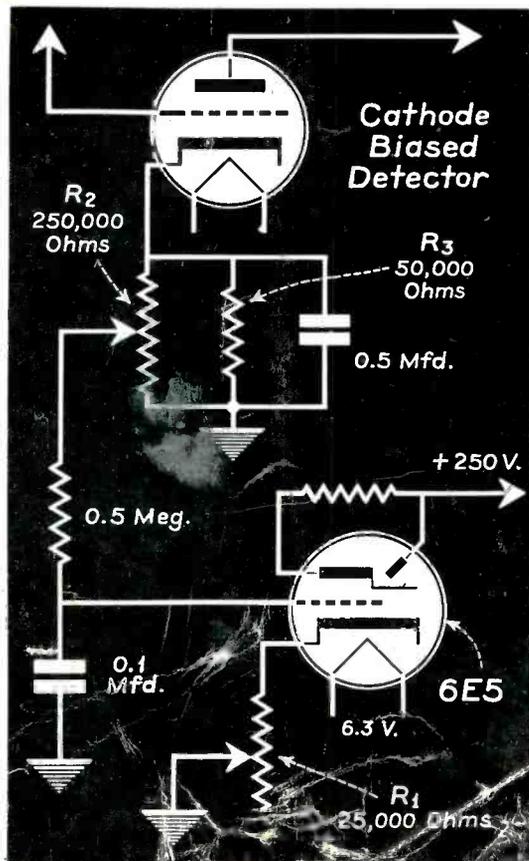


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RADIO

A Digest of

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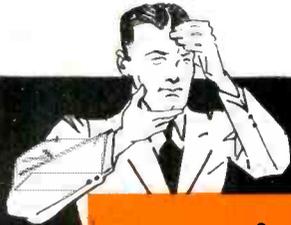


Using an Indicator Tube in Non-AVC Receivers

(See page 1)

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1938



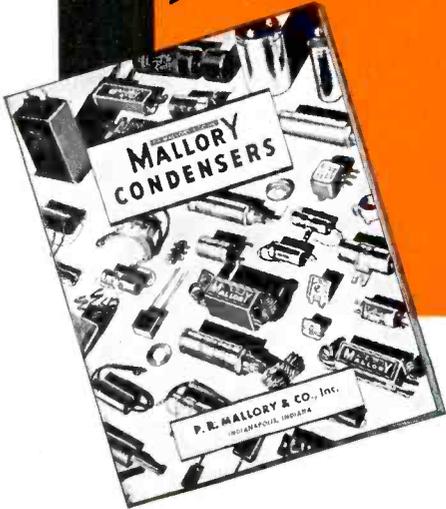
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EDITORS

FEBRUARY, 1938

Ray D. Rettenmeyer

W. W. Waltz

VOL. 7, NO. 2

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Secretary

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SANFORD R. COWAN
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FEBRUARY, 1938 •

THE ANTENNA . . .

RSA PROGRESSING RAPIDLY

JUST AS we were going to press with the January issue, word came of the steps taken, and to be taken, by the RMA and the Sales Managers' Clubs of New York and Chicago to assist in the countrywide organization campaign of the RSA (SERVICE, January, 1938, page 38).

Somewhat later, the following official announcement was released by the RMA:

"Further assistance in organization of the Radio Servicemen's Association by RMA was voted by the RMA Board of Directors at its meeting January 27 in New York upon recommendation of Director Jerome J. Kahn, chairman of a special committee cooperating with the national organization of servicemen, and also Chairman Arthur Moss of the RMA Parts and Accessory Division, and Director E. Alschuler of Chicago. The RMA will assist the Radio Servicemen's Association in its initial stages of organization. A large number of local chapters and a substantial national membership already have been organized. Arrangements for individual cooperation of leading manufacturers, in addition to the RMA, with the Radio Servicemen's Association also were agreed upon at the RMA Board meeting."

According to the latest available information from RSA headquarters, nineteen chapters have been affiliated with the parent organization, and over 1800 individuals have requested information regarding membership in RSA.

This indicates several things. First, that there is an active demand among Service Men for an organization of this type; and second, that many local groups feel the need of an affiliation with a national group for the obvious benefits to be gained through such association.

SERVICE reiterates: membership in the RSA, plus active participation in RSA activities are recommended to all those in the radio service industry.

SELLING YOUR WORK

NOT THE LEAST of the requirements of the successful Service Man is the ability to put across the idea that his work is highly technical, requiring long and often arduous training, and is to be paid for accordingly. Call it "front" or by any other name you please, the fact remains that the Service Man who gets this thought across is the one who is probably making a very fair income from his chosen profession.

Look at it this way. What you are selling, primarily, is something that your customer can't evaluate until after your work is done. It is something that can't be displayed like merchandise. It is *service*. The only guide which your customer has to your ability is the way in which you go about your work, the instruments you use, and the degree of confidence which you yourself have. If you call at your customer's house equipped with a screw-driver and little else, there is an immediate reaction against you. Far from being considered

as extremely clever for your ability to shoot trout with no equipment, you instill the idea that perhaps you don't know how to use test instruments. In the days when garages and gas stations are equipped with mysterious-looking meters and gadgets, when the electric light companies make actual measurements of line intensities, the general public expects that the radio men will likewise be equipped with instruments and that the instruments will be used. To do less destroys confidence.

On the other hand, when you start about your work in a home in a business-like manner, using all necessary test instruments, you not only gain the customer's respect, but you also save yourself some time. It is entirely conceivable that the comparatively few tests which you make may show up all of the trouble; in any event you have done part of your routine point-to-point checking so that when you do get the set on your work bench, there is just that much less to do there.

Even if this preliminary check-over in the customer's home doesn't definitely establish the source of trouble, it will at least give you enough information to enable you to talk charges in a convincing manner. You needn't hedge on a quotation when you are sure of your ground, and if you haven't a complete diagnosis of the trouble it will be just as easy to explain that while the set seems to need so-and-so, a further study and check-up will be most advisable. In this way you can avoid quoting on a job only to discover later that there was some hidden trouble that didn't come to light until you started a thorough going-over on your bench. When that unhappy event occurs, you are on a spot if you have already quoted a price for the job.

Keep in mind that there is a very fine balance between two things in the average customer's mind. It seems to be human nature to try to get *any* job done just as cheaply as possible, and at the same time many persons expect to have to pay well for work that is done with equipment that they don't understand. Keep that balance tilted ever so slightly toward the latter.

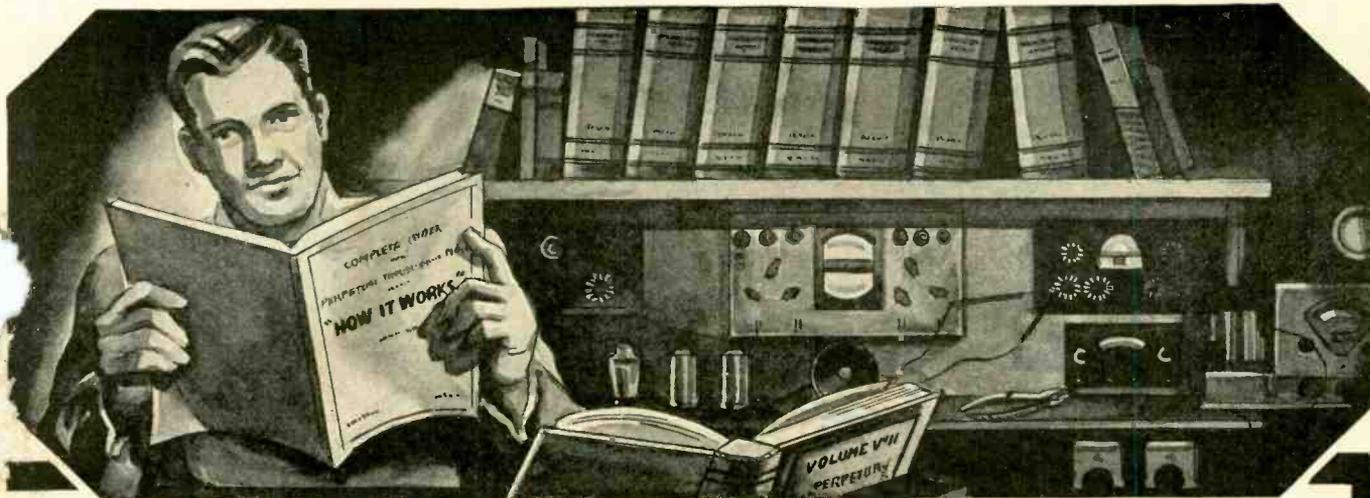
TELEVISION PROGRESS

WE LEARN that in the very near future RCA Institutes will offer a course in television for engineers; presumably this means a class graduating about two years hence and ready to handle whatever stations there may be at that time.

For Service Men this means, probably no television for quite a while yet; after all, no one seems ready to commit himself on what the receivers will be like.

But, from the same source, the tip comes for Service Men to be on their toes and to keep abreast of current developments in circuits, as well as to keep hammering on the old fundamentals which never change but have a way of continually cropping up.

More on this later!



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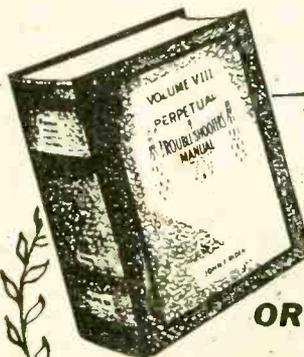
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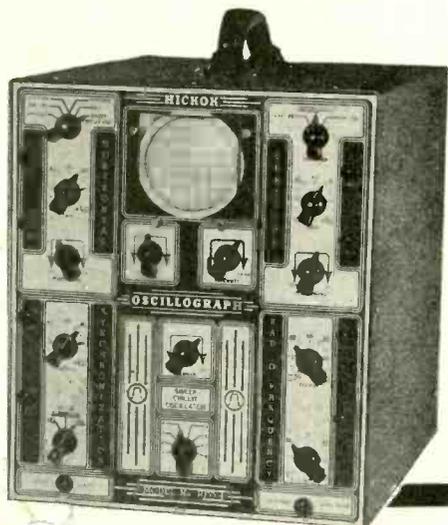
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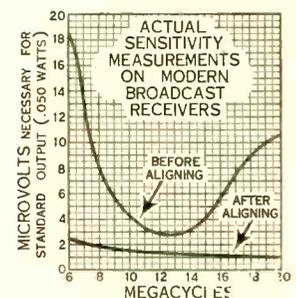
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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR FEBRUARY, 1938

A NEW SET IN AN OLD SETTING

By GLENN H. BROWNING* and F. J. GAFFNEY

IN ANY PROFESSION, it is the man with new ideas, the man who finds new outlets for his energies, who rapidly surges to the top. This is especially true of the profession of radio servicing, where the ever-increasing complexities of modern receivers sound the death knell for all but the most competent. Even the most competent Service Man, however, in these days of rapidly fluctuating economic conditions, is apt to find his business more or less spotty at times. It is to this type of individual that this article is addressed—to the service man who has originality, competence and sufficient business ability to convert his slack time into the development of a profitable professionalized enterprise.

