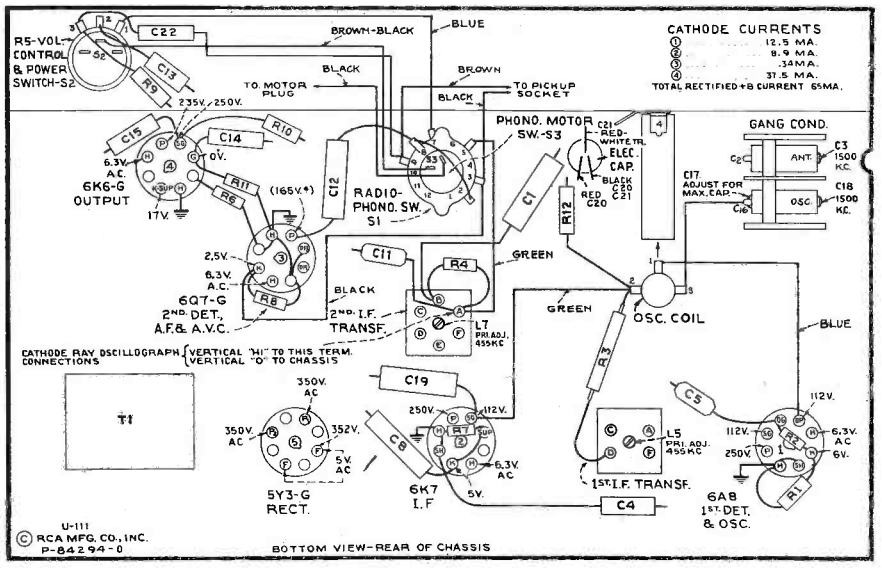

Fig. 4. Underside of chassis, RCA Victor U-111.

to coincide with horizontal lines. This is a friction adjustment.

Resealing i-f adjustment screws. After completion of alignment, seal the i-f magnetite-core adjustment screws with a few drops of household cement.

Connect the high side of the oscillator to the 6K7 i-f grid in series with a 0.01 mfd condenser. Tune oscillator to 455 kc. Turn receiver dial to some quiet point between 550 and 750 kc. Adjust L7 and L8 (second i-f transformer) for maximum output.

Connect oscillator through 0.01 mfd dummy to 6A8 grid cap. With oscillator set at 455 kc, adjust L5 and L6 (first i-f transformer) for maximum output.

Connect oscillator through 200 mmfd dummy antenna to antenna lead. Set oscillator to 1500 kc. Turn trimmer C17 clockwise for maximum capacity, then adjust C18. Then adjust C3.

Phonograph Motor

The synchronous motor used in this instrument is designed to be simple and foolproof. Among its many features are constancy of speed, low power consumption, single moving part, ease of starting, rubber damper, ease of repair, and long life. The parts that may require attention are plainly shown in Fig. 1. The motor is started by turning "on" the power switch and giving the turntable a clockwise spin with the hand. Smooth starting and running will be insured by keeping the bearings well cleaned and oiled.

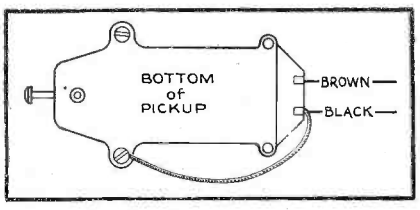

Fig. 6. Pickup connections.

Hum and Vibration. A small amount of hum when starting, decreasing to a negligible amount when running, is normal. If excessive vibration occurs it may be due to:

(1) Insufficient lubrication, or any failure that will cause binding.

(2) Leather washer not oiled. (Check to make certain that the leather washer is above the steel washer.)

(3) Motor not properly supported from motor board.

(4) Burrs on poles of rotor or stator. Remove with fine emery cloth.

Removing Rotor. The rotor and turntable assembly simply rests on the ball bearing at bottom of vertical bearing. Remove by lifting up.

Rotor Adjustment. Loosen the three screws that hold the rotor to the turntable, insert three 16-mil shims at equal distances around the gap between the rotor and stator, and then carefully tighten the three screws. The top of rotor must be flush with top of stator; add additional steel washers beneath the stator if necessary.

Lubrication. Oiling points are indicated in Fig. 1.

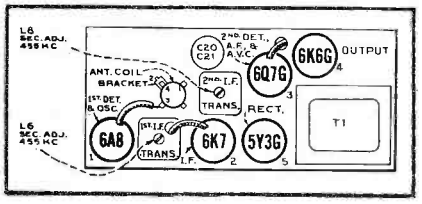

Fig. 5. Tube and trimmer locations.

RCA Victor 9K, 9K1

No signal below 600 kc: Will not work at the 550 kc end of the dial usually cutting off about 600. Replace the small condenser on top of the condenser gang going to the grid of the 6J7 oscillator tube. Use .0001 mfd.

Sylvania News

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A-C, D-C OPERATION OF SYNCHRONOUS MOTOR

(See front cover)

THERE HAS LONG been a need in the radio field for a small constant speed motor for use in a-c d-c combination radio-phonographs, according to Mark Glaser, Chief Engineer of DeWald Radio.

The circuit shown on the front cover is a novel method for using a small synchronous motor, such as the RCA Victor, on direct current. Two 25L6G tubes are used; these are connected as push-pull oscillators the tuned circuit of which is the inductance of the winding of the motor, and the capacity is the 4.25 mfd condenser shown in the diagram.

Examination of the diagram discloses that no direct current flows in the motor itself; the center-tapped choke to which the motor winding connects with the switch set for d-c operation, serves to bypass the d-c by reason of the fact that only one of the 25L6G tubes is drawing current at a time—in other words, a push-pull effect.

The 50,000-ohm resistors in series with the grids of the tubes allows the grids to operate over a greater portion of each cycle, resulting in a greater output voltage.

The change from a-c to d-c operation, or vice versa, is accomplished manually by means of a switch; automatic changeover may be obtained by means of a relay.

With the circuit constants shown, the motor operates at the proper frequency (and speed) since the proper sinusoidal wave-form and correct voltage are delivered by the oscillators. The oscillator plates are bypassed to ground to remove all r-f disturbances. Line voltage fluctuations are said to have negligible effect upon the operation of the motor.

A circuit of this type may be used to operate any other a-c equipment up to the limit of 12 watts. For frequencies other than 60 cycles, of course, the inductance (motor winding) and capacity must be adjusted accordingly. If greater output is required, 48-type tubes may be substituted for the 25L6G type.

MAKING A PROFIT

(*Continued from page 8*)

plenty to startle and perhaps shock you in the third and last chapter.

AT THIS POINT THE READER MEETS SOME EXTREMELY IMPORTANT FIGURES. WATCH THEM CLOSELY

The average time consumed from leaving the shop to the arrival back in the shop is almost exactly one hour. Using the low $1. 65 hourly basic figure, it is easy to realize that every call we make averages a cost to us of $1.65. Some calls take more time than others though one hour is the average. If you make a free service call and fail to get the job, $1.65 has gone beyond recall. That's bad enough, but, if you do get the job, when you reach the shop with the radio, you are still in the red for the sum of $1.65. Is it not the instinct of the "beast" to desire to recover that loss? What can you do? Why—that's easy; just add an hour's time to the repair estimate. Instead of $10.00 for the job, you can make it $12.75. Thus you can receive your service call fee indirectly. Isn't it nice satisfaction to know you have victimized the customer to the tune of one full hour's charge, because we are really hiding a service-call charge which she believes has cost her exactly nothing, whereas, if the charge were made legitimately in the first place, anything from $1.65 up to whatever seems reasonable could have been collected without loss. If we really wanted to make the call, free of profit or loss to ourselves and at cost to the customer, we could easily have done so by charging $1.65 only. Incidentally, the $1.65 cost hourly figure is not a figment of my imagination, but represents an existing fact concerning which I am not going to kid myself. You should accept this figure as a non-exaggerated example. I would like to add that I have not chosen some high-cost example as I have previously pointed out. That fact must be kept in mind while studying this article. Remember, $1.65 is the lowest hourly cost figure I have ever been able to reach, and any reader would do well and could feel proud if he could reach that minumum though you can hardly hope to keep your figures that low. I am not an accountant, but I do know more than a little about mathematics. When a profesional accountant, who concededly knows more about such matters than I do, shows me in cold, hard and indisputable figures that an hour's time cost to me can be undeniably computed, I would be nothing short of crazy if I at any time made estimates without using the basic hourly cost figure as the foundation upon which to

build my estimate. When I know a certain job, for example, will take 3 hours to repair plus another hour for re-installation (away from the shop) a total of 4 hours, it is as simple as "2 and 2" to realize that I must charge 4 times $1.65 if I want to do that job without any profit. Now—*you* do it—why does this not apply to you Mr. Reader? It also seems sane—and I don't know of a more appropriate word to use than "sane"—it seems the height of sanity to desire to add a reasonable profit to my cost—so—what must I do? That's easy—when one knows one's cost of anything—any sum charged and received in advance of that cost represents the net profit. The question I must decide for myself, however, is, "what would constitute an adequate profit." If the question is to be decided in a businesslike manner, it is necessary that I take time out from the shop, or some Sunday so that I may dig into some complicated annual figures. Having determined my hourly cost (and knowing that it includes a sum which I can lay to one side and which automatically will furnish the cash with which to purchase new equipment and another car when these things are needed) I must decide what I need a profit for. Will not the $1.65 pay my rent, electric light bills, etc., will it not pay for new equipment and Rider Manuals? Sure it will—that's what it is there for—but—don't you want something besides having all expenses covered and your salary paid? I do. I want to take a vacation. I'm going to Florida this summer—yes—I've been there before. I want some more good things in this life—I may even want to expand by opening some branches. If I were to charge only enough to cover my salary and all overhead expenses and depreciation items, there could (mathematically) be nothing left over and I would never go swimming down in Biscayne Bay. There is no such thing as a successful business which does not add adequate profits to its costs. It is far easier to compute these costs in a service business than in most commercial or merchandising lines for the reason that all expenses are chargeable to a total number of hours when the total number of hours is divided into the full amount of the expenses (which are also easy to find) the result is the cost per hour. I'm going to show you how to do it—but I want you to understand that what I show you is not my own personal or "pet" idea or method—nor is it the method advised or conceived by a single theorist. Basically, it is the method that is used by any business, no matter whether it is one of the giant steel corporations or a 42nd Street store. The only variations are arbitrary depreciation figures—and these need no consideration in the figures you are about to study. One thing *must* retain your interest above all other matters when studying the chart you are to use from now on. That is "Cost." "Cost" must be the prime and sole object of your computations and considerations. When this is finally determined, you will thereafter (until revision of costs a month later on) concentrate on "Profits" added to these "Costs."

You must retain a mental image of the "Cost and "Profit" set-up in your mind at all times when estimating or considering charges of any kind to customers. For example, if you have found that your total annual cost was $1,650 for the past fiscal year (that is, the 12 months immediately preceding the date of your computations) and that you had exactly 1,000 hours available for sale in that period—whether you sold them or not your average cost, to you, was $1.65 per hour. These figures don't lie—the average hourly expense which continues hour by hour for 1,000 hours is nothing more or less than exactly $1.65. Here's an "actual picture":

Total of Last Year's (or fiscal year) Annual Expense.....	$1,650
Total Number of Hours Available for Sale.....	1,000
Cost per Hour.....	$1.65

(Divide the total amount of expense by the number of salable hours).

Your costs are exactly like hidden

taxes—they are there—but you do not always think about them. A package of cigarettes is not marked "this package of 20 cigarettes is sold to you for 8 cents—the other 7 cents covers taxes paid to the Federal, State and Municipal Governments"—neither do the cigarette manufacturers sell you the package for 8 cents and ignore their own additional expenses over and above the cost of manufacture which are already included in the 8 cents. Many of you readers have merely repaired radios for what you might have thought to be a "fair price"—not too low and not too excessive. You always wanted to be fair to your customer. Never in the past have you considered that you should be fair to yourselves. Of course you may have thought that you were always fair to yourselves — but — the big point is you have never known of your own experience, perhaps had a way to determine whether you were fair to yourselves or whether you were costing yourselves money—believe it or not—you were losing money on yourselves. $15.00 a week working for some one other than yourself is better than $20.00 with all of the headaches and striving to prevent losses, bad seasons etc. The only picture that has passed before your minds has been whether the "dollars and cents" mentioned to your customers verbally have been pleasing to them or have bowled them over. You could not even make a good guess whether, in either case, you have lost money or made a profit.

What I am going to show you will startle you; at least it should, and I really pray that it does. I want this to startle you fellows so much that it will force you (in spite of any inclination you may have to the contrary) to wake up to the importance of making your next move a resolve to transact no more business until you first shall have figured out where you stand. Have will power enough to decide now, that you will put everything aside for this all-important job. Then — have GUTS enough to go through with your determination.

You can prepare for the next chapter showing the easy and non-complicated method of finding out what you want to know by procuring a substantial hard-covered book in which you will keep your monthly charts — computed each month. Twelve pages is enough to cover a single year, but there is a great advantage to keeping as many years in a single book as possible for the sake of annual comparison.

The next article will be less than one-half as long as this one and will consist mainly of the charts and a full and easy explanation of what they are, how they work, how to keep them and all of the "whys" and "wherefores."

OUTPUT POWER

(*Continued from page* 43)

power with the grid being driven to plus 30 volts and to plus 40 volts.

$$\text{Power Output} = \frac{(E_o - E_{min})\, I_{max}}{2} \text{ watts}$$

where E_o and E_{min} are expressed in volts and I_{max} in amperes.

The foregoing material is necessarily brief. The reader who desires to secure additional information and to go into the determination of distortion by graphical methods, can secure valuable information from the following references:*

Calculation of Output and Distortion in Symmetrical Output Systems, Engineering Bulletin No. 9.

Class B Amplifier Considered from Conventional Class A Standpoint, Bulletin No. 12.

Home Receiver High Output Systems, Bulletin No. 20.

Output Systems in General, Including the Direct Coupled Amplifier, Bulletin No. 25.

Data on Receiving Tubes.

*The material above can be obtained from the Raytheon Production Corporation, 55 Chapel Street, Newton, Mssachusetts; the bulletins can be had without cost, while the Databook is available at a nominal charge.

BOOK REVIEW

MALLORY-YAXLEY RADIO SERVICE ENCYCLOPEDIA, second edition. Compiled and published by P. R. Mallory & Co., Inc., Indianapolis, Ind., 1938. 335 *pages. Price,* $3.00.

Starting with an 8-page section clearly indicating how the book may be used to best advantage, the encyclopedia then provides 145 pages of tabulated data on receivers (over 17,000 models being represented) which should make it relatively simple to find the proper replacement items for those parts most generally defective. The table also gives the i-f peak of each receiver (where applicable), and the tube complement.

Then follow sections devoted to controls, condensers, vibrators, transformers, antenna design, alignment, automatic frequency control, automatic tuning, audio amplifier design and use, useful servicing formulas, and receiving tube characteristics. Each of these sections consists of a number of pages—26 pages are devoted to automatic tuning alone. The various sections, mentioned above, start with discussions of basic principles of the part being considered; theory is advanced sufficiently to enable the reader to grasp the reasons behind each statement, and then applications are considered in detail. Common, and unusual, defects are next given attention, along with suggestions for their clearance, and avoidance on future occasions. Where appropriate to a clear illustration of the subject under consideration, the section closes with several pages of schematic diagrams with numbers referring to notes listed earlier in the section and which cover points of especial interest to the diagram in question.

The section devoted to the discussion of automatic frequency control is extensive and will be referred to time and again by the readers of the encyclopedia who may still be hazy on this ever-important subject. Not only are a-f-c circuits explained in detail, but complete information on servicing receivers, especially the alignment procedure, is included.

The portion of the book in which power-supply circuits are discussed, will be found an extremely prolific source of material. It has always been the contention of this reviewer that rectifiers and filter systems, particularly the latter, have rarely been given the attention which their importance warrants; furthermore, the subject is more than a little interesting. It is gratifying to observe the wide treatment, theoretical and practical, accorded to this phase of radio receivers.

It would be possible, of course, to pick out almost any number of things which have received expert handling in this new edition, but space limitations forbid. Let it be said that here is a book primarily for the Service Man—written in his language, and one which will give its readers many profitable hours in more ways than one.