A fairly large percentage of the competent Service Men in the country have already combined the dual functions of sales and service. Unfortunately, however, during the period when service jobs are few—due to a universal lack of coin of the realm—sales resistance is also high for the same reason. Furthermore, some of the objections offered by a potential customer to purchasing a new receiver are so valid as to be extremely difficult to defeat! What is the service

man to reply, for instance, to the customer who opines "My set doesn't sound too bad, and besides it's really become a part of our living room. One of your new-fangled stream-lined models would look as out of place as a limousine in a livery stable. Anyway, I paid \$175.00 for that set and you probably wouldn't allow me fifteen."

The answer to this seemingly insurmountable obstacle to increased business lies in one word—modernization. Why not overcome his valid objections by offering him a 1938 receiver in his 1930 cabinet, at less than one-half the original cost of his old receiver? Many of you old time Service Men may smile at this suggestion. Anyone knows that

AS a stop-gap for those periods when service work may be slack, set modernization has attractive possibilities. It is a ready means of moving one's stock of parts. The authors of this article have indicated one way of handling the problems involved in bringing the old receiver up to date.

circuit redesign is ticklish business at best, that a Service Man can't be expected to perform the functions of an engineer, that the installation of efficient all-wave systems, selective i-f transformers, etc., in an old receiver chassis presents problems which demand man hours all out of proportion to the expected return. But such business can be obtained and can be handled with a nice profit to the Service Man through the availability of the Browning 83 four-band kit set, a development which, it is believed, fills a real need for a modern efficient receiver with wide installation adaptability.

The construction of this receiver is greatly facilitated by the inclusion of a tuning catacomb containing an antenna stage, a radio-frequency stage, and an oscillator stage for each of the four bands. This tuner is completely wired and tracked at the laboratory so that it is only necessary to make eight connections, including a ground, to the unit. The average Service Man can assemble this receiver in about four hours.

CUSTOMERS' REQUIREMENTS

It is estimated that there are between eight and ten million receivers in the United States which are antiquated, but which are still in service. But what do we mean by "antiquated"? What does the customer demand in a new

*Browning Laboratories, Inc.

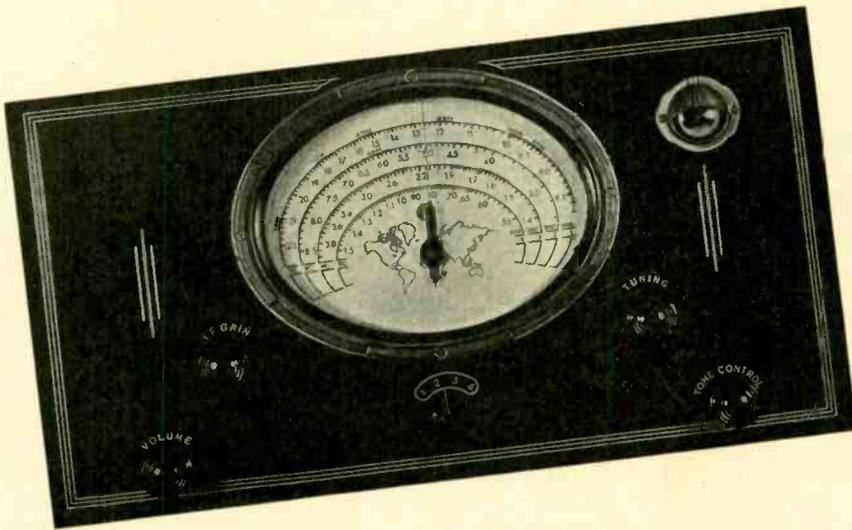
HIGH FIDELITY EXPECTED

Another important attribute which the discerning customer demands in a modern receiver is high fidelity. If the customer is a skilled mechanic of one sort or another, a category which includes many prospective "modernization" customers, he will be more than interested in seeing audio response characteristics and other factual data which show the performance of the receiver in a quantitative manner. Point out that the receiver does not merely amplify the low frequencies out of all proportion (a condition which many laymen have come to consider high fidelity) but actually reproduces the audio range from 3 cycles to 6 or 7 kc without appreciable reduction in intensity. It might prove well worth while to show him the effect of introducing the tone control to reduce the high-frequency response, showing the relation between the plotted graph and the actual sound of the received music. When a customer has once listened to high-fidelity reception in his own home, the idea will sell itself.

APPEARANCE AN IMPORTANT FACTOR

In addition to the question "How will the set perform?" the prospective customer for receiver modernization will have several others. He will want to know what sort of "front" the set has—will the dial harmonize with his old cabinet? He will ask about using parts of his old receiver, and last but not least, he will want an estimate of the cost of the complete job.

The first of these questions is adequately answered by the dial which accompanies the 83. Having an appearance which is truly modern, it is, nevertheless, sufficiently conservative to satisfy the most exacting tastes. The escutcheon is finished in bronze, a color which harmonizes favorably with any type of



Front panel, showing all controls, etc. Either this panel, or one matching the cabinet may be used.

model receiver? What additional performance does he desire which his old set cannot deliver?

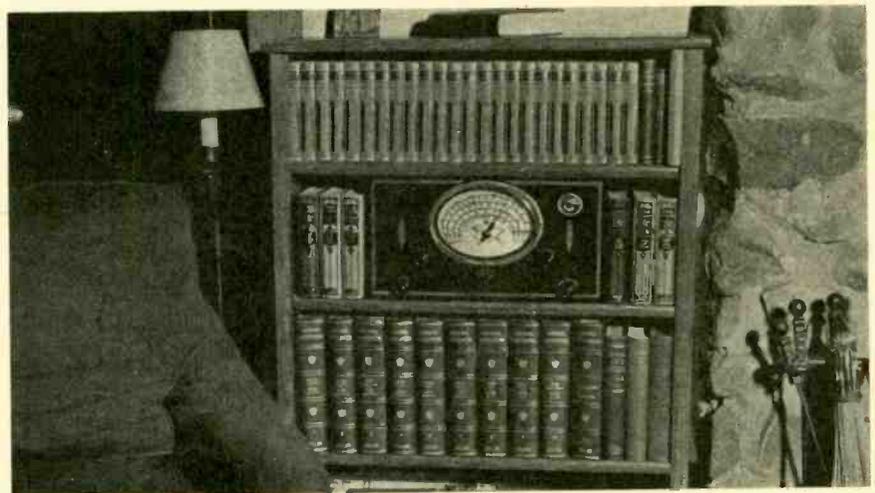
To begin with, a receiver must be "all-wave" and be sufficiently selective so that distant stations can be tuned in easily and without interference. The Browning Model 1 Tuner, the heart of the 83 kit set, covers the entire frequency spectrum from .55 to 22 megacycles with sufficient overlap on the various bands so that dead spots are non-existent. This matter of continuous frequency coverage is important. Some sets are available which have several bands but which do not completely cover the spectrum; it may be found that some of the frequency spans omitted on these sets are just the ones which a customer desires. Suppose, for instance, that he is interested in being able to pick up his local police broadcasts and finds that this frequency cannot be tuned on his receiver. The Service Man who sold him the set is faced with a trouble which he cannot rectify readily. Short-wave listening is still pretty much of a hobby and, believe it or not, there are still thousands of "DX" fans who sit up 'til the wee hours of the morning logging stations all over the world. To satisfy this type of customer, a receiver must not only be "all wave" but must have a maximum of sensitivity. The 83 has a sensitivity of 1 microvolt or better on all bands—greater than can be used except under the most favorable atmospheric conditions.

In addition to four-band continuous coverage, the critical customer demands that a receiver shall have a high signal-to-noise ratio. Even to the non-technical consumer, it is not difficult to demonstrate the fact that receiver sensitivity is limited by the noise level inherent in the set itself. For this reason, it is often

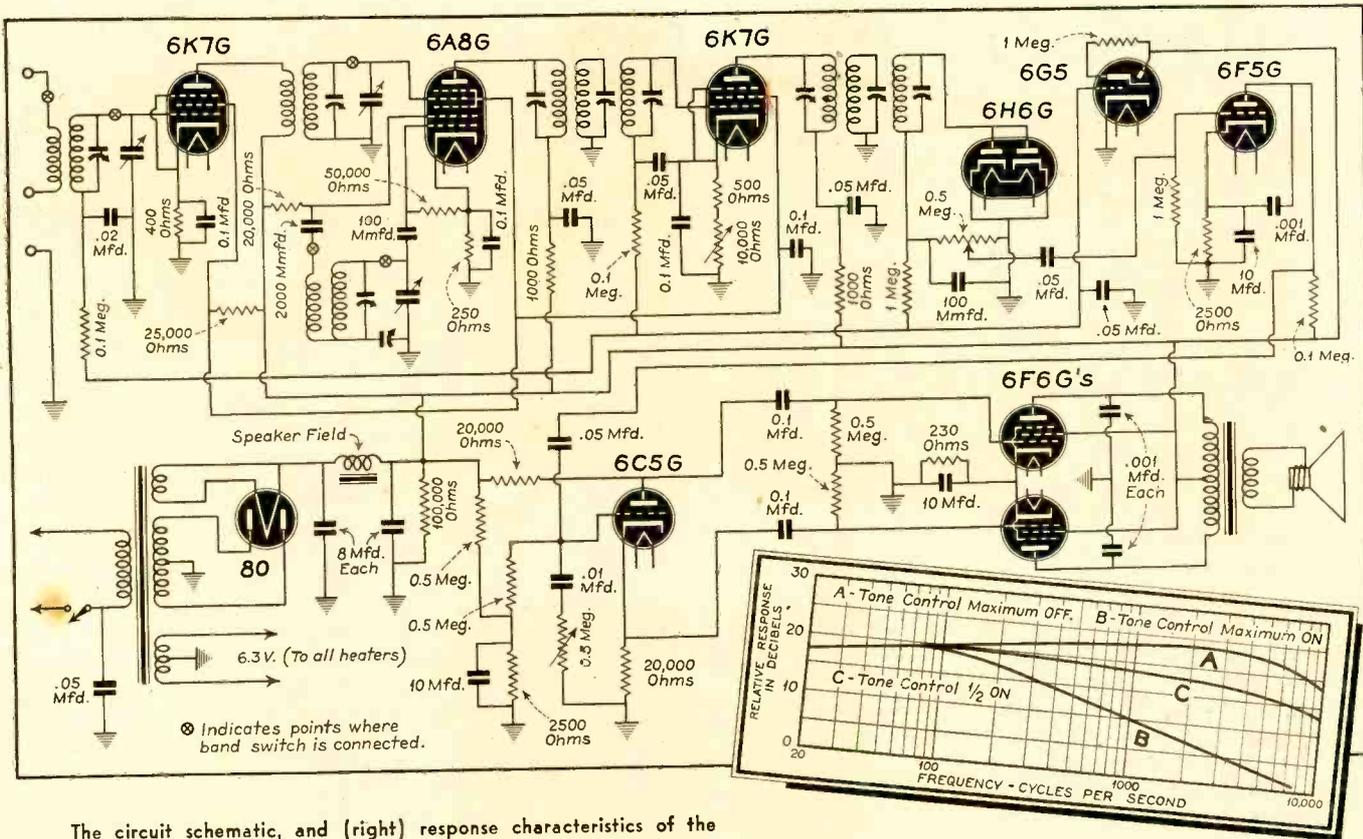


An old set revived with a modern tuner.

desirable to employ a circuit which uses as few tubes as possible and which operates with a maximum of efficiency.



Several types of furniture can be converted into radio cabinets; here a bookcase is used.



The circuit schematic, and (right) response characteristics of the receiver.

wood. The long scale makes station tuning and logging a pleasure. The drive reduction is such as to permit accurate tuning with a minimum of effort.

COMPLETE SET MAY BE INSTALLED

As regards the actual mechanics of modernization, several courses are open to the Service Man depending upon his ability and ingenuity. The most obvious of these is the substitution of the completely assembled 83 together with its recommended speaker in the customer's old cabinet. This is the easiest and, in many cases, the most advisable procedure. It will, of course, be necessary to make slight changes in the cabinet itself, particularly as regards the panel. An attractive etched, engraved panel, with a black background, measuring 17 3/8-in. by 9 5/16-in. is available for the receiver and can be utilized wherever space permits. Where this panel is not desired or where space limitations prohibit its use, the Service Man can easily fashion a suitable panel of plywood which can be stained to either harmonize or contrast with the customer's cabinet. The elliptical hole for the large dial need not be cut with any great degree of accuracy since the dial escutcheon covers this hole and overlaps it by about 1/4-in. all around. The receiver chassis itself can almost always



Another old timer with entirely up-to-date "works".

be mounted on the shelf formerly used for the old receiver.

OTHER MODIFICATIONS

Another alternative is to install the kit set complete but to retain the customer's speaker. This may prove desirable in the few cases of receivers which were originally equipped with high-quality speakers. In this connection, it will be noted that in the design of the receiver, the speaker field is used as a choke in the power-supply system. The speaker field resistance should be about 1200 ohms and the winding should be

capable of carrying safely a current of 90 milliamperes. The speaker transformer should have a primary impedance of about 10,000 ohms in order to match the plate-to-plate impedance of two 6F6's connected in push-pull.

Still another possibility that will particularly appeal to the owner of an old receiver which gives good quality reproduction but which is not equipped with an all-wave tuner, automatic volume control and the like, is the utilization of the old audio system with the new tuner and i-f system. This procedure is welcomed by many customers who dislike the idea of completely scrapping a receiver which was originally quite costly and which has given much satisfactory service. The chassis layout of the Browning 83 is adaptable to this type of installation. Diode detection is employed; thus the audio signal may be taken off the 0.5-megohm volume control resistor and applied to the grid of the first tube of any type of audio system. At least one stage of voltage amplification should, of course, be employed between the detector and the output tube or tubes. The use of the customer's audio system usually permits the retention of the old speaker and in some cases the old power supply can be used to operate the new r-f and i-f system.

Is your test bench neatly kept and efficiently arranged?

GETTING ON IN RADIO

-Some Further Notes

By BERNARD H. PORTER

MANY OF THE more important electrical principles of radio servicing can be demonstrated for the benefit of advanced and lay Service Men at the local service meetings. When the men of a community gather each month for a social and business discussion, the time can be profitably taken by the college-trained radio engineers of the group conducting a lecture period on fundamental concepts. Monthly quizzes, contrary to the opinions of any who may feel they have outgrown these or equivalent grammar-school procedures, stimulate thought by recalling to mind some of the difficult essentials. The keenest of us forget sometimes. Others are merely confused on the order of details.

To assimilate a practical aspect to this form of self-study, the club treasury can purchase a few junked receivers for the group's experimentation. These sets can be disassembled, repaired, rebuilt in various circuits and modifications thereof, and played with in a variety of ways as the class study will suggest. It is not well to carry into each club meeting the manual operations of a long day at the service bench, but rather to use this type of program three or four times a year in preference to the usual talk.

Preferably, an interested number of the monthly group could gather apart from the regular meeting to carry on some form of self instruction. J. H. Morecroft's "Experimental Radio Engineering" interpreted by a competent leader, could be the basis of such an experimental period. Facts, theories, principles, and a thorough grounding in radio-frequency phenomena are stressed in this book. An introduction of thirty pages surveys briefly the field of radio measurements and gives practical hints about a club's acquisition and calibration of suitable apparatus for the work to follow. Small contributions by each class member would defray the equip-

ment expense. The remainder of the book is then devoted to fifty-one experiments, covering the entire range of radio and each having a clearly stated object illustrating some phase of radio-frequency phenomena.

Chapters 15, 16 and 17 of E. M. Terry's "Advanced Laboratory Practice in Electricity and Magnetism" cover radio-frequency measurements, electron tubes, oscillators, and amplifiers in an experiment-instruction form that can also be used to advantage in this plan.

Those individuals of the group preferring to wield a pencil to connecting up meters will find the mathematical solution of problems an instructive way in which to pass an evening. A conscientious study of the problems in Henney's "Principles of Radio" is well worthwhile. In this connection, the author says, "The student with no mathematics beyond arithmetic and common sense will be able to work his way through most of the examples."

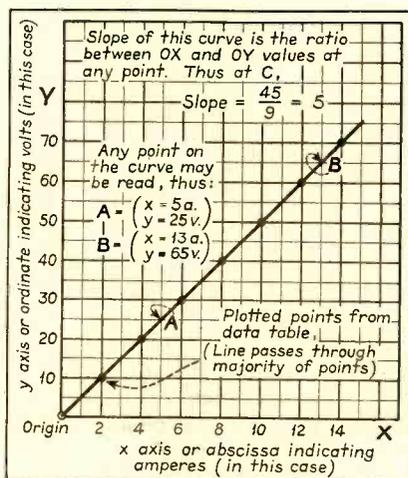
Other authors like J. H. Morecroft in his "Elements of Radio Communica-

tions" state the problem and then solve it, a procedure, incidentally, that does not mean there is nothing left for the reader to do. When the author says, "from equation (23) it is evident $R = 210$ ohms," he implies at once that you may use up a few pieces of scrap paper before verifying his statement. Moreover, he dares you to find $R = 209$ ohms! A blackboard discussion of problems among the group members will bring out many pointers to the recently new practitioners and at the same time rehash the fundamentals for old timers.

ABOUT MATHEMATICS

"How much math?" is an inevitable question. It has been suggested that the Radio Engineer knows the "why" of radio, a condition that also implies his mathematical insight of the subject. To dissect many types of natural phenomena underlying radio science, he often requires an understanding of mathematics beyond algebra. In fact, the fundamentals of calculus and complex quantities—or at least sufficient knowledge to decipher needed operations from a reference text—are demanded of the Radio Engineer. Invariably, however, the engineers who have come up through the ranks by self-study acquire unconsciously a type of mind that can follow mathematical equations without stopping to worry whether they pertain to calculus or hyperbolic functions. This "math sense," as it is called, combines facts and feelings or intuitions in such a manner that it serves effectively. Concentrated study of math essentials coupled with practical use develops this sense. When it does not meet the conditions, one is still equipped to turn to the references: R. W. Dull's "Mathematics for Engineers," or some similar text.

A typical curve; plot of the data in Table I.



Time is money. Be certain you get fair value for your time.