Attractively and durably bound—its publishers must have realized the practically continual use to which it will be put!—the book is on the "must" list of every radio Service Man. It is also recommended highly for all those in the industry who wish to avail themselves of an almost inexhaustible store of up-to-the-minute information.—*J. K. R.*

•

Emerson 102

Low volume and distortion: May be due to 0.01 mfd coupling condenser in audio stage. Set uses push-pull output stage with a 6C5 as phase inverter. When the 0.01 condenser becomes leaky or shorted, a positive bias is impressed on the grid of one output tube.

RCA Service Tip File

Auto-Radio . . .

Philco 927

Tuning: Manual
Range: Broadcast
Tubes:
R-f: 78
1st Det: } 6A7
Osc.: }
I-f: 78
A-v-c: }
2nd Det: } 75
1st A-f: }
Pwr Amp: 41 (2)
Rect: 84
Power Supply: 6-volt storage battery
I-f: 260 kc
Speaker: Electrodynamic

Alignment Procedure

Connect an output meter by means of an adapter to the plate of one of the 41 tubes and the chassis. Turn receiver volume control full on and adjust output of signal generator—which is to be connected to the receiver in accordance with the instructions given below—so that a half-scale reading is obtained on the output meter. The signal should be audible in the speaker.

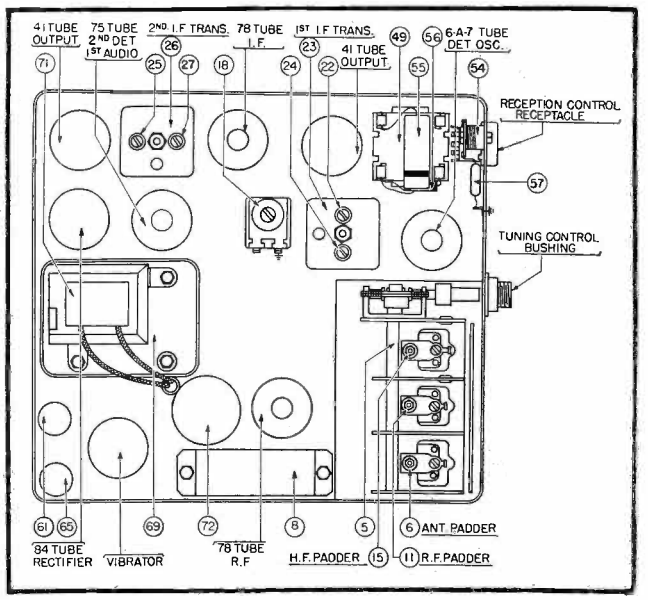
Connect the high side of the signal generator to the grid of the 6A7 through a 0.1 mfd condenser. Set generator to 260 kc; adjust i-f trimmers, 25, 27, 22, and 24, for maximum output.

Reset generator to 1550 kc and connect to antenna receptacle through a 50 mmfd condenser. Turn tuning condenser plates entirely out of mesh; adjust trimmers 15, 11, and 6, for maximum output. With generator connection remaining the same as above for each of the following adjustments, reset generator frequency to 580 kc, and set receiver tuning condenser to 580 kc. Rock tuning condenser while adjusting padder 18 for maximum output.

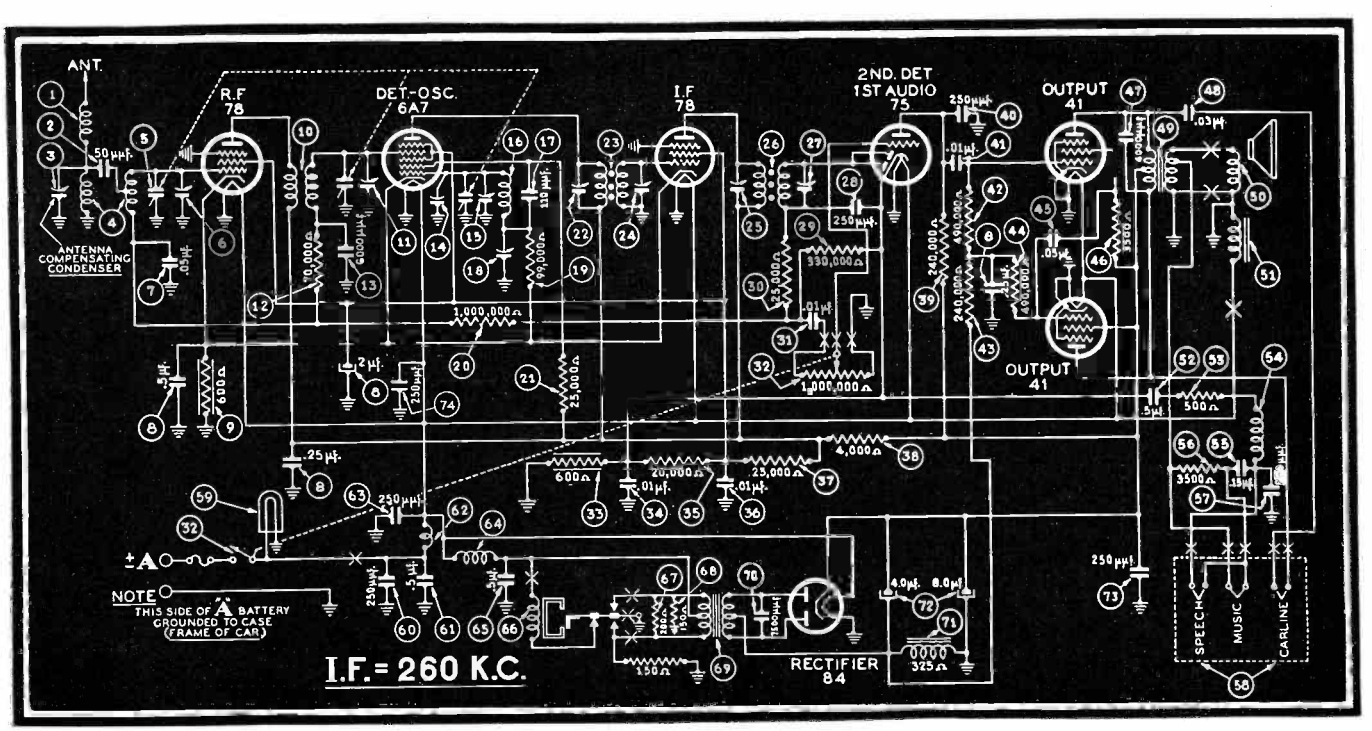
Reset generator to 1550 kc, and turn tuning condenser plates completely out of mesh. Adjust trimmer 15 for maximum output.

Reset generator to 1400 kc, and tuning condenser of receiver to the same frequency. Adjust trimmers 11 and 6 for maximum output. If this adjustment is made with the receiver in the car, the antenna lead must be connected to the car antenna in the usual manner.

When installing the receiver in a car, tune in a weak station at about 60 on the dial, and adjust antenna com-



Top of chassis.



Circuit schematic, Philco 927.

The Name

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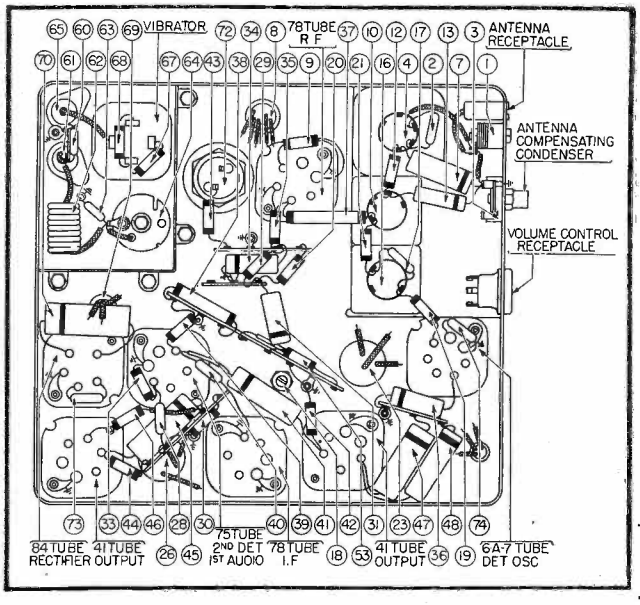


Parts and trimmer locations, Philco 927.

pensating condenser, 3, for maximum signal.

•

Antenna Lead

Loss of signal strength: Many Service Men use a great amount of shielded lead-in on auto radios, especially on convertible coupes. This cuts down the signal strength and produces a loud hiss.

To overcome this, run transmission line (that is, antenna transmission line) from the antenna to the set, covering the last 18 inches or so with shielded loom; ground both ends of the loom shielding.

RCA Service Tip File

Majestic 66 (Auto)

Low volume: If tubes and voltages check OK, trouble may be due to open choke in the second i-f transformer. Test between plates of G-6C7 tube and ground. *RCA Service Tip File*

•

Tight Tubes

Tubes too tight for easy removal: In servicing auto radios and other sets where tubes are fitted into sockets with tight springs in positions making it difficult to get hold of them, push a length of friction tape down over the bulge of the tube and lap the ends over each other. Then twist them tightly together so the tape gets a good grip on the glass bulb.

This will enable you to remove the tube without damaging it or tearing the set apart. It is also recommended as a preventive of skinned knuckles.

RCA Service Tip File

•

Arvin 6

Tuning: Push-button.
Range: 510-1540 kc.
Tubes:
1st Det: } 6A8
Osc: }
I-f: 6K7.
A-v-c: }
2nd Det: } 6Q7G.
1st A-f: }
Pwr Amp: 6K6G.
Rect: 6X5G.
Power Supply: 6-volt storage battery; 5.7 amps.
I-f: 455 kc.
Speaker: Electrodynamic.
Field Res: 4.8 ohms.
V-c Imp: 3 ohms.

Alignment

Connect the oscillator to the grid cap of the 6A8 tube through a .0002 mfd condenser. Place a 200,000-ohm resistor betwen the grid cap of the 6A8 and the grid clip which normally fits on the cap of the 6A8 tube. This will maintain the grid bias on the tube during alignment.

Adjust padders 1, 2, 3, and 4 for maximum output.

Rotate the variator shaft to its midpoint position.

(*Continued on page* 34)

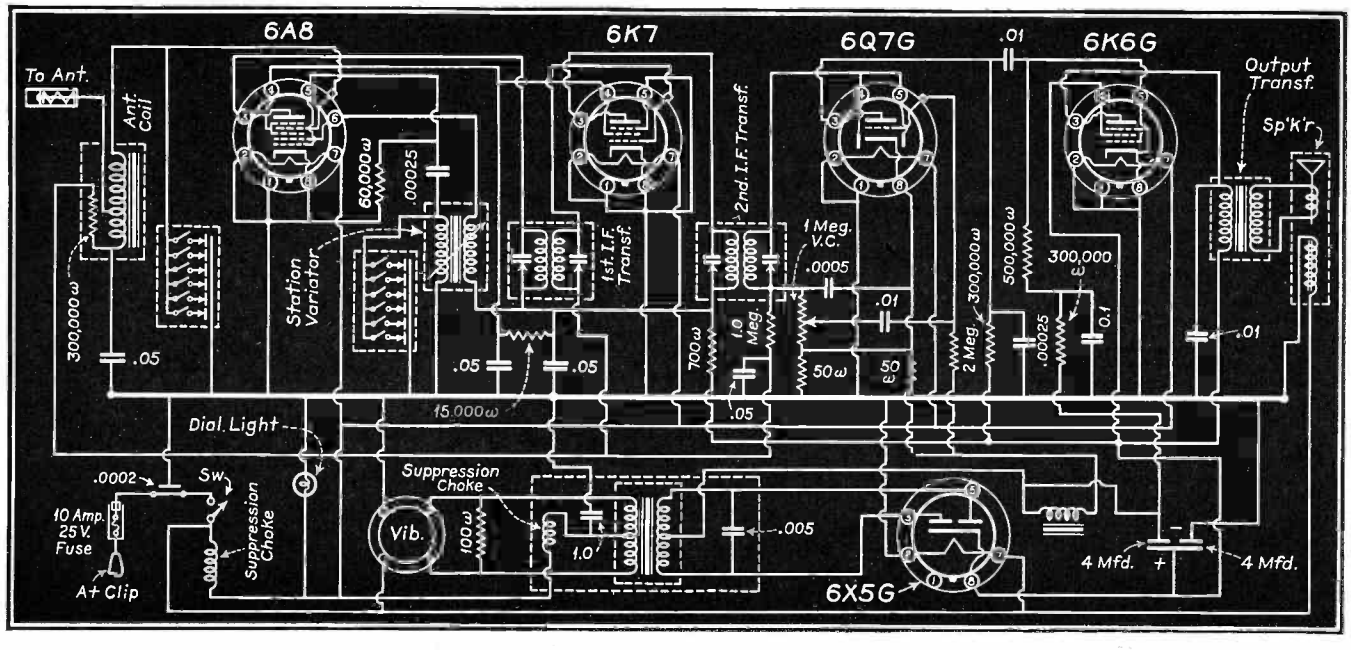
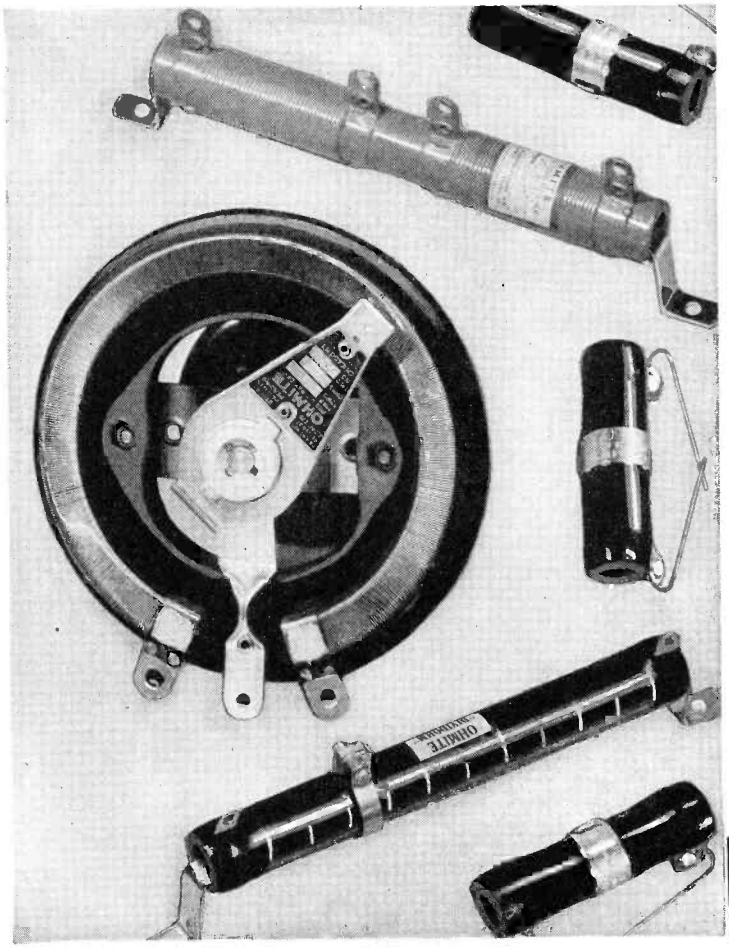


Fig. 1. Circuit schematic, Arvin 6



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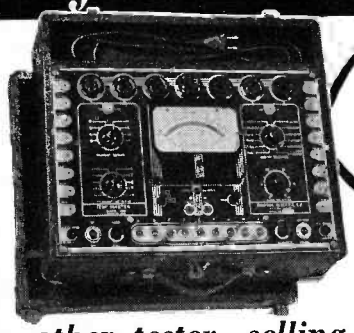

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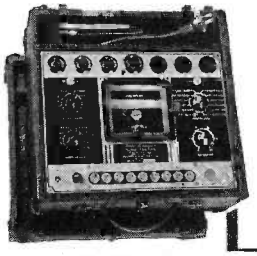

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Sound Service . . .

MICROPHONE MATCHING

By BEN EISENBERG*

THE SUCCESSFUL matching of microphones to their associated equipment depends upon the proper selection of the frequency respose, gain, and impedance of the component units.

It is known that all of the frequencies in the audible ranges are necessary to give faithful reproduction of sound. In the case of the human voice, for example, the low notes contribute to quality of reproduction, the middle range gives body to the voice, and the high frequencies add intelligibility to the speech.

The sensitivity is also an important characteristic of microphones and it varies from one type to another. The sensitivity is maximum in carbon microphones and lower in dynamic, velocity, crystal and condenser microphones.

The impedance of a microphone must be considered when associating it to the amplifying equipment. Microphones may be divided into two main classes —low impedance and high impedance. Common low impedances are 30, 200 and 500 ohms; high impedances, 5,000, 10,000 and 50,000 ohms. Carbon microphones are of the low-impedance type; dynamic and velocity are either high or low impedance; condenser and crystal microphones are of the high-impedance type. A low-impedance microphone will supply electrical energy at low voltage and high current while a high-impedance microphone will supply the same energy at a high voltage and low current.

DIRECTIVITY

Another characteristic of microphones is directivity. A non-directional microphone wll pick up, with the same intensity, sounds generated in any direction around it. A bi-directional microphone will pick up sound generated in front and in back, but not on the sides. A uni-directional microphone, finally, will pick up with maximum intensity sounds generated in front of it, and sounds generated behind it with minimum intensity. Some microphones are built so that they are definitely directional, bi-directional or non-directional. Others are of such a type that their position may be adjusted so that their directional characteristics may be changed at will.

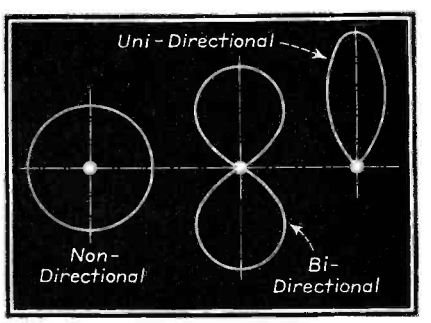
*Transducer Corp.

PRESSURE AND VELOCITY

Some microphones are known as pressure microphones; others are known as velocity microphones. The following is a brief explanation of the difference between these types. Sound waves have two different components, pressure and velocity. To illustrate better the meaning of these two quantities let us take, for example, a pendulum in motion. When the pendulum is in the middle position its velocity will be maximum, and its deflection from the rest position minimum. When the pendulum is in a position of full swing its velocity will be zero and its deflection, on the other hand, maximum. Velocity and deflection of a pendulum, therefore, vary in such a way that when one of them is maximum, the other will be minimum, or they will be 180 degrees out of phase. The same thing occurs with the velocity and pressure of a sound wave. Pressure microphones are those which follow the pressure component of the sound, while velocity microphones are those which follow the velocity component. The ability of a diaphragm to follow either component depends upon it inertia and upon the design of the baffle surrounding it.

IMPEDANCE MATCHING

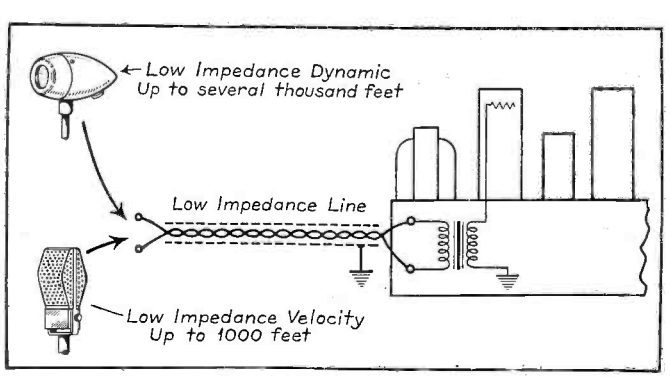
In order to obtain best reproduction of sound the impedance of a microphone must be matched to that of the input of the associated amplifier, which means that the values of both impedances must be as nearly as possible the same. If an identical value is not available, it is advisable to use microphones of slightly lower impedance than that of the amplifier. A low-impedance microphone feeding into a high-impedance amplifier will not properly reproduce the high notes while a high-impedance microphone feeding into a low-impedance amplifier will not supply low notes. The matching of impedances, which is important in any electrical coupling in order to obtain the best transfer of power between one circuit and another, is particularly delicate in the case of microphones in view of the small amount of energy which is available and of the wide range of frequencies present in sound. When amplifiers or microphones of the desired characteristics are not available, the impedance may be matched by the use of transformers.



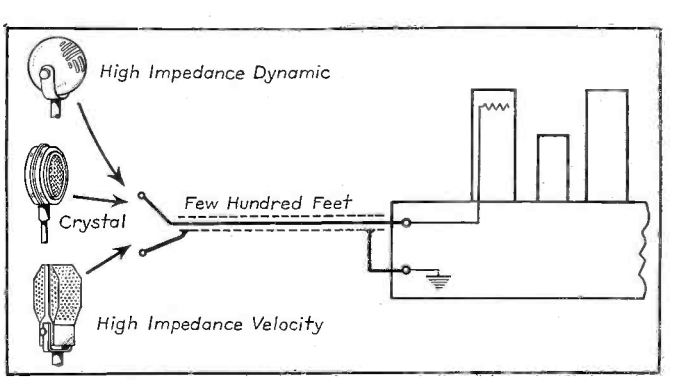
Directional characteristics of microphones.

The impedance of the coupling circuit has a direct bearing upon the maximum permissible length of line. The selection of the right impedance, therefore, must be made when the line between the microphone and speaker is designed. The proper selection of the characteristics of

(*Continued on page* 39)



Matching microphones to amplifiers having input transformers.



Working microphone directly to grid of amplifier input tube.

AUTO-RADIO—continued

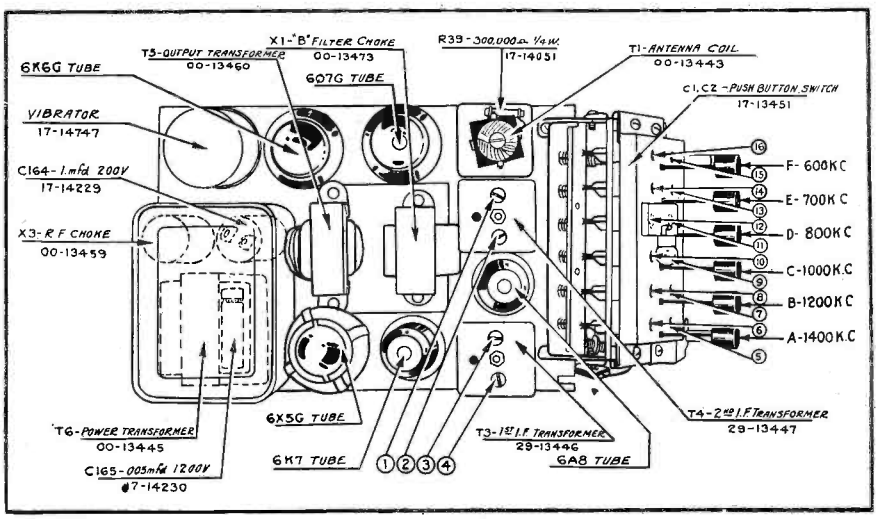


Fig. 2. Top chassis view.

Reading from left to right, the push buttons cover the following frequencies:

Button No.	Frequency Range	Oscillator Padder No.	Antenna Padder No.
A	1550-1050	5	6
B	1350- 850	7	8
C	1350- 850	9	10
D	1100- 650	11	12
E	1100- 650	13	14
F	950- 510	15	16

Push-button frequencies are adjusted by the padder screws directly above and below each individual push button. For example, suppose a station operating on 1400 kc was desired; this is within the range of button A only.

Connect a balancing oscillator to the set antenna terminal through a 50-mmf dummy antenna.

With an output frequency of 1400 kc, adjust padder No. 5 to resonance. Adjust padder No. 6 for maximum output.

Follow the same procedure for any of the other buttons, always selecting a frequency within range of the respective buttons.

Final adjustment of the antenna padders should be made with the receiver installed in the car connected to the car antenna.

●

Apex 7-A

Poor a-v-c action: Can usually be traced to 3,200-ohm Candohm resistor in the a-v-c- plate lead opening up. Replace with a 10-watt resistor of the same value. *RCA Service Tip File*

●

Atwater Kent 55

Fading: Loose rivets on wire-wound resistor cause poor tone, over-loading, and distortion. Also check two resistors across speaker field and detector bias resistor; these may have changed in value. *RCA Service Tip File*

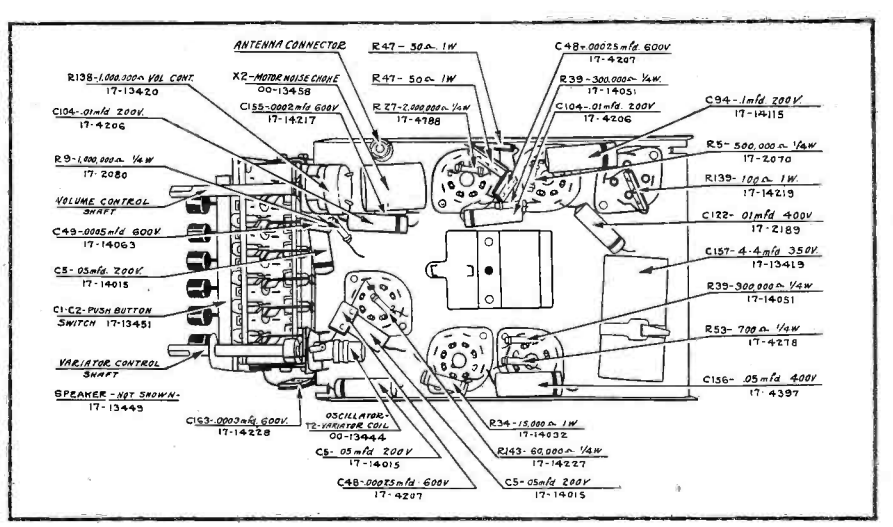


Fig. 3. Bottom chassis view.

MINIMUM SERVICE STANDARDS

(*Continued from page* 14)

their little place of business has been lost and closed and their small savings and capital dissipated.

Their hopes have been blasted, their ego has received a terrible setback, and these men then must seek employment and proceed to climb the ladder of success rung by rung, in the meantime obtaining that technical and business experience due to lack of which their business failed. But if that were all that was involved time would eradicate even it. There is, however, one angle of their stay in business and their failure which must not be overlooked. And, that is the precedents which they set; (1) in offering services at figures which meant a loss as evidenced by their failure in business, and (2) in cases of technical inability, the loss of confidence on the part of the consuming public not only in the Service Men themselves, but in others who are associated with the radio industry.

These precedents, they themselves often have to live down, and they certainly do almost unbelievable harm to the general attitude of the public toward others in the same business. These same precedents when established by any large number of men also result in the lowering of service standards and the development of practices of which the less said the better!

It is the author's opinion that before the average man can feel reasonably sure that he will succeed in business for himself it is necessary that he have had at least five years' experience in either this or some other retail service business. With that much business background and technical experience he will stand at least an even chance of succeeding.

•

Crosley 173

Intermittent: May be the 16-mfd section of the filter condenser being open. For receivers using tapped primary on power transformer, look for broken wire in tap lead.

RCA Service Tip File

•

Fada KU

Poor control at low volume: This set uses a system of screen bleeder and cathode variation for a volume control giv- poor control at low volume. To remedy this proceed as follows: Remove old volume control, installing new 15,000 ohm control with taper for antenna and cathode bias. Ground center arm of new control, left arm goes to antenna post, right arm goes to cathode bias resistor, then ground old wire leading from screen series resistor through 5,000 to 8,000 2 watt resistor. This completes the job and the volume control is now much smoother. This method can be used on other sets using the same method of volume control.

Sylvania News

•

Grunow (All Models)

Rumbling at low volume: Due to volume control. On some models, the end plate of the chassis must be removed to solder the a-c leads in place when replacing volume control unit.

RCA Service Tip File

•

Majestic 500A

Set dead with no voltages: A shorted condenser which is hard to find is the trouble. Look inside the i-f can for a small condenser and resistor assembly. The resistor will probably be burned out as it is only 1/5 watt.

Sylvania News

•

Sparton Band-Pass Model

Fading: Poor contact where pin from tuner connects to the amplifier or to the bolts holding the various units to the mounting board.

RCA Service Tip File

•

Stromberg-Carlson 846-A

Low volume: Open antenna coil. Replace coil, also sensitivity control as this may change in value from 20,000 to 35,000 or more ohms.

RCA Service Tip File

DRILL DIAMETER TABLE

Drill Number	*Diameter (Mils.)*	*Drill Number*	*Diameter (Mils.)*
1	228.	28	140.5
2	221.	29	136.
3	213.	30	128.5
4	209.	31	120.
5	205.5	32	116.
6	204.	33	113.
7	201.	34	111.
8	199.	35	110.
9	196.	36	106.5
10	193.5	37	104.
11	191.	38	101.5
12	189.	39	99.5
13	185.	40	98.0
14	182.	41	96.0
15	180.	42	93.5
16	177.	43	89.0
17	173.	44	86.0
18	169.5	45	82.0
19	166.	46	81.0
20	161.	47	78.5
21	159.	48	76.0
22	157.	49	73.0
23	154.	50	70.0
24	152.	51	67.0
25	149.5	52	63.5
26	147.	53	59.5
27	144.	54	55.0

Diameters are specified in "thousandths" of an inch (mils). To change to inches, divide the diameter in mils by 1,000.

—From "Radio Field Service Data"—Ghirardi.

Test Equipment . . .

D-C MEASUREMENT WITH THE OSCILLOSCOPE

By E. M. WEAVER

THOSE SERVICE MEN who are fortunate enough to possess a cathode-ray oscillograph have an excellent device which has almost infinite impedance for voltage measurement. However, for d-c measurements it is not entirely satisfactory in its present form, but an easily built mechanism will convert any oscillograph (with or without sweep circuit) into an excellent device for measuring d-c voltages without drawing any current.

The principle involved is that of changing the d-c into a pulsating d-c which will trace a pattern on the oscillograph screen. The amplitude of the pattern is a measure of the voltage—and the device can be easily calibrated.

Measurements can be made either directly with the oscillograph deflection plates or through an amplifier, the latter connection giving a large pattern for low voltages, which is a very desirable feature.

The device to be described is really nothing more than a motor-driven switch or chopper. Since an ordinary dollar fan motor can be used, the entire cost of the mechanism is less than $2.

ASSEMBLY DETAILS

The accompanying plan shows how the device is assembled. In addition to the motor, a wooden disc about three inches in diameter is needed to provide support for the commutating rings. Two of the rings are mounted on the face of the disc, and four segments are screwed to the periphery of the disc; this is shown quite clearly in the diagram of commutator connections.

When mounting the rings, circles should first be drawn with a compass from the center of the circular disc so that the rings will be mounted and centered properly with the shaft. The four segments are fastened to the circumference of the wheel.

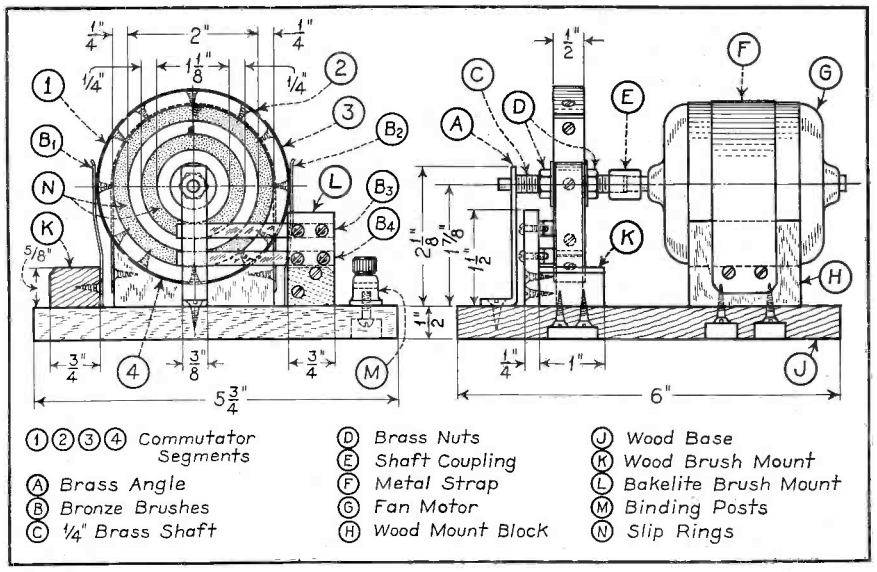
Both the rings and segments are most easily made from brass and should be fastened with screws or nails near the edges so that the brushes will not wear out through constant contact with heads.