Table 3

Current (I) in Amps.	E.M.F. (E) in Volts
0	0
2	9.5
4	20.5
6	30.0
8	40.5
10	50.0
12	59.8
14	70.0

Table 1

"Mega" = M = 10 ⁶ = One Million Times	= Greek for Great
"Myria" = = 10 ⁴ = Ten Thousand Times	= Greek as in "Myriad"
"Kilo" = K = 10 ³ = One Thousand Times	= Greek for 1000
"Hecto" = h = 10 ² = One Hundred Times	= Greek for 100
"Deka" = dk = 10 ¹ = Ten Times	= Greek for 10
"Deci" = d = 10 ⁻¹ = One Tenth Part of	= Latin for 10 (Dime)
"Centi" = c = 10 ⁻² = One Hundredth Part of	= Latin for 100 (Cent)
"Milli" = m = 10 ⁻³ = One Thousandth Part of	= Latin for 1000 (Mill)
"Micro" = μ = 10 ⁻⁶ = One Millionth Part of	= Greek for Small
"Millimicro" = mμ = 10 ⁻⁹ = One Thousand Million Parts of	
"Micromicro" or "Pico" = μμ = 10 ⁻¹² = One Million Million Parts of	

Table of Conversion Factors and Abbreviations *

Abbreviation	MULTIPLY	BY	TO GET
a	Amperes	10 ⁻¹²	Micromicroamperes
"	Amperes	10 ⁻⁶	Microamperes
"	Amperes	10 ⁻³	Milliamperes
~	Cycles	10 ⁶	Megacycles
"	Cycles	10 ³	Kilocycles
fd.	Farads	10 ⁻¹²	Micromicrofarads or Picofarads
"	Farads	10 ⁻⁶	Microfarads
"	Farads	10 ⁻³	Millifarads
h	Henrys	10 ⁻⁶	Microhenrys
"	Henrys	10 ⁻³	Millihenrys
h.p.	Horsepower	0.7457	Kilowatts
"	Horsepower	745.7	Watts
Kc.	Kilocycles	10 ⁻³	Cycles
kV.	Kilovolts	10 ⁻³	Volts
kw.	Kilowatts	10 ⁻³	Watts
"	Kilowatts	1.341	Horsepower
Mc. or mc.	Megacycles	10 ⁻⁶	Cycles
1/μ.	Mhos	10 ⁻⁶	Micromhos
"	Mhos	10 ⁻³	Millimhos
μa. or Ma.	Microamperes	10 ⁶	Amperes
μfd. or Mfd.	Microfarads	10 ⁶	Farads
μh. or Mh.	Microhenrys	10 ⁶	Henrys
"	Micromhos	10 ⁶	Mhos
μΩ. or MΩ.	Micro-ohms	10 ⁶	Ohms
μV. or MV.	Microvolts	10 ⁶	Volts
μW. or MW.	Microwatts	10 ⁶	Watts
μμfd. or Mμfd.	Micromicrofarads	10 ¹²	Farads
μμΩ. or MμΩ.	Micromicro-ohms	10 ¹²	Ohms
ma.	Milliamperes	10 ³	Amperes
mh.	Millihenrys	10 ³	Henrys
"	Millimhos	10 ³	Mhos
mΩ.	Milliohms	10 ³	Ohms
mv.	Millivolts	10 ³	Volts
mw.	Milliwatts	10 ³	Watts
"	Ohms	10 ⁻¹²	Micromicro-ohms
"	Ohms	10 ⁻⁶	Micro-ohms
"	Ohms	10 ⁻³	Milliohms
v.	Volts	10 ⁻⁶	Microvolts
"	Volts	10 ⁻³	Millivolts
w.	Watts	10 ⁻⁶	Microwatts
"	Watts	10 ⁻³	Milliwatts
"	Watts	10 ³	Kilowatts

* Adapted from "Basic Physics Course" A.A. Ghirardi

Table 2

Grid Potential	E _g , e _g
Grid Current	I _g , i _g
Grid Conductance	g _g
Grid Resistance	r _g = 1/g _g
Grid Bias Voltage	E _c
Plate Potential	E _p , e _p
Plate Current	I _p , i _p
Plate Conductance	g _p
Plate Resistance	r _p = 1/g _p
Plate Supply Voltage	E _b
Emission Current	I _s
Mutual Conductance	g _m
Amplification Factor	μ = g _m /g _p
Filament Terminal Voltage	E _f
Filament Current	I _f
Filament Supply Voltage	E _a
Grid-Plate Capacity	C _{gp}
Grid-Filament Capacity	C _{gf}
Plate-Filament Capacity	C _{pf}
Grid Capacity	C _g = C _{gp} , C _{gf}
Plate Capacity	C _p = C _{gp} , C _{pf}
Filament Capacity	C _f = C _{gf} , C _{pf}

The Service Engineer, on the other hand, needs only an extra dose of common sense and a working knowledge of straight arithmetical and algebraic operations. Neither trigonometry nor calculus is necessary at this stage.

Oftentimes, it is argued that higher mathematics is not essential. One hears it said that college-trained engineers forget all they ever knew about the subject two days after graduation. The fact is they do. But the argument does not stop there—if the engineer knew a lot in the first place, he can still forget a sizeable portion and yet have a little reserve to work on later—so they say. Unfortunately, however, Service Men can not afford such a luxury. And why the waste? Is it not better to know thoroughly the essentials and to use them, leaving the mind failure to others?

Without further ado, then, study (not read) the last chapter of Duncan's "Foundations of Radio," already mentioned. Pass from there to C. I. Palmer's "Practical Mathematics," Part I concerning "Arithmetic with Applica-

tions." Part II on "Algebra with Applications" is next in order, special attention being paid to chapters 13 and 16. By way of rounding out the contents of these two parts, study chapters 1, 6, 8, 18, and 19 of Ford & Ammerman's "Second Course in Algebra" covering fundamental notions, graphical equations, square roots, exponents, and radicals. G. A. Wentworth's "College Algebra" is a valuable reference text for use after mastering the previously named books.

We repeat that knowing the major content-sections of these books and using them in the daily work will assist in promoting many a Service Man to Service Engineer. Common sense plus some mental grease—both indefinable things—are the necessary adjuncts.

Later, when passing on to the stage of Radio Engineer, one can review all mathematical operations found useful to date before starting on S. P. Thompson's "Calculus Made Easy," and later using C. I. Palmer's "Practical Calculus for Home Study" as a reference.

Throughout one's study of mathematics, the general procedure is to learn only the useful parts, use the portion learned, and leave the forgetting to those who have time for trivial details!

RADIO SHORTHAND

Service Men, aspiring to graduate into Service Engineers, make daily and practical use of the academic facts learned during spare time. Having mixed about equal portions of mathematics and radio in their self-training periods, these men have no fear of equations like these:

$$(I_s)_{max} = 2.334 \times \frac{(V_g^{1/2} + V_a^{1/2})^2}{a^2};$$

$$Z_x = Z_n \left(\sqrt{\frac{Z_c - 1}{Z_n}} \right)^2,$$

realizing full well that letters constitute an engineer's shorthand and the markings but algebraic steps to solution. There are other shorthand methods besides the mathematical. These should be

at the mind's edge of every Service Man for immediate use.

As SERVICE has had letters from men in various parts of the country suggesting that a review of radio shorthand and first principles of servicing, in article form, might be more stimulating than recourse to one's now dog-eared texts, let us reconsider some of the old material. Somehow it never wears out.

Since speed is essential in daily work, Radio Engineers write numbers thus:

- units = 10^0
- tens = $10 = 10^1$
- hundreds = $100 = 10^2$
- thousands = $1000 = 10^3 =$ (kilo)
- tens of thousands = $10,000 = 10^4$
- hundreds of thousands = $100,000 = 10^5$
- thousands of thousands (million) = $1,000,000 = 10^6 =$ (mega)
- one tenth = $1/10 = 0.1 = 10^{-1}$
- one hundredth = $1/100 = 0.01 = 10^{-2}$
- one thousandth = $1/1000 = 0.001 = 10^{-3} =$ (milli)
- one ten thousandth = $1/10,000 = 0.0001 = 10^{-4}$
- one hundred thousandth = $1/100,000 = 0.00001 = 10^{-5}$
- one thousand thousandth (one millionth) = $1/1,000,000 = 0.000001 = 10^{-6}$ (micro)

This system is used in expressing large numbers, especially those having many zeros. Rather than write them out, one uses the multiple 10 with an

index to indicate the power to which it is raised. The 10 and its number is called the *base*. The small integer at the right of and above the base is called an *exponent*. It tells how many times the base is used as a factor. thus:

- $1.2 \times 10^2 = 1.2 \times 10$ times 1.2×10 ;
- 10^2 means 10 times 10 (or 100) and is read "ten square" or "ten to the second power";
- 10^4 means 10 times 10 times 10 times 10 (or 10,000) and is read "ten fourth" or "ten to the fourth."

The exponent, or number above the line, is positive for numbers greater than one and negative for those less than one. This sign indicates whether the designated power of 10 is to be used as a multiplier or as a divisor. For example, $7 \times 10^2 = 700$, but $7 \times 10^{-2} = 0.07$.

The rules for using exponents are simple:

- (1) When multiplying numbers, add exponents.
- (2) When dividing numbers, subtract exponents
- (3) When squaring numbers, double exponents.
- (4) When getting square roots, halve exponents.
- (5) When transferring an exponent across the dividing line, change its sign.

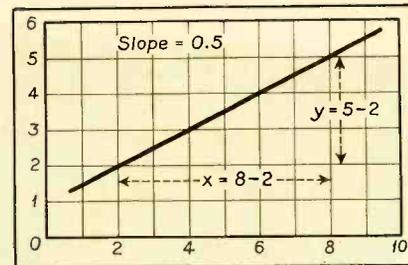


Fig. 3. Method for finding the slope of a curve.

A study of the mathematical statements below will further amplify the laws just stated. Better still, a little pencil work on the part of the reader with similar problems will establish this useful shorthand in one's mind.

- (a) four thousand = $4000 = 4 \times 10^3 = 4$ times 10 times 10 times 10.
- (b) four thousandths = $0.004 = 4 \times 10^{-3} = 4/1000 = 4/10^3$.
- (c) $350,000,000 = 3.5 \times 10^8$.
- (d) $0.0000084 = 8.4 \times 10^{-6}$.
- (e) $9,653,000 = 9.653 \times 10^6$.
- (f) $0.000432 = 4.32 \times 10^{-4}$.
- (g) $723 \times 10^{-4} = 723/10,000 = 0.0723$.
- (h) four thousand times four hundred = 4×10^3 times $4 \times 10^2 = 16 \times 10^5 = 1,600,000$.
- (i) four thousand times four hundredths = 4×10^3 times $4 \times 10^{-2} = 16 \times 10^1 = 16 \times 10 = 160$.
- (j) ten cube squared = $(10^3)^2 = 10^6$ times $10^3 = 10^9$.
- (k) three thousand divided by one hundred and fifty = $3 \times 10^3 / 1.5 \times 10^2 = 3/1.5 \times 10^3 \times 10^{-2} = 2 \times 10^1 = 2 \times 10 = 20$.
- (l) twenty thousand times twelve hundred all divided by six thousand = 2×10^4 times $12 \times 10^2 / 6 \times 10^3 = 2 \times 12 \times 10^4 \times 10^2 \times 10^{-3} / 6 = 24/6 \times 10^8 = 4 \times 10^8 = 400,000,000$.

Numbers are also expressed in prefixes, or first parts of a radio term. For example, *milliampere* means one thousandth of an ampere. (10^{-3} or 0.001 amperes). If "deci" means one-tenth of a unit, a *decimeter* would be 0.1 of a meter. A *microfarad* (micro meaning millionth) is 10^{-6} of a farad; a *microhenry*, 10^{-6} of a henry. Rather than say that a condenser has a capacity of 0.00035 microfarads (3.5×10^{-4}), we express it as 350 *micro-microfarads* (mmfd).