The brushes can be made of either sheet brass or phosphor bronze, preferably the latter. The diagram shows how the segments and rings should be wired.

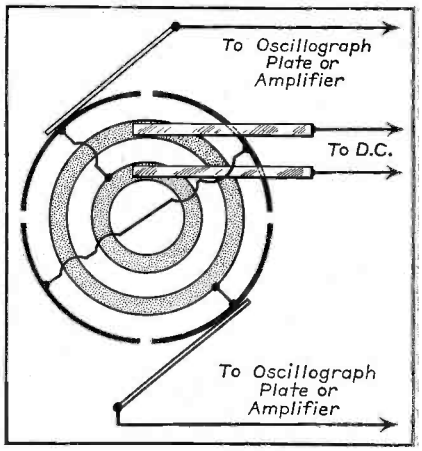
OPERATION

Note that the waveform has twice the amplitude of the d-c. This is because the commutator reverses the d-c voltage fed to the cathode-ray deflection plates. Note also that for part of the cycle the voltage is zero—this is done purposely to discharge the deflection plates before applying a voltage of reversed polarity.

The current drawn by the device is practically zero. Since the motor turns 3600 rpm or 60 times a cycle, the current drawn by the cathode-ray tube in charging and discharging is equal to that of a condenser having a few micro-microfarads capacity. The frequency, as mentioned, is 60 cycles per second. This current is so small that it has little effect in d-c measurements.



Complete assembly of motor-driven chopper.



Wiring details of the chopper-commutator. Disc is made of wood, thoroughly dried and impregnated in hot paraffin wax. Brushes on circular disc go to d-c voltage to be measured. Collectors on the periphery are connected to the oscillograph terminals.

CALIBRATION AND USE

In using the oscillograph it is first calibrated on a known voltage of the same order of magnitude as the unknown voltage to be measured.

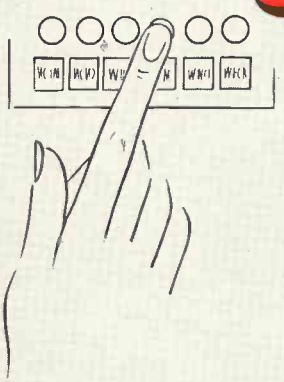
If a sweep circuit is employed and properly synchronized, the pattern will be similar to the one illustrated. If a sweep circuit is not employed—and the writer believes that better results are obtained this way—the pattern will be a vertical line with a pronounced dot at either end and one in the middle. The distance between the dots, or between the top and bottom lines if a sweep is used, is a measure of the d-c voltage.

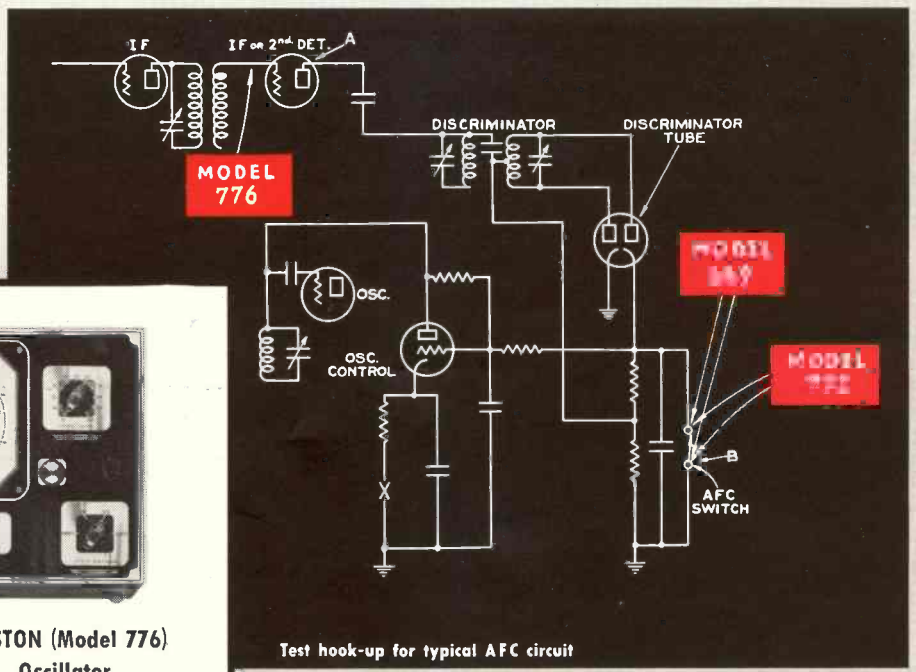
If the pattern is too large to keep on the screen, position the pattern so that only one-half is centered on the screen.

By measuring the amplitude which a known voltage causes, it is possible to calibrate the oscillograph. If the amplitude of the unknown voltage is three-

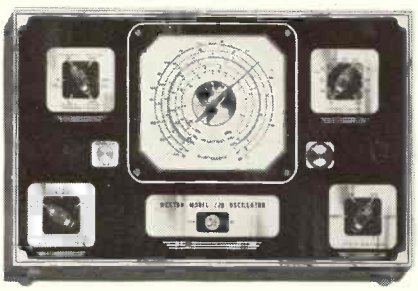
(*Continued on page* 51)

These 3 instruments MAKE AFC ALIGNMENT Quick, Simple, Profitable!



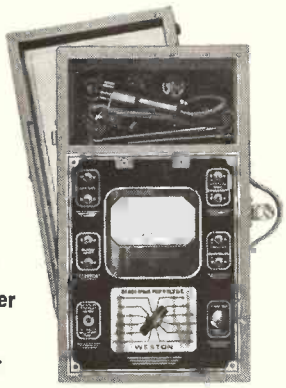


Test hook-up for typical AFC circuit



WESTON (Model 776)
Oscillator
individually hand calibrated dials

WESTON (Model 669)
Vacuum Tube Voltmeter



WESTON (Model 772)
Super-Sensitive Analyzer
sensitivity
20,000 ohms-per-volt

Push button tuning provides another real opportunity for servicemen properly equipped. Nothing complex, nothing time-consuming about AFC alignment when you have these 3 dependable, WESTON instruments. Instead, perfect alignment is a quick, simple operation . . . *highly profitable* the WESTON way. And equipped with these 3 instruments, plus the WESTON Tube Checker, you are *set* for all servicing needs.

If you are anxious to *save money* on your instrument purchases over the years . . . *make more money* servicing *every* year . . . be sure your instruments are dependable WESTONS. The coupon will bring you complete information, as well as a copy of the "WESTON Pointer" . . . which gives profitable suggestions and short cuts for AFC alignment and on other servicing problems. Return the coupon today!

WESTON *Instruments*

WESTON ELECTRICAL INSTRUMENT CORPORATION
604 Frelinghuysen Avenue, Newark, N. J

Send a copy of the WESTON POINTER, Vol. 1—and literature on WESTON Instruments.

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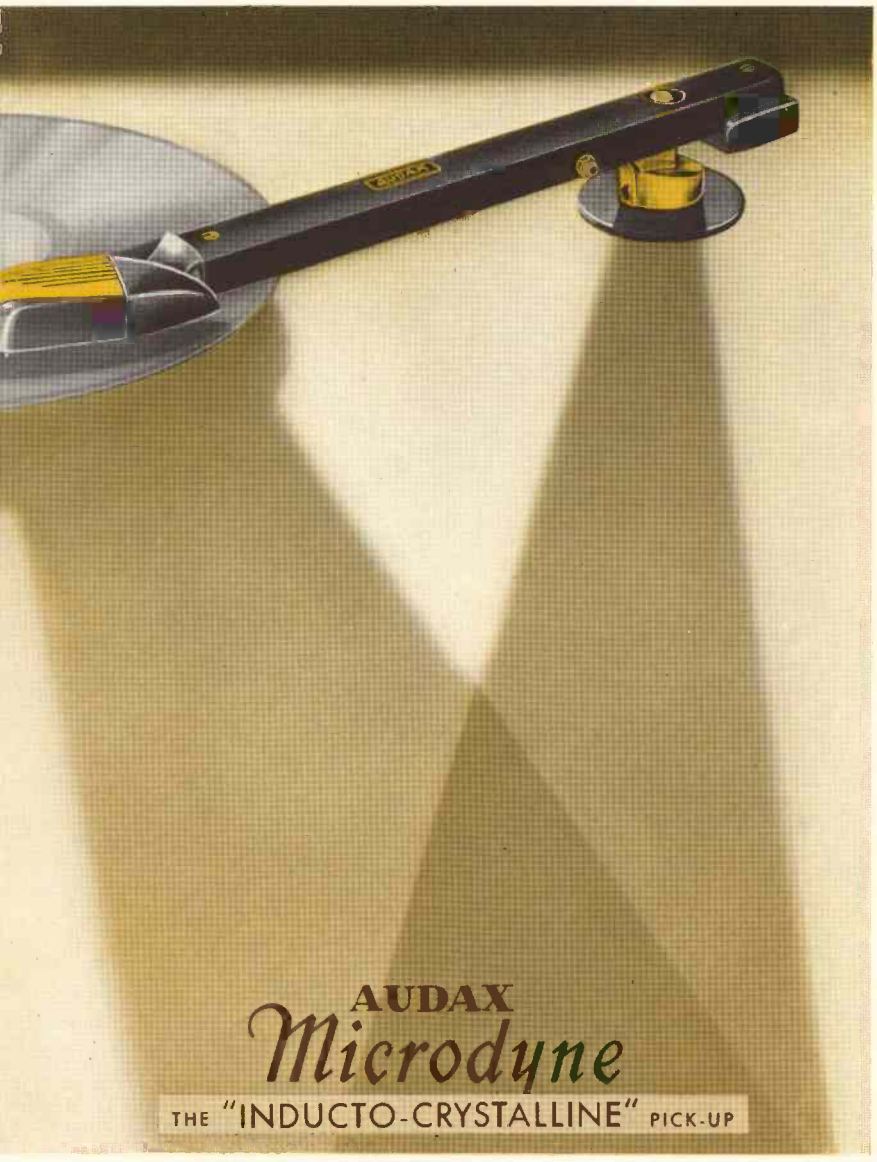
AUDAX

announces still another development . . . .

INDUCTO-CRYSTALLINE

type MICRODYNE



THE "RELAYED FREQUENCY" MICRODYNE is now standard in Leading Radio Stations, Studios, Laboratories and wherever quality sound is paramount. Through constant refinements it now has a FLAT response within ± 2 db, over the entire recorded spectrum and operates with but a few grams on the record.

In the startling development here presented, for use where price is a factor, a new type Inductor is so coupled by a mechano-low-pass filter (a Semi-Crystallized ingredient,—*not piezo-electric),* as to boost the bass frequencies, thus compensating for this well known deficiency in the record itself. RESULT: a marvelous *facsimile* realism all the way UP and all the way DOWN.

NOTE THESE FEATURES

- Delivers consistently uniform response indefinitely, with the sharp, clean-cut definition of the finest Magneto-Inductive pickup
- FLAT from 350 cycles up, and compensatory gradually rising characteristic from 350 cycles down, reaching about 14 db at 46 cycles
- Absolutely immune to moisture and temperature changes
- High voltage output sufficient for practically any amplifier
- Available in any impedance
- Small, beautifully streamlined offset head, AUDAX-engineered, easily adaptable to any automatic changer arm
- Considerably lighter pressure on record than any other commercial pick-up—no record wear
- Equipped with instant tip-jack connectors
- Needle impedance is exceptionally low
- Equipped with newly developed Needle-Guide
- Immune to stray fields
- New non-resonant arm—precision ball-bearings

Costs no more than ordinary pickups

Write for detailed literature

A truly remarkable pick-up, with everything MICRODYNE has, plus this ingenious new self-contained bass-compensation through a new crystalline ingredient with none of the shortcomings commonly associated with crystals!

SEE and HEAR

for yourself . . . . .

Booth 211 Franklin Ave., Chicago Show

AUDAK COMPANY

500 Fifth Avenue New York City

the line between a microphone and an amplifier is of primary importance, if the quality of the microphone performance must be preserved. An ordinary line will attenuate the high notes more rapidly than the lows, and therefore if a long line is employed the reproduction of the high frequencies will not be at its best. "Long" is a somewhat indefinite term since the effect of the length depends on the impedance of the line itself and on the type of cable. High-impedance lines transfer electrical energy at a higher voltage than do low-impedance lines; therefore, the attenuation is greater. The ideal impedance for long lines is either 200 or 500 ohms. Such lines require a transformer at the amplifier end which is sometimes, particularly in the case of badly designed amplifiers, troublesome, since it may pick up hum from the power transformer of the amplifier itself. For this reason some amplifiers are made without input transformers; they require the use of low-loss lines consisting of low-capacity concentric cable.

Lines and Line Matching

There are basically two different ways to solve the problem of line impedance between amplifier and microphone.

If the amplifier is supplied with an input transformer, the primary of which has an impedance of 200 to 500 ohms, a very long line—1,000 feet up to as much as one or two miles—may be used; this can be ordinary two-wire shielded cable or, better, concentric low-capacity cable. The length of this line depends primarily on the output of the microphone. At the far end of the line one may use a dynamic microphone of 200 or 500 ohms impedance or any other microphone provided it is equipped with a pre-amplifier with an impedance of 200 to 500 ohms. If the distance is only a few hundred feet, a velocity microphone may be used without a pre-amplifier.

In case the amplifier does not have an input transformer, one may use a high-impedance microphone, dynamic, velocity, or crystal, directly connected to it. The maximum distance at which such a setup would properly work is, however, limited to a few hundred feet. If a longer distance must be reached, it is necessary to use a step-down transformer or a low-impedance microphone at one end of the line and a step-up transformer from line to the input of the amplifier.

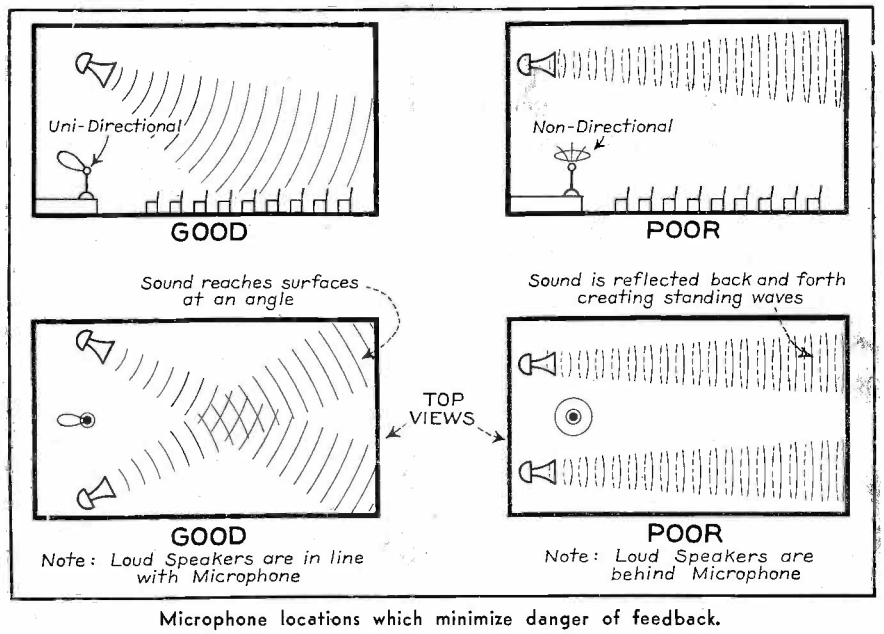
Low-impedance lines are generally used in broadcasting and in high-quality sound transmission since they are the least subject to pickup from power lines, telephones, bells, and electric noise in general.

It is, in any event, important that the microphone supply enough energy to the amplifier to drive the first tube. A chart converting decibels to power and to voltage for various impedances help considerably to solve the problem.

Amplifier and Speaker Considerations

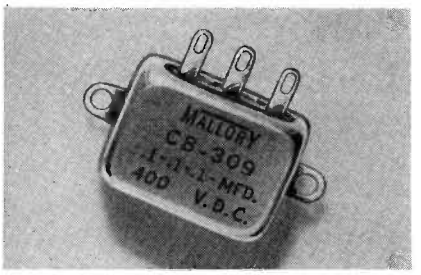
It is also important that the frequency response of amplifier and reproducing equipment be at least as good as that of the microphone in order to obtain proper

(*Continued on page* 51)



Microphone locations which minimize danger of feedback.