The complete notation is shown in the Conversion Table.

Likewise, radio terms are abbreviated or indicated by symbols, a few of the more important ones being given in Table 1. In the same way, radio devices are expressed in picture form for circuit representation. These symbols are too well known to require reproduction here.

(Continued on page 26)

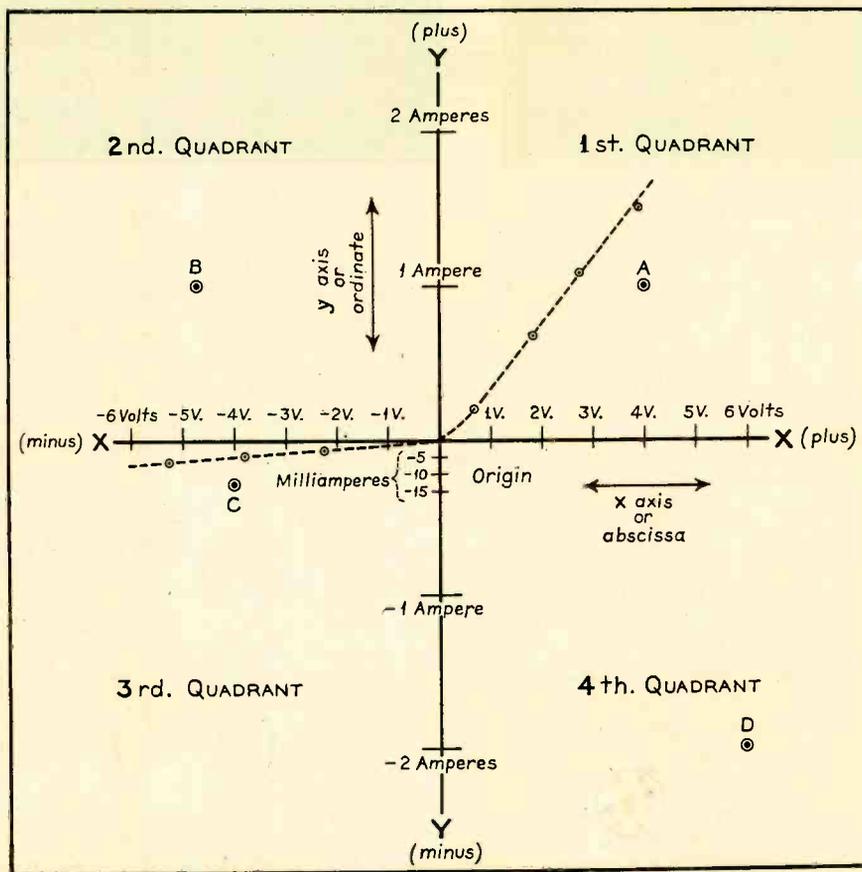


Fig. 2. Characteristics of a copper-oxide rectifier; showing method of plotting.

General Data . . .

Emerson AP-165, AP-166, AP-177
 Chassis: AP.
 Cabinet: Radio-Phono Combination.
 Tuning: Manual.
 Ranges: 150-375 kc; 540-1,600 kc;
 5.7-17.5 mc.

Tubes:
 1st Det: } 6A7
 Osc: }
 I-f: } 6D6
 A-v-c: }
 2nd Det: } 6Q7
 1st A-f: }
 Pwr Amp: 25L6
 Rect: 25Z5
 Ballast: 3CR-241

Power Supply: 105-125 v, a-c or d-c,
 IF: 456 kc.
 Speaker: Models below serial number
 1291800 use electrodynamic; above
 that serial number, p-m speakers are
 used.
 Phono Connection: Crystal pickup and

phono motor included in assembly.
 Information given below regarding
 voltage readings was taken with volume
 control on full, with no signal input.

ADJUSTMENTS

An oscillator with frequencies of 150,
 350, 456, 600, 1,500 and 15,000 kc should
 be used.

An output meter should be used across
 the voice coil or output transformer for
 observing maximum response.

Use a standard dummy antenna when
 aligning either the long-wave or
 medium-wave bands. A .0002 mf condens-
 er may be used as a substitute.
 When aligning the short-wave band use
 a 400 ohm dummy antenna (a 400 ohm
 resistor in series with antenna lead).

Always choose the minimum capacity
 peak on oscillator trimmers and maxi-
 mum capacity peaks on antenna trim-
 mers. The last motion in adjusting

trimmers should always be a tightening
 one, not a loosening one.

Always use as weak a test signal as
 possible during alignment.

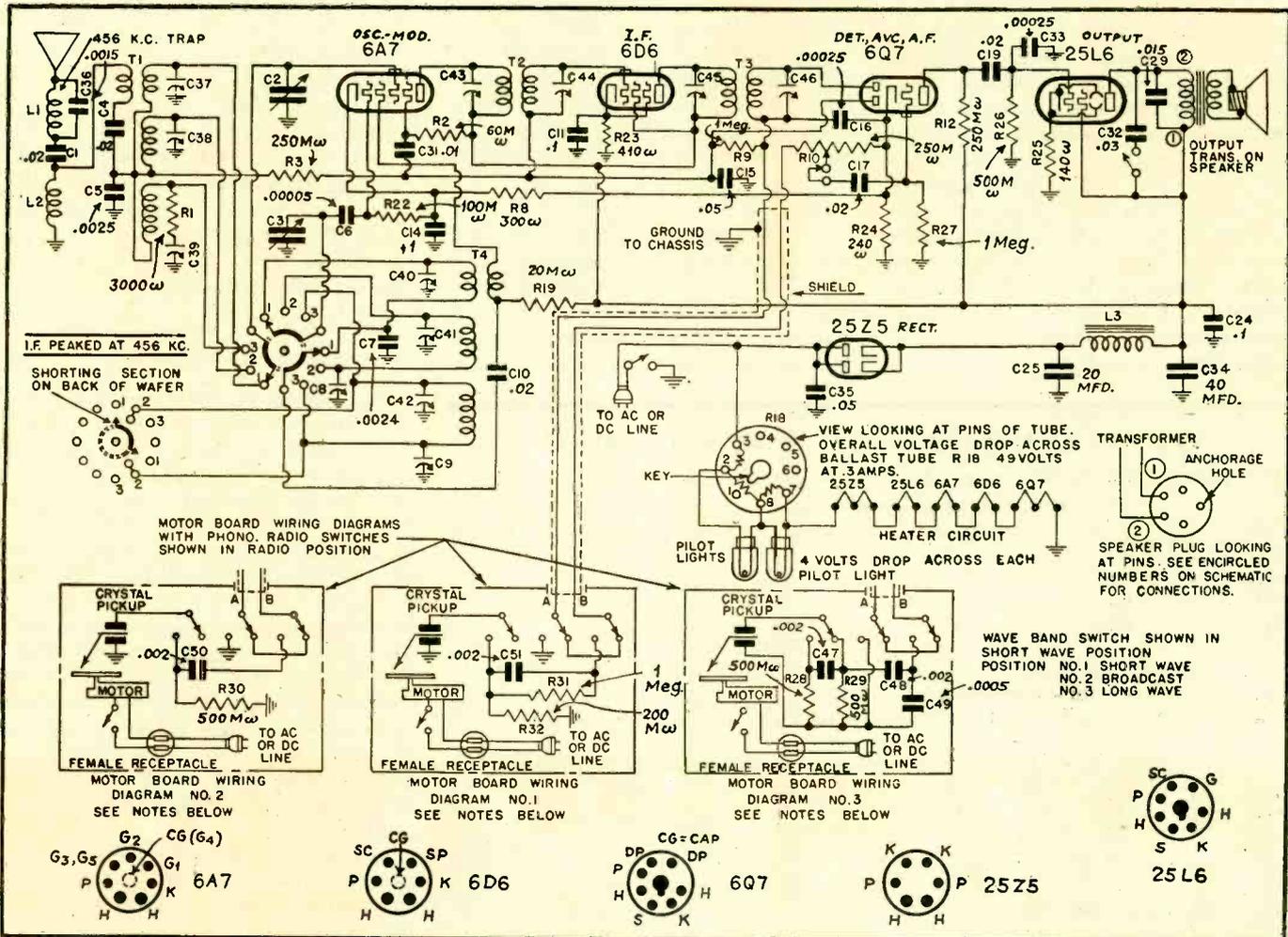
Never leave a trimmer with its out-
 side plate so loose that there is no ten-
 sion on the screw. Either bend the
 plate up or remove the screw entirely.

LOCATION OF COILS AND TRIMMERS

The two i-f transformers are located
 on top of the chassis deck. The second
 i-f transformer is the one directly be-
 hind the variable condenser. The four
 trimmers, two for each transformer, are
 accessible through holes in the tops of
 the cans.

The dual adjustable padding con-
 denser is mounted on the left side of
 the front chassis wall.

The antenna coils for the three bands
 are wound on one form and mounted
 underneath the chassis deck directly be-
 hind the adjustable padding condenser.
 The trimmers for these coils are ac-
 cessible through holes in the top of the
 chassis. The trimmer nearest the front
 of the chassis is the medium-wave an-
 tenna trimmer. The central trimmer is
 the short-wave antenna trimmer. The
 trimmer farthest from the front of



Emerson AP-166 circuit schematic.

GENERAL DATA—continued

the chassis is the long-wave antenna trimmer.

The oscillator coils for the three bands are wound on one form and mounted underneath the chassis deck near the variable condenser. The trimmers for these coils are also accessible through holes in the top of the chassis. The trimmer nearest the front of the chassis is the medium-wave oscillator trimmer. The central trimmer is the short-wave oscillator trimmer. The trimmer farthest from the front of the chassis is the long-wave oscillator trimmer.