SEEN AT



MALLORY

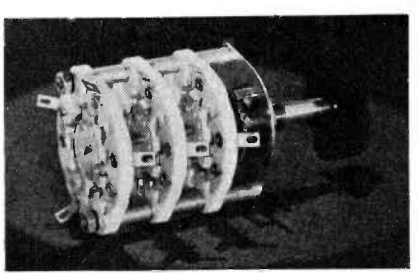
Cased Bypass Condensers are now available in two working voltages, 400 and 600, a wide variety of capacities, and in single and multiple section types. For convenience Mallory has combined the usual 200-volt listing with the 400-volt ratings but has retained the small size of the 200-volt type. This eliminates unnecessary items. In making this change the insulation of former 200-volt units was increased to equal the required insulation for 400-volt rating.

These and other new items may be seen at the P. R. Mallory & Co. booth.

•

CENTRALAB

In addition to the Isolantite-insulated switches, as pictured here, Centralab is featuring ceramic capacitors, controls, etc. None of these items have been on display before this show as they are all newcomers to the product line of this company.



TACO

Technical Appliance Corporation is featuring its new Taco 600 Antenna System. This antenna system efficiently handles both standard broadcast and short-wave signals. It comprises one long aerial, transformer unit, twisted-pair downlead, set coupler, and necessary accessories. Everything comes assembled, wired, soldered. System can be strung up in an hour or less, without tools or special skill.

HYGRADE SYLVANIA

The Hygrade Sylvania Corporation is showing a Model Radio Service Shop in their show booth at 204-206 Ampere Street, Exhibition Hall, during the National Radio Parts Manufacturers' Show. Practically every detail found in their original Model Service Shop at their Emporium plant has been duplicated in the show booth display, except where physical limitations of the booth space prohibited.

This Model Service Shop has been designed along strictly modern lines. It is just as important for a radio service shop to have a modern, neat appearance as it is for other progressive businesses. Feeling that the radio service profession has been somewhat backward about store appearance and noting that most other businesses have become very conscious about this, Sylvania designed and built a modern service shop at their Emporium plant in an endeavor to stimulate remodernization activity and place the profession in a better light to the consumer.

The modern interior lends a clean, cheery atmosphere to the store. Cabinets, bookcases, instrument panels and tool drawers have been built in to take advantage of all available space. Its compactness ideally adapts it to shops which have only limited space. The two display windows in the shop installed at the Radio Trade Show have been decorated with Sylvania advertising material which is available to all Sylvania radio tube dealers. Here it is demonstrated how Sylvania advertising displays, signs, dummy cartons, etc., can be effectively employed by dealers in decorating their windows.

A book containing working plans and descriptions of the Model Service Shop is being distributed by the Sylvania Booth attendants.

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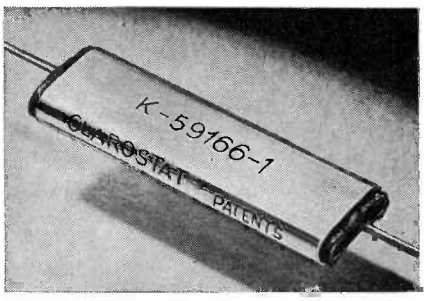
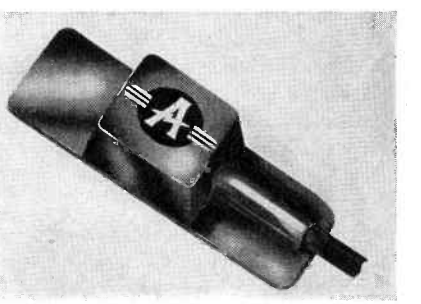
BRUSH

The Brush Development Company's display features the newly-developed unidirectional microphone, along with numerous other cell microphones, headphones, "Hushatones," vibration pickups, and others.



CLAROSTAT

The Clarostat booth provides many attractions. Victor Mucher and Eddie Trefz of the home office are on hand to demonstrate and discuss the Clarostat line. Various items are exhibited on the revolving display stand; there are several new ones, including the full line of midget controls, and new fixed resistors of the metal-clad bakelite-insulated type shown here.



AMPERITE

Because of the unusual popularity of the Amperite Kontak Unit, a new one was developed at a lower price which can be used for home and professional use.

An idea of the quality obtainable with this unit can be obtained from the fact that it was used by Edgar Stanistreet of the Philadelphia Symphony Orchestra, to reinforce a mandolin solo.

It has an output of —40 db and a flat frequency response from 60 to 6,000 cycles.

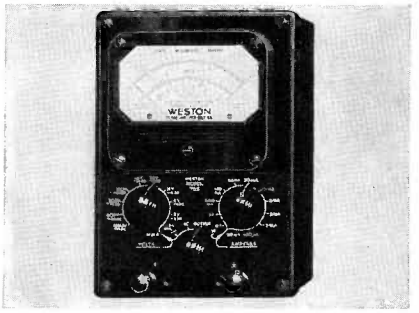
This may be seen at the Amperite booth.

H. E. Osmun.

Arthur Moss.

Show

THE SHOW



WESTON

In the exhibit of modern servicing equipment by the Weston Electrical Instrument Corporation, Newark, N. J., the new Weston Model 776 test oscillator, featuring precision control both as to frequency and output level, will be of particular interest. This new servicing instrument is designed for high-stability operation from any 110-120-volt 60-cycle a-c line. The six frequency scales on its large 330-degree dial are individually calibrated with hand drawn scale divisions, and cover all frequencies from 50 kilocycles to 30 megacycles. Only air condensers and coils of fixed characteristics are present in the oscillator circuit—assuring sustained accuracy of calibration in service. The unit utilizes a special newly developed circuit to provide automatic amplitude control.

The Weston Model 775 "dual-unit" servicing set, combining the 20,000 ohm-per-volt analyzer and its companion tube-tester in a single portable case, will also be a featured item in the exhibit. This unique combination of two instruments . . . electrically independent but forming a balanced operating unit in function and design . . . has met with particular favor among service men because of its flexibility in use.

•

MUTER

The Muter Company is showing their 5-watt Zipohm resistor, pushbutton switch with bakelite button, midget knife switches and other items of their line.

THORDARSON

New literature of Thordarson Electric Mfg. Co., 500 W. Huron, Chicago, available at the Radio Parts Trade Show includes:

Amplifier Catalog No. 600-C—Illustrates six models with outputs ranging from 8 to 60 watts. The 15, 25 and 40 watt models are in the new solid walnut cases with illuminated control panels which are recessed and arranged at a convenient operating angle. The catalog contains technical data with regard to each of the models, general information about the line, illustrations and prices of speaker and portable cases, etc. 12 pages.

Catalog No. 400-C—The complete catalog of Thordarson radio and amplifier transformers, chokes, etc. Covers each of the items in the line with complete electrical characteristics, prices, etc. 24 pages.

Bulletin SD-378—Offers complete decription of foundation units for: 100 watt band-switching transmitter, giving selection between any three pre-selected amateur bands; a 6L6 plate modulator for phone operation; a universal speech amplifier. 4 pages.

Radio Servicing Guide No. 342-C—Written by Thordarson engineers giving many helpful servicing and constructional hints. Tells how to build an improved condenser analyzer and impedance bridge, a 32 volt d-c power supply, etc. Gives details of adding an extra speaker to a receiver without upsetting the load impedance and other valuable servicing helps. This is the third of the series of manuals which Thordarson has published for the aid of radio servicemen. 32 pages. There is a nominal charge for this book.

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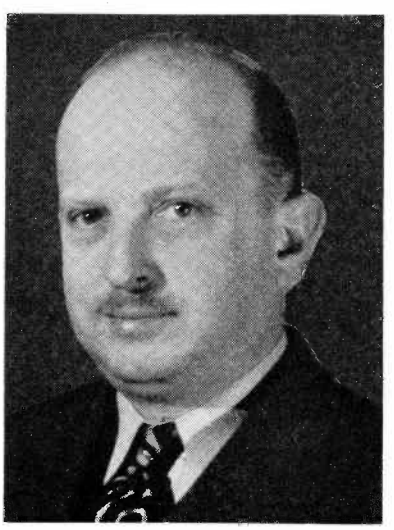
TRIUMPH

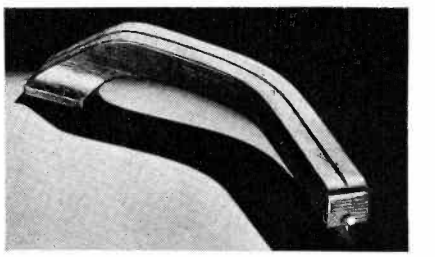
Featured in the display of the Triumph Mfg. Co., is the Model 430 automatic tube tester. The tester makes electronic conductance tests, shows leakage, employs automatic switches—in short, is claimed to be exceptionally versatile.



A. A. Berard.

Directors

S. N. Shure.



WEBSTER ELECTRIC

Webster Electric Company is featuring, at their exhibit, the new X-76 series of crystal pickups. These new pickups incorporate radical advancement in principle and consruction of the crystal cartridge in particular.

The crystal element of rectangular shape, torque type, is thoroughly moisture-proofed. In addition to that, it is housed and completely sealed in a molded flexible rubber housing. A metal outer shell serves as an electro-magnetic or electrostatic shield, as well. This construction offers the greatest possible protection against the damaging effects of moisture or humidity, and at the same time offers greatly increased protection against accidental breakage of the element.

Further advantages offered—the crystal element is of high capacity and low reactance; has low needle point impedance and improved tone; leads are brought directly out of the cartridge, eliminating any necessity of soldering; excellent damping quality of the rubber housing eliminates internal resonance.

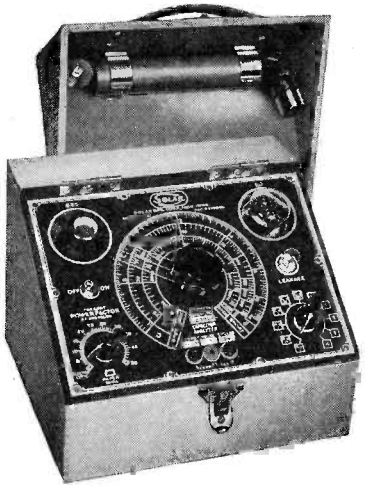
This new crystal cartridge is offered in a solid walunt hand-rubbed tone arm of unusual appearance. This tone arm is designed to minimize tracking errors down to 3 to 4 per cent. Full lift facilitates needle insertion.

•

CORNELL DUBILIER

Cornell-Dubilier Electric Corp., whose booth is in charge of Leon Adelman, sales manager, is calling attention to the redesign on their type BR—"Beaver"—condenser. Special vents in the new "Beaver" electrolytics permit normal dissipation of the harmless, odorless electrolytic vapor, and afford a great safety factor under all operating conditions. This recent improvemen on the highly efficient "Beavers" has led Cornell-Dubilier to publicize them with the slogan, "not a firecracker in a carload."

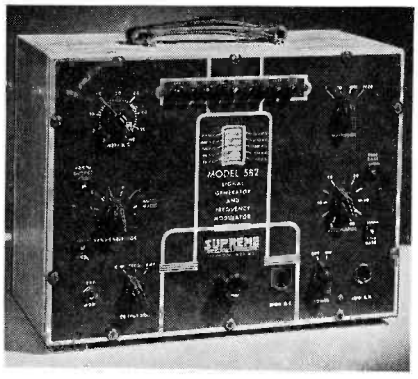
Cornell-Dubilier's exclusive patented hi-formation process affords a higher voltage breakdown. Tubular, compact construction provides ease of wiring into circuit and a new varnished protective sleeve is spun-over at both ends to prevent possible short-circuits of leads to the aluminum container.



SOLAR

The Model CC Capacitor Analyzer at the Solar booth is similar to popular Model CB, but still more widely useful. It measures capacity from 0.00001 to 800 mfd including motor-starting condensers. Power factor from 0 to 50 percent, and resistance from 50 to 2,000,000 ohms as well as insulation resistance of 1,000 megohms can be measured on the new instrument, using test voltages to 600 volts dc.

Condenser leakage and intermittent open and shorts can be detected on this new improved analyzer. Its dimensions are 9¾" x 8¼" x 6⅝"; weight 8 lbs.

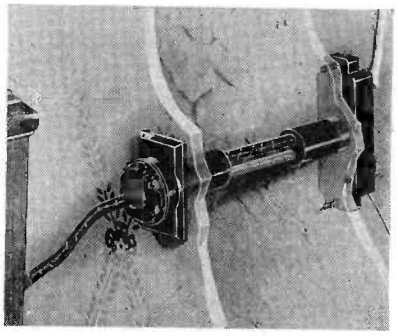


SUPREME

The first signal generator with push-button tuning, has already been announced by Supreme and it is rumored that startling innovations will also be incorporated in other new Supreme units. One testing instrument which has a panel but slightly more than one-third square foot in area offers nearly fifty ranges with resistance measurements up to 50 megohms, yet is completely self-contained! Another instrument known as the "Zephyr" was secretly held for a surprise announcement at the Show.

It is also rumored that Supreme will announce a complete rack and panel testing unit which will sell at the lowest price of any rack job. This unit will take up less than one square foot of space on the serviceman's bench.

Other units are shown at the Supreme booth and it is suggested that every serviceman should see this exhibit.



CORNISH WIRE

Said to be the invention of a service man, Cor-Nex, deluxe connector between aerial and receiver, is shown by Cornish Wire Company, manufacturers of antenna and wire products.

Cor-Nex consists of lightning arrester, inside plate with leads and polarized plug with cord. It is easily and quickly installed and does away with the awkward window strips and impromptu wires which housewives have always considered a nuisance.

•

STANCOR

Standard Transformer Corporation is showing their newest service transformer; it is said to be novel in that fourteen of the transformers will service a majority of existing receivers.

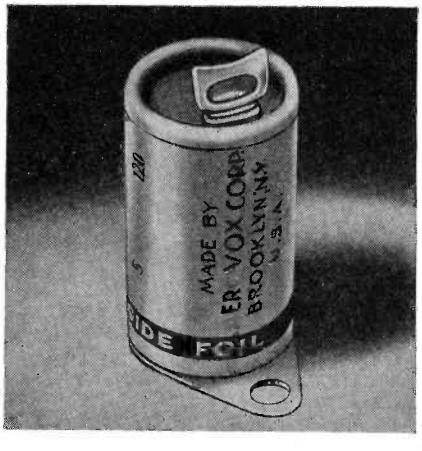
•

AEROVOX

Including representatives from all parts of the country, the Aerovox sales force are present in full force, headed by S. I. Cole, president, and Charley Golenpaul, in charge of jobber sales.

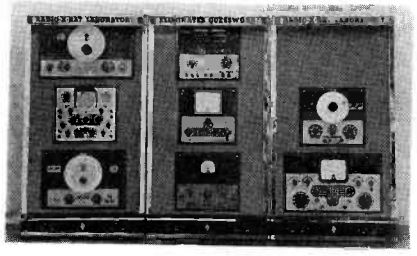
Products exhibited include dry and wet electrolytics, paper, mica, auto-radio, transmitting, exact-duplicate, fixed mica, padder, rubber-molded paper condensers, and the latest Aerovox auto-radio "hash" or generator noise-suppressing condenser—a metal-can paper job with grounded bottom bracket and top terminal lug, intended for mounting and connections directly on the car generator. The standard capacity is 0.5 mfd., but other capacities will be made available if called for. The voltage rating is 100, although the condenser is subjected to little over 6 volts in normal service.

Also interference filters and noise analyzer, and condenser bridge and analyzer. Likewise motor-starting capacitors and capacitor tester. Finally, carbon and insulated resistors, and vitreous-enamel fixed and adjustable resistors.



WEBSTER COMPANY

Being featured is the new Mobile Sound System Model M-928. This new 28-watt amplifier of Webster-Chicago design operates from either 110-volt ac or 6-volt dc. The changeover from one source of power to another requires simply the operation of the selector switch and changing the power connection. Motor for turntable is scientifically designed, operating from main power pack whether on 6-volt storage or 110-volt power line.