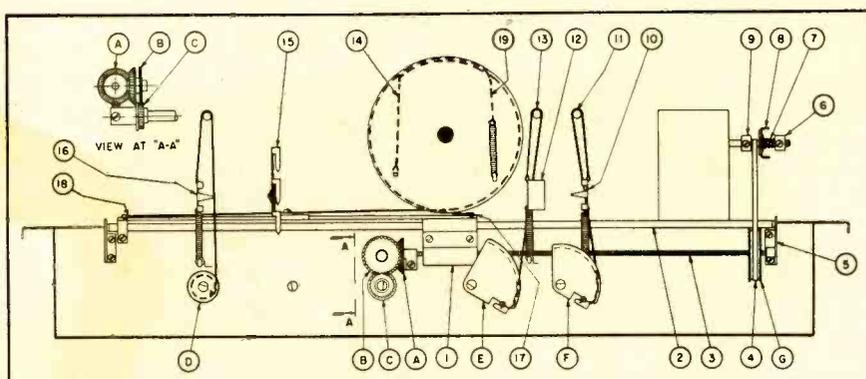


Fig. 1. Tuning mechanism, G.E. F-135.

I-F ALIGNMENT

Rotate the wave-band switch to the medium-wave (central) position and set the variable condenser to minimum. Feed 456 kc to the grid cap of the 6A7 tube. Adjust the four i-f trimmers for maximum response.

LONG-WAVE ALIGNMENT

With the wave-band switch at long-wave (clockwise) position set the dial pointer at 150 and feed 150 kc to antenna. Adjust the long-wave series padder (hex nut on dual padder) for maximum response. Move pointer to 350 and feed 350 kc to antenna. Adjust the long-wave oscillator trimmer then the long-wave antenna trimmer for maximum response. Reset pointer to 150, feed 150 kc and rock (rotate back and forth through a small arc) the variable condenser while adjusting long-wave series padder for maximum response. Reset pointer to 350, feed 350 kc and check alignment. If readjustment is necessary return to 150 kc and repeat entire procedure.

MEDIUM-WAVE ALIGNMENT

Set switch at medium-wave (central) position and dial pointer at 600. Feed 600 kc to antenna and adjust medium-wave series padder (slotted screw on dual padder) for maximum response. Move pointer to 1,500, feed 1,500 kc and adjust medium-wave oscillator trimmer and then the medium-wave antenna trimmer for maximum response. Reset pointer to 600 feed 600 kc and rock variable condenser while readjusting medium-wave series padder for maximum response. Reset pointer to 1,500, feed 1,500 kc and check alignment. If readjustment is necessary return to 600 and repeat entire procedure.

SHORT-WAVE ALIGNMENT

Set wave-band switch at short-wave (counter-clockwise) position. Set pointer at 15, feed 15 megacycles to antenna and adjust short-wave oscillator trimmer and then short-wave antenna trimmer for maximum response.

G.E. F-135

Cabinet: Console

Tuning: Manual and Automatic

Ranges: 540-1620 kc; 1620-5600 kc;
5600-18000 kc; 18000-43000 kc

Tubes:

R-f: 6K7

1st Det: 6L7

Osc: 6J5G

I-f: 6K7 (2)

A-f-c: 6J5G; 6H6

2nd Det: 6H6

1st A-f: 6J5G

Ph Inv: 6J5G

Pwr Amp: 6L6G (2)

Rect: 5Z3

Power Supply: 110/120 volts, 50-60 cycles; 110/120 volts, 25 cycles. Adjustments provided in both cases for 120/130 volt operation

I-f: 465 kc

Speaker: Electrodynamic

V-c Imp: 5.5 ohms

RECEIVER OPERATION

The antenna transformer T-6, used in conjunction with a 6K7 tube, and the r-f transformer T-4 are the essential elements of the r-f amplifier. The output from the r-f amplifier and the output from the 6J5G oscillator tube are combined in the 6L7 converter tube to give an output frequency of 465 kc. The 465 kc signal is then amplified by the i-f amplifier which consists of three double-tuned transformers and two 6K7 tubes. The primary and secondary coils of these transformers are carefully adjusted midway between the points of critical and overcoupling so as to give the i-f amplifier a broadened band width with a subsequent better fidelity of the received program.

The output of the i-f amplifier is applied to a 6H6 diode rectifier, which is a combination detector, automatic volume control, and discriminator voltage source for the automatic-frequency-control tube. A detailed explanation of the afc will

VOLTAGE ANALYSIS EMERSON AP-165, AP-166, AP-177

(For models with permanent-magnet speakers; serial numbers above 1291800)

(Voltages are between point indicated and ground)

Tube	Plate	Screen	Cathode	Osc Plate	Fil
6A7	118	38	2.0	76	6.3
6D6	118	115	4.2	..	6.3
6Q7	45	...	1.0	..	6.3
25L6	108	115	8.0	..	25.0
25Z5	...	...	130.0	..	25.0
Voltage across filter choke.....					12
Voltage across resistors in ballast tube.....					49
Voltage across each pilot light section in ballast tube.....					4

(For models with electrodynamic speakers; serial numbers below 1291800)

6A7	110	34	2.4	67	6.3
6D6	110	110	4.2	..	6.3
6Q7	45	...	1.2	..	6.3
25L6	100	110	7.0	..	25.0
25Z5	...	...	135.0	..	25.0
Voltage across speaker field.....					25
Voltage across resistors in ballast tube.....					49
Voltage across each pilot light section in ballast tube.....					4

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GENERAL DATA—continued

be found in a following paragraph. A second 6H6 diode is used to supply minimum bias to all tubes controlled by the avc. One of the plates (18) of this diode supplies initial bias to the r-f stage, while the other plate (19) supplies the 6L7 converter and 1st i-f amplifier with the proper bias. Since the cathodes of the 6H6 are connected to a 3.2 volt point on the bleeder resistance R-40, this allows the avc controlled tubes to have a constant — 3.2 volt bias with no signal input. This bias will remain constant until the point at which the avc voltage developed, becomes greater than this — 3.2 volts, at which time the bias on these tubes will then be dependent upon the avc developed by the strength of the carrier. The sensitivity is automatically increased on "C," "D," and "E" bands by a section on the band switch which grounds the cathode of the 6K7 1st i-f

amplifier. This ground removes the self bias which is necessary on "B" band to reduce interstation noise.

The volume is controlled by the variable potentiometer (R-22) in the grid circuit of the 6J5G 1st audio amplifier tube. This tube is resistance coupled to both the 6L6G output tube and to the 6J5G phase inverter tube. The phase inverter tube is used to drive the second 6L6G output tube 180 degrees out of phase with the first 6L6G. Engineers have carefully balanced this circuit so that the 6L6G tubes are operating push-pull into the output transformer which they designed to correctly load these tubes over the entire audio range of frequencies.

This careful balance together with controlled negative feed back enables the two 6L6G tubes to deliver ample undistorted power output to the twelve-inch electrodynamic speaker.

TONE CONTROL

Negative feed back is used to control the quality and tone of reproduction. The frequency response of the audio circuit is varied by the tone control switch and its associated network as follows:

In the "Normal" position, voltage from the voice coil is fed back through R-29, R-21 and C-46 to a tap on the volume control. The tone control switch S-11 is in No. 1 position and does not make any connection with the circuit. Engineers have carefully chosen the value of R-29 and C-46 so that the negative feed back voltage holds down the "boom" caused by pentode output and speaker resonance. This arrangement improves the quality and response to an external range of both high and low frequencies.

No. 2 is the "Bass" position. The long arm of S-11 grounds C-38 thus connecting this capacitor across the volume control and limiting the high frequency input to the audio amplifier. The negative feed back circuit is the same as used in the "Normal" position.

The "Treble" position is No. 3 where high frequencies are injected into the second tap on the volume control. It should be noted that C-38 is removed from the circuit, and the short arm on S-11 connects C-39 across the top part of the volume control thus increasing the higher frequencies present in the lower portion of R-22. The shorting bar of S-11 across No. 2 and No. 3 connects R-30 in parallel with R-21 and C-46. This allows more degeneration of the lower frequencies. The result is improved quality with a nearly flat low frequency response and a very much extended high frequency range.

In the "Foreign" position No. 4 highs are again limited by C-38. The shorting bar across contacts No. 3 and No. 4 shorts out R-21 and C-46 thus leaving only R-29 in the feed back circuit. Because of the limiting of highs by C-38 and more degeneration of lows by the feed back circuit, a middle range response is obtained. This position may be used to reduce noise and to reduce bass response on programs which predominate in low frequency tones.

C-38 is removed from the circuit in the "Speech" position. R-21 and C-46 are shorted out of the feed back circuit. R-29 is left in the circuit to limit the amount of feed back voltage. This arrangement gives improved quality and flat response to the entire audio range of frequencies.

It should be noted that on "C," "D," and "E" bands contacts No. 13, 14 and

ALIGNMENT PROCEDURE

I.F. Alignment with Oscilloscope

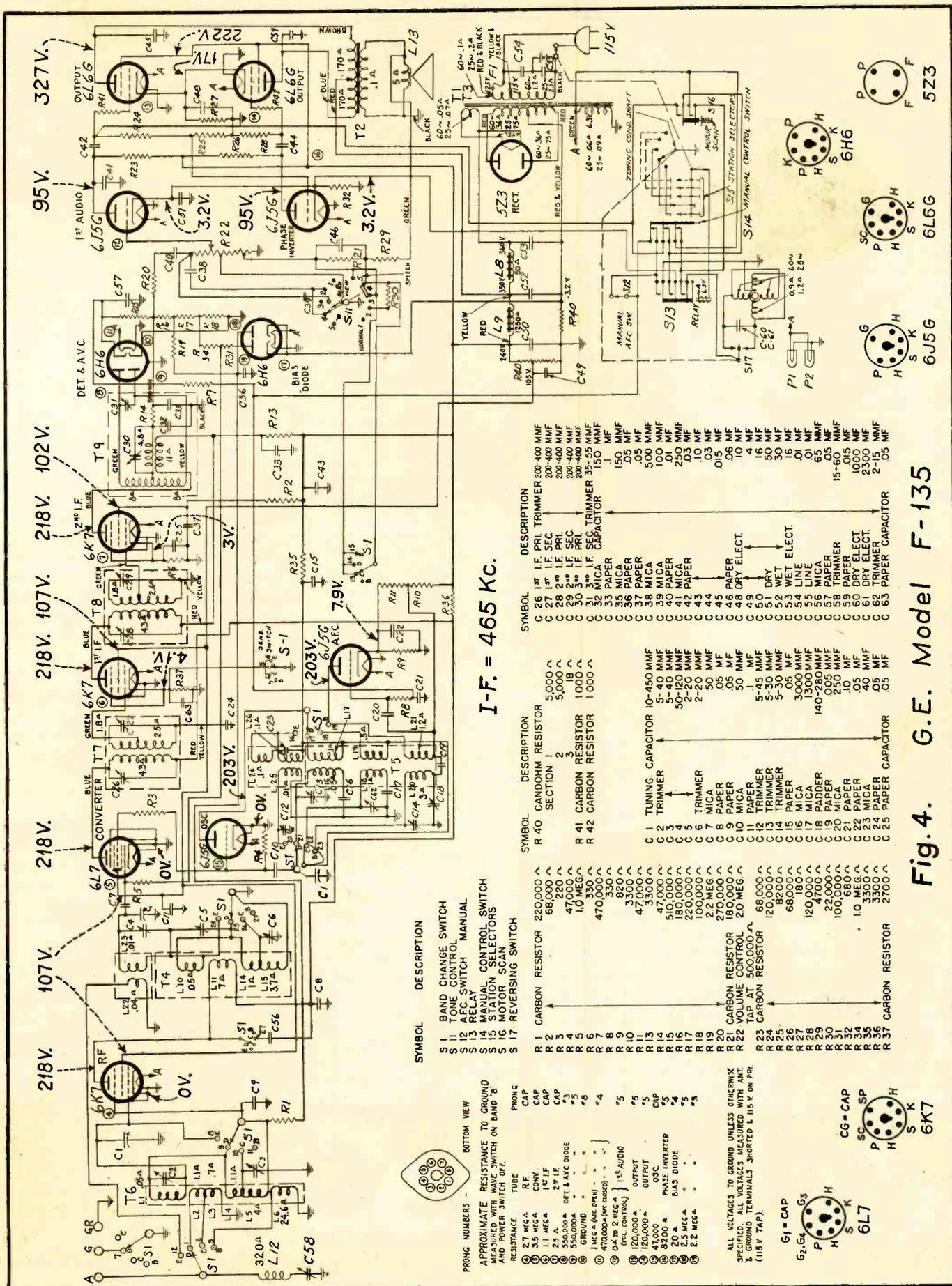
Band Switch Setting	Input Frequency	Point of Input	Dummy Ant.	Trimmer (See Fig. 9)	Remarks
1. Band "B"	465 kc. Sweep	2nd I.F. Grid	.05 Mfd.	3rd I.F. Pri. (C-30)	A.F.C. switch "off"—Condenser gang at minimum capacity vertical input of oscilloscope to ground and the junction of R-15, R-16, R-20 and Brown lead from the 3rd I.F. trans. Adjust trimmers in order listed for a single curve of maximum amplitude.
2. Band "B"	465 kc. Sweep	1st I.F. Grid	.05 Mfd.	2nd I.F. Sec. (C-29) Pri. (C-28)	
3. Band "B"	465 kc. Sweep	Converter Grid	.05 Mfd.	1st I.F. Sec. (C-27) Pri. (C-26)	
4. Band "B"	465 kc. Sweep	Converter Grid	.05 Mfd.	3rd I.F. Sec. (C-31)	Disconnect one end of C-57—Turn A.F.C. switch "on"—vertical input of oscilloscope to ground and discriminator cathode; prong no. 4 on 6H6. Adjust trimmer for cross on horizontal axis.
5. Band "B"	465 kc. Sweep	Antenna Post	250 Mmf. 400 Ohms	Wave Trap Trimmer (C-58)	Adjust for minimum amplitude.

I.F. Alignment with Output Meter

1. Band "B"	465 kc. Modulated	2nd I.F. Grid	.05 Mfd.	3rd I.F. Pri. (C-30)	A.F.C. switch "off"—Condenser gang at minimum capacity output meter connected across the voice coil—volume control at maximum—input as low as practical. Adjust all trimmers in order listed for maximum output. Do not attempt an over-all re-alignment once a stage by stage alignment has been completed.
2. Band "B"	465 kc. Modulated	1st I.F. Grid	.05 Mfd.	2nd I.F. Sec. (C-29) Pri. (C-28)	
3. Band "B"	465 kc. Modulated	Converter Grid	.05 Mfd.	1st I.F. Sec. (C-27) Pri. (C-26)	
4. Band "B"	.....	.....	.....	3rd I.F. Sec. (C-31)	See paragraph on A.F.C. adjustment.
5. Band "B"	465 kc. Modulated	Antenna Post	250 Mmf. 400 Ohms	Wave Trap Trimmer (C-58)	Adjust for minimum output.

R.F. Alignment

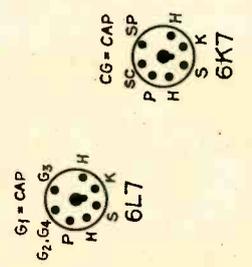
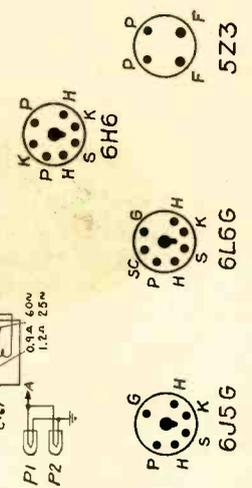
1. Band "B"	.....	.....	.....	.....	Turn A.F.C. switch "off"—Set dial pointer to first line at left-hand end of dial scale with condenser gang fully meshed.
2. Band "E"	42 mc. Modulated	Antenna Post	250 Mmf. 400 Ohms	Osc. (C-12) Ant. (C-4)	Connect output meter across voice coil—Turn tone control to bass. "E" band image should be 930 kc above input signal when oscillator trimmer (C-12) is peaked properly.
3. Band "D"	18 mc. Modulated	Antenna Post	250 Mmf. 400 Ohms	Osc. (C-13) R.F. (C-5) Ant. (C-2)	"D" band image should be 930 kc below input signal when oscillator trimmer (C-13) is peaked properly. Example: 15 mc.—image 14.07 mc. Peak C-2 and C-5 while rocking gang condenser.
4. Band "C"	5220 kc. Modulated	Antenna Post	250 Mmf. 400 Ohms	Osc. (C-62)	Adjust trimmer for greatest output with set dial at 5220 kc.
5. Band "B"	1500 kc. Modulated	Antenna Post	250 Mmf. 400 Ohms	Osc. (C-14) R.F. (C-6) Ant. (C-3)	Adjust trimmers, in order listed, for greatest output at 1500 kc.
6. Band "B"	580 kc. Modulated	Antenna Post	250 Mmf. 400 Ohms	Osc. Padder (C-18)	Adjust padder for maximum output in vicinity of 580 kc while rocking gang condenser.
7. Band "B"	.....	.....	.....	.....	Repeat operation No. 5



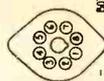
I-F = 465 Kc.

SYMBOL	DESCRIPTION
S 1	BAND CHANGE SWITCH
S 11	11 TONE CONTROL
S 12	12 AFC SWITCH
S 13	13 MANUAL CONTROL SWITCH
S 14	14 MANUAL CONTROL SWITCH
S 15	15 MOTOR SCAN
S 16	16 REVERSING SWITCH
S 17	17 REVERSING SWITCH
R 1	CARBON RESISTOR 220,000 Ω
R 2	68,000 Ω
R 3	68,000 Ω
R 4	47,000 Ω
R 5	1.0 MEG Ω
R 6	330 Ω
R 7	470,000 Ω
R 8	330 Ω
R 9	820 Ω
R 10	3,000 Ω
R 11	4,700 Ω
R 12	47,000 Ω
R 13	180,000 Ω
R 14	220,000 Ω
R 15	100,000 Ω
R 16	2.2 MEG Ω
R 17	270,000 Ω
R 18	180,000 Ω
R 19	20 MEG Ω
R 20	20 MEG Ω
R 21	CARBON RESISTOR 180,000 Ω
R 22	180,000 Ω
R 23	180,000 Ω
R 24	68,000 Ω
R 25	120,000 Ω
R 26	68,000 Ω
R 27	180 Ω
R 28	180 Ω
R 29	120,000 Ω
R 30	22,000 Ω
R 31	100,000 Ω
R 32	680 Ω
R 33	1.0 MEG Ω
R 34	3,300 Ω
R 35	3,300 Ω
R 36	2700 Ω
R 37	CARBON RESISTOR
R 40	CANDOHM RESISTOR
C 1	TUNING CAPACITOR 10-450 MMF
C 2	TRIMMER
C 3	TRIMMER
C 4	TRIMMER
C 5	TRIMMER
C 6	TRIMMER
C 7	MICA
C 8	PAPER
C 9	PAPER
C 10	PAPER
C 11	PAPER
C 12	TRIMMER
C 13	TRIMMER
C 14	TRIMMER
C 15	MICA
C 16	MICA
C 17	MICA
C 18	PAPER
C 19	PAPER
C 20	MICA
C 21	PAPER
C 22	MICA
C 23	MICA
C 24	PAPER CAPACITOR
C 25	PAPER CAPACITOR
C 26	PAPER CAPACITOR
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C 57	PAPER CAPACITOR
C 58	PAPER CAPACITOR

Fig. 4. G.E. Model F-135



ALL VOLTAGES TO GROUND UNLESS OTHERWISE SPECIFIED.
 DISTANCES MEASURED WITH ANTENNA GROUND TERMINALS SHORTED TO 115 V. ON P.R.



PRONG NUMBERS - BOTTOM VIEW
 APPROXIMATE RESISTANCE TO GROUND WITH SWITCH ON BAND 'B' AND POWER SWITCH OFF.

- ① 2.7 MEG Ω
- ② 3.5 MEG Ω
- ③ 1.1 MEG Ω
- ④ 2.5 A
- ⑤ 550,000 Ω
- ⑥ GROUND
- ⑦ 470,000 Ω
- ⑧ 0.4 TO 2 MEG Ω (1st AUDIO (REL. CONTROL))
- ⑨ 120,000 Ω
- ⑩ 120,000 Ω
- ⑪ 47,000 Ω
- ⑫ 8200 A
- ⑬ 20 A
- ⑭ 2.5 MEG Ω
- ⑮ 2.2 MEG Ω

GENERAL DATA—continued

15 of the band switch S-1 short out R-21 and C-46 so that the feed back circuit provides flat degeneration at all times. This reduces the possibility of howl on short waves due to excessive vibration of the chassis on low frequency notes.