CLOUGH-BRENGLE

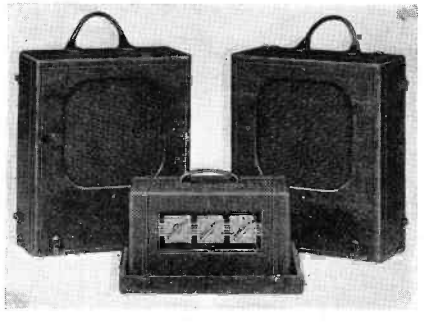
Coincidentally with the showing of their complete Radio-X-Ray Laboratory, the Clough-Brengle Company announces a country-wide tour to meet with service groups for the demonstration of the proper operative technique for the Clough-Brengle instrument line.

Illustrated here are the rack-and-panel assemblies of various types of instruments —so arranged as to be not only useful to the Service Man, but also impressive to the customers.

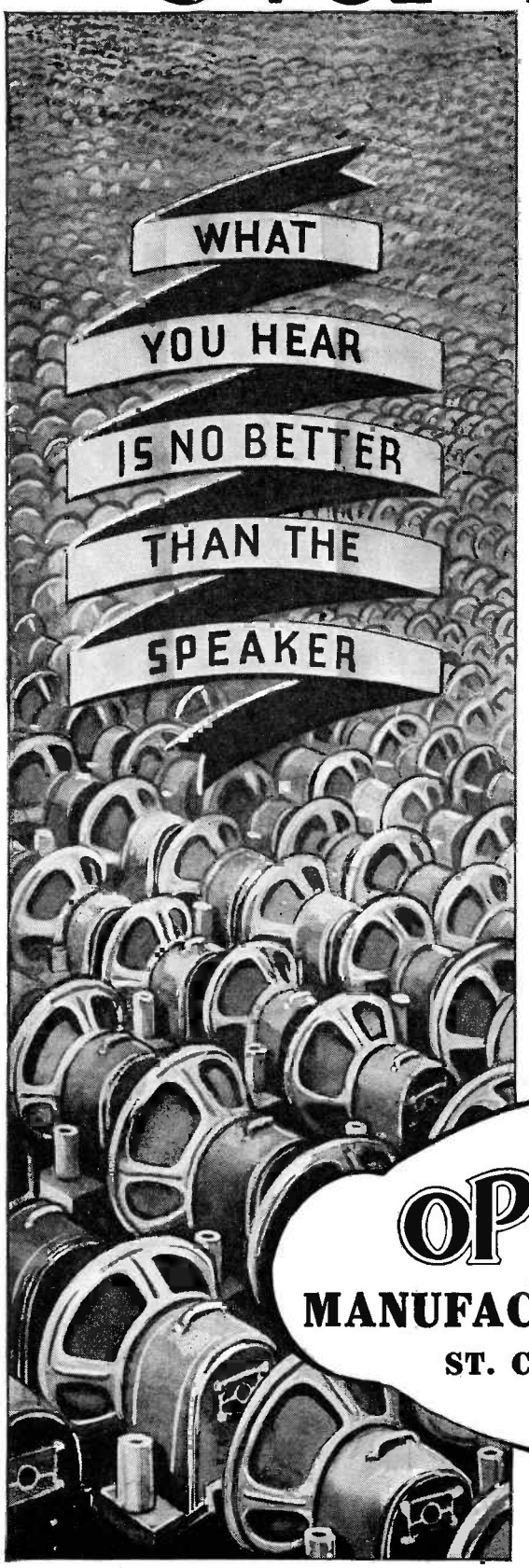
•

OPERADIO

Remote volume control, said to be the first offered in a portable p-a unit features the Model 414 Operadio portable 14-watt p-a system. The amplifier unit has protected recessed illuminated controls, high gain, cathode degeneration, and other desirable points. According to early advices received from Operadio Mfg. Co., the development is outstanding in the p-a equipment field.



Over 1,000,000 SPEAKERS YEARLY



● In the last five years, Operadio Speaker sales to radio set manufacturers have averaged more than 1,000,000 per year. One year volume means nothing. But when, year in and year out, engineers say "Operadio Speakers go in," then Operadio must know what makes a good Speaker. Engineers know that the speaker is the heart of the Radio Set . . . that what you hear is no better than the Speaker. Here is an acceptance that can mean only one thing—CONFIDENCE in the engineering knowledge, skill, and experience of the Operadio organization.

It is this same organization that has been placed at your disposal, to provide you with Radio Replacement and P. A. Speakers. Increased facilities now make it possible for you to buy the precision made Operadio product.

There are features that will interest you. There is our Universal Self Matching Transformer. This eliminates buying a transformer for every Speaker . . . means, that being interchangeable, it is adaptable to as many as four Speakers. So you invest less money, keep down inventory, get wider coverage, greater flexibility, and better service.

We believe it would be decidedly worth your while to see just how much more Speaker value Operadio can offer you. An informative, fully illustrated Speaker Catalog will be sent if you address Dept. S6.

OPERADIO
MANUFACTURING COMPANY
ST. CHARLES, ILLINOIS

When at the Parts Show, your time will be well spent visiting Demonstration Room 550A and Booth No. 218, Hertz Avenue.

EXPORT DIVISION: 145 W. 45TH ST., NEW YORK CITY

MUELLER CLIP

A new and extremely small test clip has been announced by the Mueller Electric Co., 1583 East 31st Street, Cleveland, Ohio. This clip, known as the model 88 Wee-Pee-Wee is entirely non-ferrous and is distinguished by its light weight, thin nose, and overall insulation.—SERVICE.

•

RECORD-PLAYERS PROVIDE EXTRA REVENUE FOR SERVICE ENGINEER

An increasing number of radio service men have found a profitable means of increasing their income by taking along one of the new, compact little RCA Victor record-players on service calls.

Many extra sales have resulted from impromptu home demonstrations. The most successful procedure is for the service man to connect the record-player to the radio receiver he has just repaired.

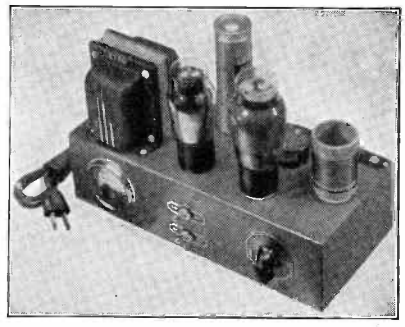
VOCAGRAPH

Vocagraph Sound Systems are showing their Model 30-A30C thirty-watt amplifier which introduces an improvement that makes practical the advantages of independent high- and low-frequency compensation. By using two parallel stages, it is possible not only to boost high and low frequency response independently by adjusting the gain of each parallel stage, but also to raise them jointly, thus securing the much wanted "saddle-back' reproduction. "Colorgraph" control likewise provides the option of perfectly flat frequency response or any degree of attenuation of high and low notes as well.

Input is provided for velocity, dynamic and crystal microphones, any two of which may be separately controlled or blended with the phono-radio input. Output impedances of 2, 4, 8, 166, 250, and 500 ohms are available at three output sockets by means of an impedance selector switch.

Gain is 135 db using two 6F5G high gain input stages, two 6C8G electronic mixer-tone compensator parallel stages, one 6N7G driver, two 6L6G push-pull output, and an 83 rectifier. Extremes of compensation are plus and minus 14 db at 100 cycles and 5000 cycles. Peak power output, forty watts.

Four controls for attenuation, mixing, and tone are provided. Separate power switch and pilot light are located on the front panel.



GTC PEE WEE TRANSMITTER

A low-power transmitter, supplied in kit form for the new amateur, is announced by General Transformer Corp., 1266 W. Van Beuren St., Chicago. It is called Pee Wee, The kit contains all of the parts required for building the unit—tubes, crystal, coil form—even the hook-up wire and solder. Both the power and the r-f portion are mounted on a single battleship gray chassis. This little unit allows the new amateur to go on the air with an economical crystal-controlled transmitter that goes together with minimum effort—the entire unit assembles and wires in a couple of hours. Its usefulness is not limited to the 25 watts input. Working three bands with one crystal and all five bands from 160 to 10 meters with two crystals, the Pee Wee forms a flexible exciter unit for a 100 watt stage when added power is desired.

AT THE SHOW—continued

BOGEN AMPLIFIER

The Bogen Model CX70 Binaural amplifier features auditory perspective reproduction. This unit is actually two amplifiers in one; dual channel throughout. Each of the two separate output stages delivers 35 watts of power with less than 4 per cent distortion. Combined, a total of 70 watts is available. Either output channel may be operated separately or both simultaneously. In addition to the Binaural effect, other advantages are that one channel may be run at a high volume level for outdoor speakers while the other channel operates at a lower level for indoor speakers. As an emergency feature either channel may be cut off in case of tube failure. Electronic Tone Correction is also incorporated in this model permitting the operator to create any degree of high or low tones without loss or distortion and thereby offset acoustic deficiencies of an installation.

Dimensions: 19″ long, 17″ high, 9½″ deep.

17 tubes with 4-6L6's in the output channels.

Manufactured by the David Bogen Co., Inc., 663 Broadway, N. Y. C.

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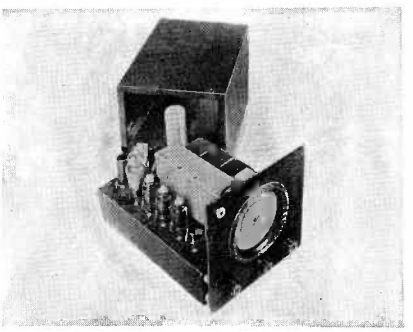
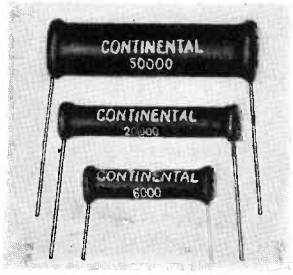


MEISSNER P-A TUNER

A practical build-it-yourself tuner for the p-a man has been announced by Meissner Mfg. Co., Mt. Carmel, Ill. The tuner is a t-r-f broadcast band unit, said by its makers to be highly selective yet retaining the quality usually associated with receivers of this type.

The kit contains complete parts and schematic and wiring diagrams are furnished.



CONTINENTAL CARBON

Continental Carbon, Inc., offer a new style of wire wound resistor in which a wire of exceptionally low temperature coefficient is employed. The resistance wire is wound on a porcelain core and firmly bonded to tinned copper leads. A jacket of special cement coating is placed over the entire resistor, providing protection of the wire. The cement is impervious to moisture and does not crack with heat. Ultrawatt resistors are made in three sizes: W5, five watts; W10, ten watts; and W20, twenty watts. Tolerance limits of 5 percent are maintained.

•

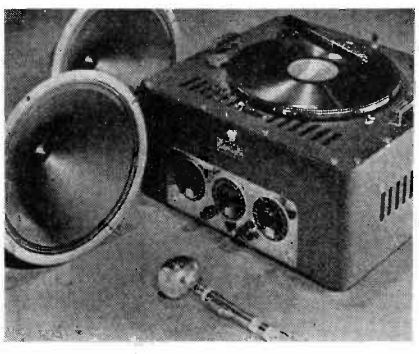
BALLASTRON TUBES

The Micamold Radio Corporation, 1087 Flushing Ave., Brooklyn, has recently announced their "Ballastrons." These are a novel type of Ballast Tube (or Plug-in Resistor) designed for replacement purposes. Two of these Ballastrons will serve as perfect replacements for nearly all of the RMA standard types of ballast tubes having octal bases. Two of the base pins are removable and there is a strip on the base that can be cut at from one to three places. The user refers to an instruction sheet which describes how to remove pins or break the strip for the RMA type number wanted. The Ballastron, when installed, has the right resistance values to give correct filament and pilot lamp voltages.

•

BELL SOUND

Among the products exhibited by Bell Sound Systems, Inc., are the 60-watt p-a system, the Belfone Intercommunicating system, and the M-24 Mobile system; this latter is illustrated here. Features of the M-24 include 24-watt power output, 110-volt a-c or 6-volt d-c operation, three channel input, crystal microphone, two 12-inch speakers, in addition to other items which are included in the complete system.



NATIONAL UNION

Among the items to be seen at the National Union booth are the new Quick Reference Tube Manual, and the 6AD6G tuning-indicator tube.

The manual presents in a readily used form, all of the technical data on NU tubes; several sections are devoted to considerations in the design of circuits for use with various tubes.

National Union engineers have developed a novel cathode-ray tuning indicator tube which is being introduced to the trade as type number 6AD6G. This tube embodies everal new features not heretofore available. The National Union 6AD6G is comprised of a circular target, two ray control electrodes, and a cathode, indirectly heated by a 6.3 volt, 150 milliampere filament. Structurally, the tube differs from other tuning indicator tubes previously on the market. It is much smaller—approximately one-half the length of previous tubes—and is based with a metal shell type of base, thus facilitating its use in a clamp behind the dial of a radio receiving set.

Even more interesting are the electrical and operational characteristics of the tube. Two identical ray-control electrodes are employed with connections to each brought out to separate pins on the base. These control electrodes each produce a shadow pattern on the circular target, and consequently, several varieties of shadow movement are available. The 6AD6G will find application in expensive receivers where deluxe tuning indication is desired, and also in low-priced receivers where simpler indication is justified.

•

PAULEY-JAMES

Pauley-James Corporation, 4619 Ravenswood Ave., Chicago, report unusual success with their new James Vibrapowr unit. Initial sales effort was started March 15, 1938, and to date over one hundred jobbers have taken on the line.

Twelve new types have been added to the James line making a total of twenty different types now being produced. Another new development is the removable base on all zinc container models. This new feature enables the serviceman to remove the entire unit from its container in an instant. After adjusting and servicing the unit can be replaced with no injury to the can.

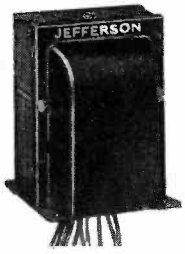
Interesting exhibits pertaining to Vibrapowr manufacturing processes, different applications of vibrators, test methods, etc., will be found at the Pauley-James booth, 205 Ampere St., Radio Parts City, Stevens Hotel.

•

COMPACT SOLDERING TOOL

A new type Thermo-Grip Solderer called the "Handy" has just been added to the line of electric soldering tools manufactured by the Ideal Commutator Dresser Co., 4035 Park Avenue, Sycamore, Illinois.

This new unit is especially designed for light, delicate work on radios, telephones, small motors, instruments, etc. It is only 6½" long by 7/16" in diameter so that it reaches deep down through intricate mazes of wire and parts to form connections where no other soldering tool can reach.



JEFFERSON

The Jefferson Electric Company is showing an addition to its line of a new plate transformer designed for operation from either 115-volt 60-cycle primary, or from 6-volt d-c supply for operation in conjunction with a vibrator unit. This transformer, No. 465-301, delivers 300 volts dc at 100 ma from either 115-volt 60-cycle or 6-volt d-c primary supply. The 6-volt primary is tapped to supply heater voltage for a rectifier unit when the 110-volt primary is used. This transformer is assembled in sturdy black enameled housings of upright type with secondary leads out of bottom, as illustrated.

•

DRAKE HEAT CONTROL

Said to increase the life of the soldering iron, keep the tip properly tinned, and to keep the iron warm at a low cost, the Drake No. 300 heat control is announced by Drake Electric Works, Inc., 3654-56 Lincoln Avenue, Chicago, Ill.

•

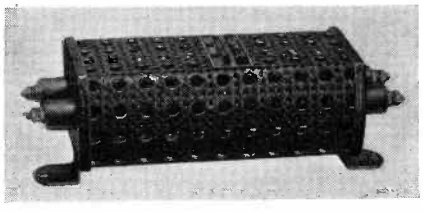
VENTILATED CAGE TYPE RESISTORS

Ohmite Manufacturing Company has just announced a new standardized series of ventilated cage type resistors. There are three sizes, for one, two, or four resistors, in this convenient type of completely protected enclosure.

These cage resistors are well suited for use where it is desired to prevent accidental contact with the resistor. They are often mounted on switchboards and test panels, etc., in control, protective, or line voltage dropping circuits, where wattages up to several hundred watts are to be dissipated.

The cages consist of sturdy sheet metal ends with perforated metal sides finished with black wrinkle japan. Mounting is by means of two holes in the strong supporting brackets. The terminals of the resistors are brought out at the ends by "feed-through" type porcelain insulators. This makes interconnection simple to wire the resistors in series or parallel when desired.

Cage resistors of different sizes and types are available from the maker, the Ohmite Manufacturing Company, 4835 W. Flournoy Street, Chicago. Illinois.



STRAIGHT FROM THE SHOULDER

There's been a lot of ballyhoo 

about Tube Equipment Deals. 

But dig deeper into the facts  and you will find:  1. That Arcturus gives you the finest equipment.  2. That you get it at less actual cost 

than any other deal. 3. That not one cent 

has been added to standard Arcturus Tube prices 

to defray the cost of the equipment we supply. 4. That Arcturus Down Payments are lower . . . they average about ONE-SIXTH 

the amounts required by other deals!

More good news 

comes in the fact that your tube purchases are held to an absolute minimum. 

Arcturus brings you the finest tubes in the World  —and helps you keep them moving  with the most complete line of merchandising helps on the market today! 

THAT'S WHY WE SAY . . .

The Arcturus Equipment Deal is unquestionably the fairest, easiest and most PROFITABLE deal ever devised to enable dealers and servicemen to obtain up-to-the-minute shop equipment—at almost NO COST!

Get the facts! Compare the Arcturus Plan, point-for-point, with *any* other equipment deal—then *you* be the judge!

MAIL THE COUPON!

ARCTURUS

INDEPENDENT TUBES FOR DEALERS WHO DO THEIR OWN INDEPENDENT THINKING

Arcturus Radio Tube Co., Newark, N. J.

Gentlemen:

Send complete details of your new Equipment Deal.

☐ I am a Dealer

☐ I am a Serviceman

Name .....

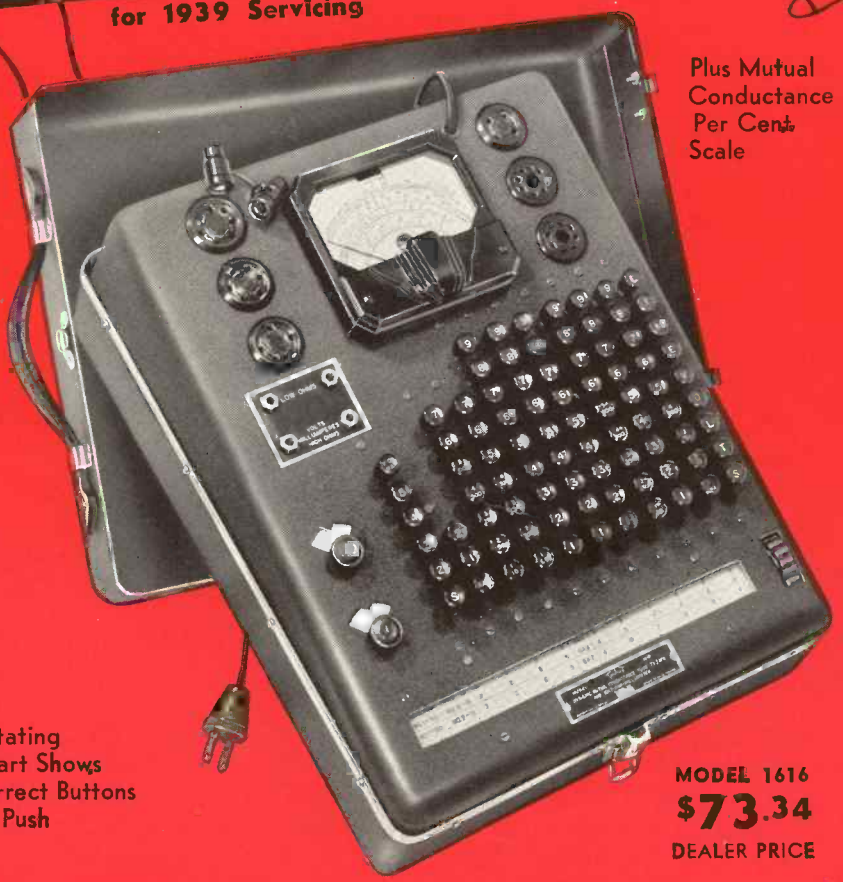
Address .....

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

NEW push-button TESTING

for 1939 Servicing

ON DISPLAY AT THE PARTS SHOW OR SEE IT AT YOUR JOBBERS



Plus Mutual Conductance Per Cent Scale

Rotating Chart Shows Correct Buttons To Push

MODEL 1616
$73.34
DEALER PRICE

DYNAMIC MUTUAL CONDUCTANCE
Tube Tester and Volt-Ohm-Milliammeter

This new Triplett model incorporates two revolutionary advancements in tube tester design. First, Push-Button control gives a new order of simplification. The buttons are clearly marked on chart at base. Just rotate the Chart to the tube to be tested—then the button to push is indicated in line under each row of push buttons. What could be simpler?

The second revolutionary improvement is the arrangement of the measuring circuit of the dynamic mutual conductance test for amplifiers and power tubes. The tube tested not only shows GOOD or BAD but the percentage of mu to the 100% Good Condition is also indicated. In critical sets this permits the service dealer to pick his tubes with confidence. . . . Diodes and rectifiers are tested for emission according to the latest approved engineering standards. Gas and Ballast tube tests included.

Rotate Chart to Volt-Ohm-Milliammeter settings—push button for D. C. scale: 0-10-50-250-500-1000 Volts at 1000 Ohms per Volt; 0-10-50-250 M.A.; .2 Ohms - 500 Ohms - 300,000 Ohms - 1½ Megohms - 3 Megohms; 0-10-50-250-500-1000 A.C. Volts at 400 Ohms per Volt; decibel chart furnished to 42 dbs. (Ohmmeter is line powered and provision is made for using batteries if desired). Uses plug-in type rectifier, simplifying replacement in case of unintentional damage.

Installed in attractive, all-metal case with lustrous finish. Removable cover. For portable or counter use . . . sloping panel.

● **MODEL 1615**
Dynamic Mutual Conductance Tube Tester only with Push-Button testing. Same tube tester circuit and push-button panel as Model 1616, but for tube testing only. Complete with all necessary accessories. . . . Dealer Price **$63.34**

● **MODEL 1610**
Emission Type Tube Tester with Push-Button Testing. Has new R. M. A. approved circuit with every essential for dependable emission test on all type tubes. Testing greatly simplified by Triplett push-button testing. Installed in metal case with removable cover, of compact size; complete with all necessary accessories. . . . Dealer Price.. **$39.00**
An accepted test for practically all tubes.

● **MODEL 1611**
Emission Type Tube Tester with Push-Button Testing and Volt-Ohm-Milliammeter. Similar to Model 1610 above described except Volt-Ohm-Milliammeter added. Ranges similar to those of Model 1616. . . . Dealer Price **$49.50**

TRIPLETT
Precision
ELECTRICAL INSTRUMENTS

THE TRIPLETT ELEC. INSTRUMENT CO.
176 Harmon Dr., Bluffton, Ohio

Please send me more information on

_____Model 1616; _____Model 1615;
_____Model 1610; _____Model 1611.

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

results; amplifiers are usually of good quality even when not expensive as compared with microphones. Some loudspeakers, in the low-price field have lately been made of different characteristics, some emphasizing high frequencies and performing well with one type of microphone; others with an abundance of low frequencies, are particularly adapted to be used with still other microphones. In high-priced equipment both microphones and speakers are fairly flat. A flat frequency response, however, sometimes does not satisfy the taste of the public; there is a definite preference for boominess of sound in some sections of the country, and a definite preference for high notes in others.

FEEDBACK

Very often microphones are purchased when the rest of the p-a equipment is already assembeld and installed, and, in consequence units of various makes are tested with a more or less cut-and-try process. Better results are undoubledly obtained when sound installations are planned in advance as a whole; the result of an improperly matched installation may be feedback.

Feedback problem is very severe whenever one or more of the component units of a sound system does not have a flat frequency response. The compensation of an abundance of certain frequencies in one of the units by a lack of the same frequencies in the other unit, either microphone or loudspeaker, will not eliminate feedback as much as the use of flat frequency response components throughout; this is the main reason for the popularity of flat response units.

Feedback, however, is not only due to lack of flatness of microphones and loudspeakers, but also to their relative position, to the position of the reflecting surfaces from which the sound reverberates, and to the reflecting power of these surfaces which depends upon their finish as well as on their angle or relative position. The figures give a clear idea of the effect of the relative location of sound translating devices with respect to the walls of an auditorium and the desirable selection of components.

•

Philco 52

Distortion: Often this set distorts and blasts with everything checking OK. Between the negative of the large filter condenser which is insulated from the chassis and grid resistor of the 47 audio tube, there is a yellow and black resistor (490,000 ohms). Replace this resistor with one of 200,000 or 250,000 ohms and the set is OK. This condition is caused by too much bias on the 47 tube and cannot be located with a voltmeter on account of high resistance in the circuit.

Sylvania News

•

RCA Victor C-11-1, T-10-1

Set cuts off: Disconnect the green wire on the volume control and connect a 30,000 ohm resistor (original was 27,000 R13 on RCA diagram) from this volume control tap to a .015 mfd condenser, connecting the other terminal of the condenser to the ground. Disconnect the yellow wire from the other v-c tap and connect a 9,000 ohm resistor (original 8,200) to the tap, connecting the other end to a .05 condenser and connecting the other end of the condenser to the chassis ground. Connect the mid-point of this condenser-resistor setup to the music-speech switch by removing the blue wire. The tone is improved by this wiring change.

Sylvania News

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RCA Victor 140

Intermittent: Tone control reactor defective. All voltages, etc., check OK. Replace reactor.

RCA Service Tip File

•

Stewart Warner R-127-A

Distortion: Replacing output tube, coupling condensers and biasing resistors did not clear trouble. Tone control was found to be open over half its range. Replacing control cleared the trouble completely. *Sylvania News*

SIZES OF TAP AND CLEARANCE DRILLS

Screw Number	Threads Per Inch	Tap Size	Drill Number For Tap	Drill Number Clearance
2	48	2x48	50	44
2	56	2x56	50	44
2	64	2x64	50	44
3	40	3x40	47	39
3	48	3x48	47	39
3	56	3x56	45	39
4	32	4x32	45	31
4	36	4x36	44	31
4	40	4x40	43	31
6	32	6x32	36	28
6	36	6x36	34	28
8	24	8x24	30	17
8	32	8x32	29	19
10	24	10x24	25	10
10	30	10x30	22	10
10	32	10x32	21	10
12	20	12x20	19	2
12	24	12x24	16	2
12	28	12x28	14	2
14	20	14x20	10	1/4
14	24	14x24	7	1/4

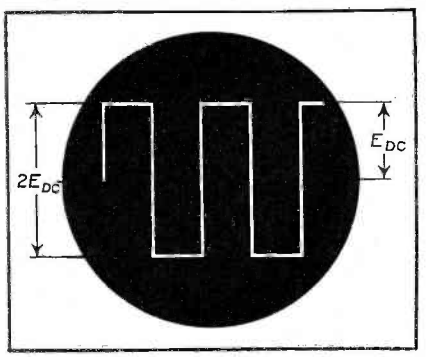
These are the drill sizes for average use. The size drill to use varies somewhat with the material being drilled. For tapping Bakelite or hard rubber use a drill one size larger than specified in this table.

—From "Radio Field Service Data"—Ghirardi.

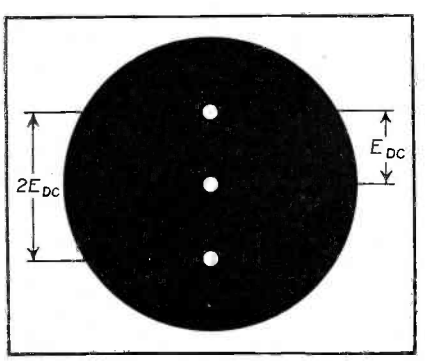
fourths of the known, then its value is 75 percent of the known voltage.

When using an amplifier, the setup should be calibrated for whatever setting of the gain control is used. Naturally the calibration will vary with the gain control setting.

For large voltages, the 110-volt a-c or d-c line provides an excellent calibration. It can be measured with the usual meters found in test instruments. Remember, however, that the peak a-c voltage is 1.41 times the rms voltage



Waveform delivered to the oscilloscope by the chopper.



Waveform on oscillograph screen when sweep circuit is not used.

that is indicated on an a-c voltmeter. Smaller voltages, such as biases and a-v-c potentials can be first calibrated on a 4½-volt "C" battery.

Results with this device have been very gratifying and with care have given accuracies within 5 percent—usually much better. However, for highest accuracy the trace on the screen must be adjusted for a fine line or small dots. When measuring the distance between the dots, always measure from the center.

•

Stewart-Warner R-102-A, B, and E

Intermittent: 100,000 (color code brown, black, yellow) ohm resistor changes value but does not show up on the voltage readings. Best way is to listen to set playing, then when a fade starts, if it is accompanied by a buzzing sound, it is probably the resistor.

RCA Service Tip File

ASSOCIATION NEWS . . .

RSA

Continuing its rapid increase in growth, the RSA in the past three weeks has affiliated with the national organization local groups in Alton, Illinois; Staten Island, New York; Holyoke, Massachusetts; Fremont, Ohio, and Lansing, Michigan.

Regional setups in several sections of the country are in the process of formation and will be completed in the near future.

The first Board of Directors meeting of the RSA is being held in conjunction with the first RSA Convention at the Hotel Stevens, in Chicago.

Freeport

On May 2, the Freeport chapter held its regular monthly dinner meeting after which the meeting was adjourned to the physics laboratory at Freeport High School. The speaker of the evening, Tom Moers, is a physics instructor at the high school. His subject was Light. Mr. Moers wrote the thesis for his master's degree on this subject and has also done considerable study since. He made a number of interesting experiments and demonstrations. The chapter has made arrangements with F. W. Whitlock to teach them afc, avc, asc, etc. We have felt for some time that a knowledge of alternating-current theory would be very helpful in understanding newer developments in new sets. The first class met Monday, May 9, and plans were made to meet twice monthly thereafter.

Steubenville, Ohio

Steubenville chapter voted to affiliate with the RSA at their last meeting. This chapter is under the leadership of Chairman, R. P. Harris; Secretary, Edward Zysko; Treasurer, J. B. Stringer.

New York Region

The chapters in the New York region, namely, Westchester, Newark, N. J., and the Metropolitan N. Y. are collaborating on a projected show program for the early fall. Final details will be announced in the near future.

St. Paul

The St. Paul chapter voted some time ago to affiliate with the RSA and final details of the affiliation were carried out at a meeting held Thursday, May 26. This chapter is under the leadership of President, W. T. Moffitt; Secretary, Paul J. Biehler. Irv Polsky, who was present at the original formation meeting of the RSA in Chicago, is an active member.

Lansing

Lansing chapter held its first meeting on May 10. Second and fourth Tuesdays of each month were selected as regular meeting dates. These meetings to be held at 8:00 p. m. at the E. Michigan Avenue Fire Station Club Rooms until further notice. Joe Cole, the District Director, was present, as was Frank Anderton, the Secretary of the Detroit Chapter. These two men went very thoroughly into the purposes of the aims and ideals of the RSA.

Johnstown

At our last meeting, Philip Lopresti gave a talk on state laws that affect our business. His talk was very interesting and gave us much needed information on this vital subject. It was decided that during the summer months only one meeting per month, on the second Wednesday, would be held beginning May 11. Lunch and refreshments were served.

Rochester

The Rochester group continues to grow in membership. B. L. Lewis is very active in the formation of this group and has served on the first organizing board of the RSA. Mr. Lewis was National President of the NRSA and has always been a consistent worker for the betterment of servicing conditions in the Rochester area.

Duluth

The Duluth chapter attended the Minneapolis Radio Dealers' Convention in a body. A fine time was reported by all. In the early fall we plan to hold a get-together of our own at which time speakers as well as a well-rounded program of entertainment will be provided. Further details will be announced in the future.

Fremont

Under the leadership of John Mutschler, the Fremont, Ohio, chapter was formed. This chapter has in its membership area several towns in and around Fremont. Interesting technical lectures as well as business meetings are planned for the near future. Meetings will he held the second and fourth Mondays of each month.

New Bedford

New Bedford chapter announces with regret the death of F. Fiske, who was president of the chapter and had been connected with the service industry since the first days of broadcasting. The chapter has voted to discontinue temporarily the weekly lectures of its new training course, pending the return of A. C. W. Saunders.

Detroit

Detroit chapter has held a series of closed meetings at which time the by-laws were thoroughly thrashed out and a final set adopted. A copy has been sent to the national office for perusal and comment. We feel that these by-laws will form a permanent frame-work upon which the Detroit chapter can be built to the greatest heights in its existence.

Alton, Illinois

The Alton chapter voted to affiliate with the RSA and join with other groups of servicemen throughout the country to improve the business and technical efficiency of its members. Officers are: Chairman, Robert W. Clayton; Secretary-Treasurer, R. L. Foster.

Boston

Boston chapter is holding an election for Director in District Twenty. At the time of going to press Messrs. Saunders and Paulsen are running neck and neck and the final outcome will be very close.

Jamestown

At a meeting held May 17, a discussion was entered into on some of the highlights of John Rider's talk at Buffalo for the benefit of members who did not hear Mr. Rider. Reports on results of cash policy which has been put into effect by all dealers and servicemen show that it is working out very well and is a great improvement over old credit methods. General discussion on proper prices to charge for autoradio installations resulted in a minimum charge of $3.50 for dealers be established. We have changed the meeting dates of the chapter for the first Monday of every month through the summer. Plans are being carried forward for an annual summer banquet to be held on shores of Lake Chautauqua in July.

Buffalo

At the April 5 meeting of the ARSE the proposal to affiliate with the new national association was thoroughly discussed and affiliation with the RSA was decided upon by a very clear majority.

The Executive Secretary of the RSA, Joe Marty, Jr., and B. L. Lewis, member of the RSA Board of Directors were present in answer to invitations sent to them by the President of the ARSE.

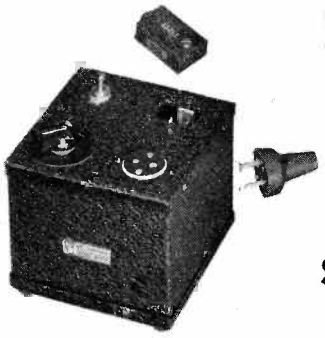
Upon conclusion of a talk on the proposed affiliation with the RSA, Mr. Marty asked to be excused while his proposition was discussed among the members of the ARSE and the groups from Jamestown and Rochester. After this discussion, and while Mr. Marty was still absent a vote was taken and the vote being in favor of the affiliation the petition for a local charter from the RSA was filled out, signed and presented to Mr. Marty who expressed his thanks for our enthusiastic acceptance of his proposal.

The ARSE takes this opportunity to extend a personal invitation to all radio servicemen to attend its meetings and to hear the many excellent guest speakers that will soon be obtainable through the RSA Speakers Bureau.

Now that the ARSE has approved affiliation with the RSA we can offer many more advantages to the radio servicemen in Buffalo and vicinity and we feel certain that membership in the ARSE. with its national contacts through the RSA, can be of extreme benefit to all persons engaged in the radio service profession in Buffalo and we therefore take this opportunity to extend an invitation to all interested persons to file their applications immediately in order that they can start receiving these benefits in the very near future.

Association of Radio Service Engineers of Buffalo had the pleasure of hearing John Rider on May 10. During John's talk, which lasted two and one-half hours, he covered the radio service profession from soup to nuts, after which he answered questions fired at him by various servicemen. On May 24 we had the pleasure of having an engineer from the Radiart Corporation who explained vibrators and their application, and auto-aerial design and engineering.

NEW! NEW! NEW!



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Changes impedance from a 250 or 500 ohm line to match impedance of any number of 500 ohm speakers up to 6.

• **Another scoop by Halldorson engineers** . . . takes plenty of grief from the shoulders of the Sound Specialist. Just turn the knob to match for any number of speakers to 6. Two transformers will handle to 12, etc.

Remember—8 types of Halldorson Vacuum Sealed Transformers answer 90% of demands.

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For more information and new catalog—Write
The Halldorson Company, 4500 Ravenswood Ave., Chicago, Ill.

The Dictionary TELLS IT BEST

Theory: Fundamental principles underlying a science.

Practice: The accomplishing of a set of principles.

Successful servicemen, learning theory *first*, are never troubled by circuit changes or complicated problems.

You Need *Theory* if you are to succeed in *Practice* . . . .

For "knowledge of the fundamentals" needed in modern service work depend on

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AFC SYSTEMS: Absorb AFC knowledge and cash in! Here's a book you need. 144 pages. Hard covers.....$1.00

THE CATHODE RAY TUBE: Oscillograph data, etc., and an introduction on the newer Cathode Ray Tubes. 366 pages, 450 illus.....$2.50

Other Rider Books: **Servicing Superheterodynes; Aligning Philco Receivers—$1.00 each. "Hour a Day with Rider" books on AVC Control; on Resonance & Alignment; on A-C Distribution in Radio Receivers; on D-C Distribution—60c for each book.**

RIDER MANUALS
for Practice

Rider Manuals are used daily by thousands of servicemen as a practical guide through the most complicated receivers. Volume VIII, covering 1937-38, contains the most comprehensive compilation of service data available. Covers 1715 models of over 100 manufacturers plus a 64-page *"How It Works"* section dealing with the basic theory behind the electrical operations of modern receivers.

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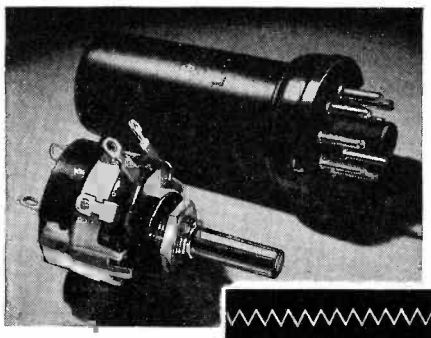
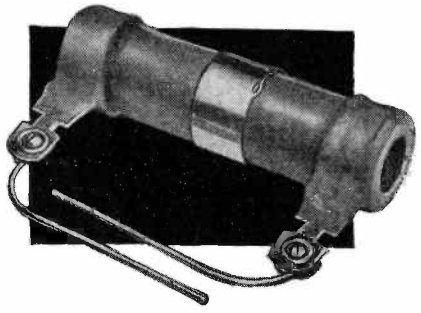


Two servicing essentials—CLAROSTAT MT (Metal-Tube) Resistor and Midget Volume Control with Ad-A-Switch.

Let CLAROSTAT *Solve* YOUR RESISTANCE PROBLEM

● **You don't have to shop around for *this* volume control, *that* ballast, *and the other* power resistor. CLAROSTAT provides ALL THREE—and more. You can save time, trouble and money by standardizing on CLAROSTAT.**



New!

CLAROSTAT POWER RESISTORS

Superior wire-wound power resistors just released after the most exhaustive tests by our engineers. Set an entirely new performance standard. Note:

Characteristic green finish for ready identification.

Inorganic cement coated, Solidified at low heat. Wire unimpaired.

May be operated at red heat without blistering, cracking, deteriorating.

Withstand continuous operation at greater power input than wattage rating.

Provided with combination soldering lugs and 1½" pigtail leads.

5 and 10 watts (varnish coated for extreme humidity). 10 and 20 watts in cement coated. 1 to 50,000 ohms.

See Us at the Show . . .

Visit Booth at 208 Steinmetz Ave. See the CLAROSTAT line with latest additions. Get latest data and servicing manual. Or write.

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BROOKLYN, NEW YORK, U.S.A.
• OFFICES IN PRINCIPAL CITIES •

HIGHLIGHTS . . .

RAYTHEON HANDBOOK OF AMATEUR TUBES

E. S. Riedel, General Sales Manager of the Raytheon Production Corporation, announced the publication of a new "Handbook of Amateur Tube Uses." This new Raytheon Handbook is an encyclopedia of technical information which should be in the hands of every amateur who desires to intelligently design his own equipment for maximum results. Thoroughly covering the numerous problems associated with the proper design of the modern transmitter, it permits him to select the correct tubes for his needs, and then to use them to the greatest advantage.

Incorporated in this book is a new exclusive Raytheon feature long needed by the amateur—the Raytheon temperature color chart, the only one available for amateurs' user! This valuable chart which ranges in color from a dull brownish red to an incandescent white, permits the amateur to tell when his tube is being properly operated, merely by comparing the color of the plate of his tubes with the chart and reading the temperature. This temperature color chart alone is worth the price of the book, as it permits maximum operation of tubes without endangering their life.

The book is available at nominal cost from Raytheon distributors.

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WESTON "POINTER"

The first issue of the Weston "Pointer," an illustrated journal featuring new developments and technical aid for the radio service man, has just been published by the Weston Electrical Instrument Corporation, Newark, N. J. The publication is to be issued at intervals throughout the year, and will be sent without charge to men actually engaged in radio service work.

Articles in the first issue discuss fixed condensers for the i-f stage of superheterodyne receivers, automatic-frequency-control alignment, microampere measurements, and other subjects which will help the Service Man to save time and do a better job. Subsequent issues will describe new radio receiver circuits, servicing shortcuts and point the way to more effective use of servicing instruments. Contributions are requested for an "Idea Box"—to feature practical ideas which Service Men have developed in their own work.

Service men interested to receive the issues of the Weston "Pointer" as they appear should watch advertising in which announcements of the various issues will be made from time to time.

•

RADIART DISPLAY

Radiart's newest aerial display is said to be more than display; it is a "one-of-a-kind" stock of six popular hinge and cowl model aerials, and it includes Radiart's Matching Resonator which improves peak performance of mismatched aerial and set combinations. Not only is the strikingly painted display unit given without charge but the aerials themselves take a special discount which makes Radiart's D-5 Display Deal an exceptional profit opportunity.

Further details available from Radiart Corp., East Cleveland, Ohio.—SERVICE.

CORNELL-DUBILIER PUBLISHES BOOK

A new book, entitled "Electrolytic Capacitors," in which both radio and electrical men will find authenticated information on the theory, construction, characteristics and applications of electrolytic capacitors of all types, and which is replete with the data for which they have been seeking, has just been published. Its author, Paul McKnight Deeley, is chief engineer of the electrolytic division, Cornell-Dubilier Electric Corporation.

Mr. Deeley is considered a foremost authority on electrolytic capacitors. "Electrolytic Capacitors" is available through the Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

•

MIKE-STAND CATALOG

Eastern Mike-Stand Co., of 56 Christopher Ave., Brooklyn, N. Y., have just released two new catalog sheets covering their line of microphone stands and accessories. One measures 17" x 22" long and is intended for wall mounting in the sound room. The other is a four page catalog of standard 8½" x 11" size intended for the jobber's file.

The larger sheet shows the various types of floor and table stands available and has a listing showing the various weights, base diameters, etc., so that the desired stand may be readily chosen. The new line features floor stands having noiseless operation, non-dropping mike rods and adjustable pressure chuck locks.

•

PILOT LIGHT MERCHANDISER

A flasher display board for pilot light assemblies is being offered free to jobbers by the Dial Light Co., 136 Liberty St., New York. The jobber is required to pay for only the 8 or 10 assorted pilot light assemblies on the board itself. As the jewel of each assembly is sparkling and colorful, the lighted effect is quite arresting. Attractively finished in black crackle with yellow lettering. The display board and a free catalogue may be obtained by writing to the above address.

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UNIVERSAL BULLETIN

Universal Microphone Co., Inglewood, California, on March 1 issued a special bulletin showing the various types of hand microphones. It covers the subject of hand microphones exclusively and shows the exterior appearance as well as the circuit diagrams for use as call systems in hospitals, paging systems, sports announcing, ship to shore, police car transmitters, aircraft use, etc. The firm manufactures a special model for each of the above with a choice of carbon or crystal model interiors.

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BULLETIN ON KNOBS

A bulletin illustrating and describing many types of knobs for radio and test equipment is available from the Harry Davies Co., 1428 N. Wells St., Chicago, Ill.

WESTON N. Y. OFFICE MOVES

The Weston Electrical Instrument Corporation announces removal of its New York Office from 50 Church Street to 11 Park Place, New York City, as of May 1. At the new location, additional space and facilities will be available. The office remains under the management of L. C. Nichols.

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N. U. OFFICES AT NEWARK

Sales headquarters of the National Union Radio Corporation which have been located at 570 Lexington Avenue, New York, have been consolidated with the research and engineering headquarters of the company at 57 State Street, Newark, New Jersey. Direct wires to New York City will be maintained, so that the trade by calling the present National Union telephone number in New York will be afforded immediate contact with the Newark Offices.

The following executives of National Union will be located at the Newark Office: S. W. Muldowny, R. H. Van Dusen, J. H. Robinson, G. E. De Nike, F. M. Paret, J. J. Clune, Le Roy Schenck.

New offices have also been developed for additional National Union executives at 45 Spring Street, Newark, N. J. Among those located at this address will be: H. R. Peters, President; H. G. Butterfield, Andrew A. Priest and R. E. Booth.

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ELECTRONIC DESIGN BULLETIN

A revised edition of the bulletin on Polarity Changers has been released by Electronic Laboratories, Inc., 122 West New York Street, Indianapolis, Ind. Copies of this bulletin, which describes various models of Polarity Changers for converting from dc to ac, may be obtained by writing to the manufacturer at the address given.

•

ATR MOVES

The offices and factory of the American Television & Radio Co., are now located at 300 East Fourth Street, Saint Paul, Minn.

•

HOWARD TO EXHIBIT

The Howard Radio Company, Chicago, announces for the first time its participation in the Radio Parts Show at the Hotel Stevens, Chicago, June 8th to 11th. The new Howard Communication receivers will be on exhibit at 214 Marconi Street, in the Exhibition Hall.

•

GREYHOUND EQUIPMENT CO. FORMED

Announcement is made of the formation of Greyhound Equipment Company, specializing in radio and industrial coil windings, with offices and factory at 1720 Church Avenue, Brooklyn, N. Y.

F. K. Coppel heads the organization, with Sylvan A. Wolin as representative in the metropolitan New York area on domestic and export sales.

Advertising Index

MODEL CC

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CAPACITOR ANALYZER

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INCORPORATES
MODEL CB FEATURES
plus
HIGH CAPACITY SCALE
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NEW . . . Destined to prove even more popular than our famous CB Model . . . because more useful. This is what it does: Measures Capacity .00001 to 800 mfd., including motor starting condensers; measures Power Factor 0 to 50%, including motor starting condensers; measures Resistance 50 to 2,000,000 ohms; measures Insulation Resistance to 1000 megohms, using test voltages to 600 D.C.; detects leakage and intermittents. A.C. operated

Catalog No. CC-1-60, for 110 volts
60 cycles operation, less tubes

YOUR COST . . . $24.90

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The Finest Automatic Record Changer ever Offered by RCA!

AND HERE'S WHY

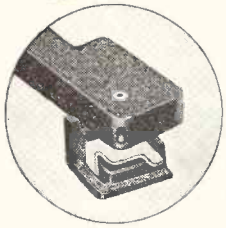
It automatically plays eight 10″ or seven 12″ records . . . repeats last record. Pickup impedance is 100,000 ohms at 100 cycles (1600 mmfd. over the range of 70-7000 cycles). Output is 1.5 volts at 1,000 cycles with 500,000 ohm load. 3-ounce needle pressure. Finished in attractive brown wrinkle lacquer with chromium trim. Power supply, 110-120 volts, 60 cycles, 25 watts (50-60 cycles motor available at slight additional cost).

Stock No. 9844 List Price $74.95

New RCA Senior Crystal Pickup

Top needle loading and automatic needle ejection are features which will appeal to your customers. The used needle is ejected by loosening needle screw and pressing needle box ejector lever. A new needle is inserted in the hole at the top of the pickup. In this case, the ejector functions as a needle positioning bracket. This is the same pickup and arm assembly used on new RCA Victor Automatic Record Changer. A built-in shorting switch is included in pickup.

Stock No. 9847 . . . List Price Less Needle Bracket. $6.95



Stock No. 9848

Needle Cup Assembly (inset) provides proper needle positioning bracket for the Senior Crystal Pickup.

List price 75¢

This new RCA Automatic Record Changer not only plays either 10″ or 12″ records automatically, but will also play them in mixed sequence when they are not warped or chipped.

One of its new features is the top loading crystal pickup with automatic needle ejector. Needle changing is accomplished by simply loosening the needle screw and pushing the ejector lever.

The instrument's mechanism is of simple fool-proof design. Shock absorbing type coupling between motor and turntable avoids transferring mechanical vibration and assures constant speed. Shock-proof mounting is used between motorboard and motor.

Minimum wear on record is assured through proper positioning of the arm and motor, together with correct needle weight. For details get in touch with your RCA parts distributor.

Over 325 million RCA radio tubes have been purchased by radio users . . .
In tubes, as in parts and test equipment, it pays to go RCA All the Way.

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

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