DIAL MECHANISM

Tuning mechanism diagram (Fig. 1) is self-explanatory. The tuning condenser drive cord can be easily replaced without removing *any* part of the chassis while all dial indicating control cords are made readily accessible for servicing by merely removing the seven small screws holding the dial reflector assembly.

- (A) Manual drive leather faced bevel gear
- (B) Beveled idler gear
- (C) Tuning shaft gear
- (D) Volume control drive cord pulley
- (E) Band switch drive cord pulley
- (F) Tone control drive cord pulley
- (G) Belt driven spiral rod drive pulley
- (1) Spiral drive rod rider
- (2) Pointer slider guide rod
- (3) Tuning pointer spiral drive rod
- (4) Motor belt
- (5) Spiral rod bracket with bearing
- (6) Motor shaft collar
- (7) Clutch tension spring
- (8) Pulley dog
- (9) Motor shaft collar
- (10) Tone control pointer
- (11) Tone control cord pulley-stud
- (12) Band switch indicator
- (13) Band switch indicator cord pulley-stud
- (14) Long dial drive cord
- (15) Dial scale pointer
- (16) Volume control pointer
- (19) Short dial drive cord
- (20) Stationary spring support
- (23) Relay armature extension
- (24) Armature back stop

Fig. 3

AUTOMATIC FREQUENCY CONTROL

The automatic frequency control used in this receiver shifts the oscillator frequency so that the correct intermediate frequency is always produced.

The essential elements are the discriminator-transformer T19, the twin diode 6H6 with its balanced discriminator network, and the 6J5G control tube connected across the broadcast oscillator plate coil.

The discriminator transformer is designed to deliver (when properly tuned to 465 kc) equal voltages to each section of the 6H6. Under this condition the voltage drop across R-15 is equal and opposite to the voltage across the total resistance of R-16, R-17, and R-18, thus

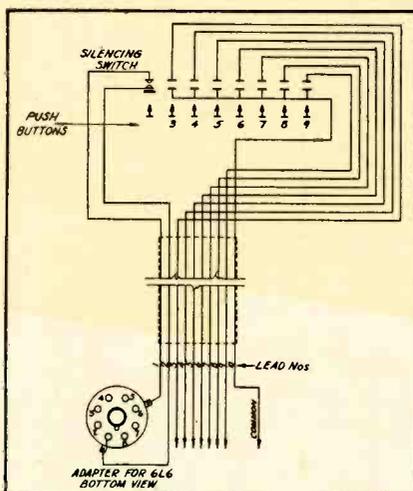


Fig. 2. Remote control cable connections, G.E. F-135.

no discriminator voltage is produced to control the 6J5G tube.

However, if the signal frequency is increased above 465 kc, unequal voltages are applied to the diodes, and the voltage over R-15 is greater than the voltage over the combined resistance of R-16, R-17, and R-18. The difference of these two voltages is positive and is applied to the 6J5G control tube.

When the signal frequency is decreased below 465 kc the result is less voltage over R-15 and a greater voltage over the combined resistances R-16, R-17, and R-18. The difference of these two voltages, as applied to the 6J5 control tube, is negative.

Thus three conditions arise:
On resonance, no discriminator voltage developed.

Above 465 kc, a positive control voltage.

Below 465 kc, a negative control voltage.

The 6J5G afc control tube has a combination of self and fixed bias, the latter

being the result of the current supplied through R-10 and R-11 to the cathode resistor R-9. The r-f voltage applied to the control grid of the 6J5G is obtained from the drop across the C-18 series padder and C-19. The vector sum of these two voltages is applied to the phase-shifting network C-20 and R-8 and in turn to the control grid. This phase-shifting network causes the control tube to appear as a reactance in parallel with the oscillator coil. The value of the apparent reactance depends upon the control voltage produced by the discriminator.

When the set is mistuned above the incoming signal the converter output is above the 465 kc required. A positive discriminator voltage is produced as explained above. This causes the 6J5G tube to act as more capacitive reactance and thus lowers the oscillator frequency; this gives a lower converter output frequency, approximately 465 kc.

When the set is mistuned below the incoming signal, the converter output is below the 465 kc required. A negative discriminator voltage is produced as explained above. This causes the 6J5G to act as less capacitive reactance thus increasing the oscillator frequency. This in turn gives a higher converter output frequency approximately 465 kc.

TOUCH TUNING

The General Electric Touch Tuning System was described in detail in the September 1937 issue, to which reference should be made for complete information.

REMOTE CONTROL

There are ten leads in the "Remote Touch Tuning Control" cable. These leads serve the following functions:

The No. 1 and No. 2 leads are connected to the octal base adapter and serve to connect the silencing button to the output tube.

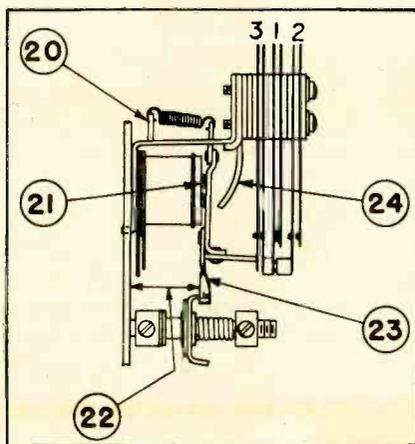
The No. 3 to No. 9 leads correspond to the button numbers and, with the No. 10 lead, provide the selection of stations from the remote control unit. These leads are to be connected to pins on the contact segment on the rear of the chassis.

Remove the least desirable station's letters from one of the "Touch Tuning" buttons of the receiver and insert the "Remote" tab. Note the number of this button as marked on the escutcheon.

Remove from a pin on the contact segment on the receiver, the lead which bears this number, and connect it to the No. 10 lead from the remote control cable, Fig. 3.

(The pin on the contact segment from

Fig. 3. Relay assembly, G.E. F-135.



NEW! — AN A. C. OSCILLATOR THAT HOLDS ITS ACCURACY

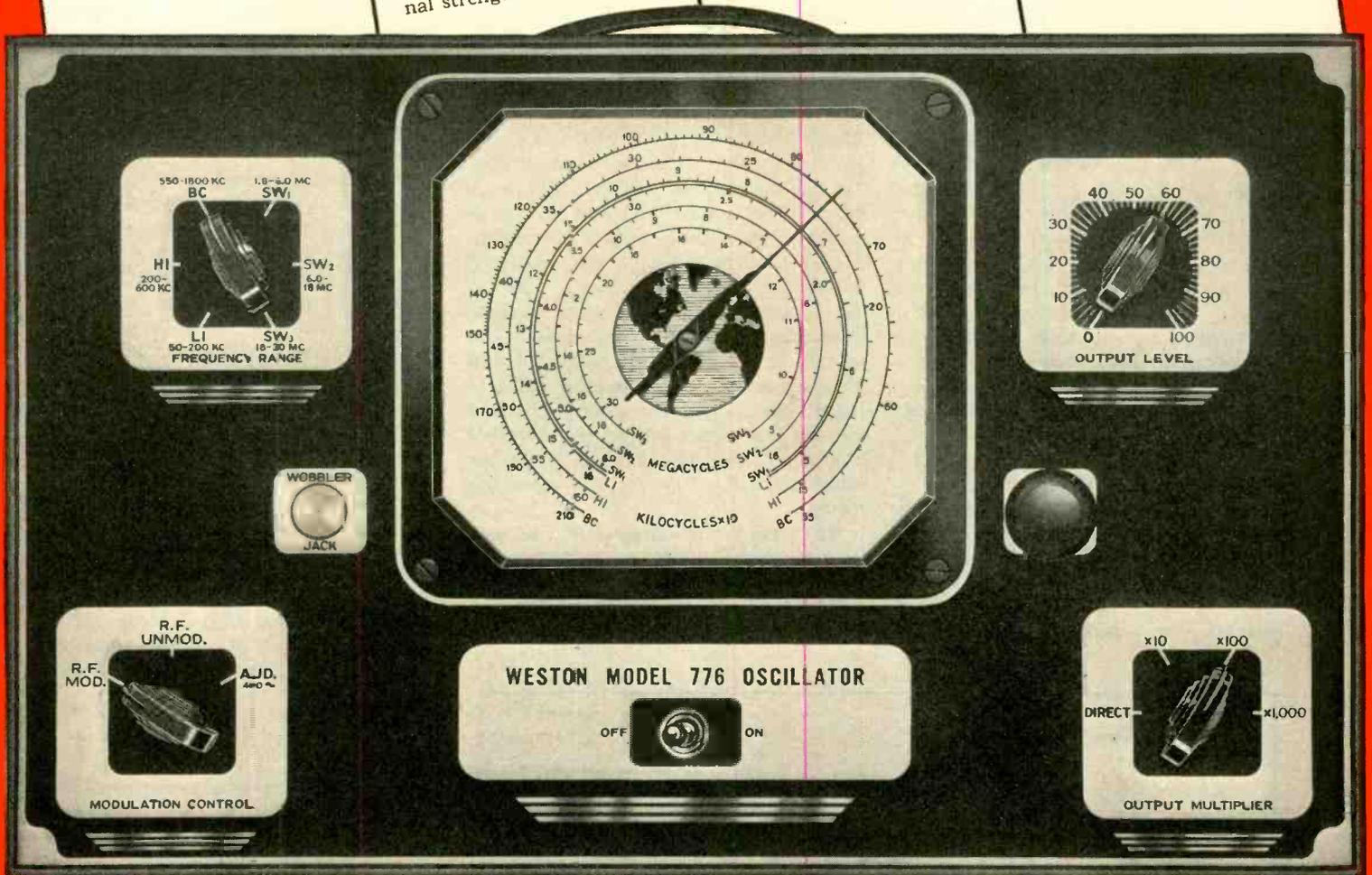
(Individually hand calibrated dials)

ACCURATE frequency calibration assured by large 330° fully visible *hand calibrated* dial! (Not troublesome trimmers or padders used.)

UNIFORM output level regardless of frequency assured by new WESTON A.A.C. circuit. Tuning oscillator or shifting frequency band does not increase or decrease signal strength.

CONSTANT signal free from drift or shift in frequency assured by A. A. C. circuit which automatically regulates mutual conductance of oscillator tube.

COMPLETE attenuation of signal on all bands assured by new WESTON design, thorough double shielding, and elimination of line feedback.



The above 4 features, heretofore available only in high priced laboratory oscillators . . . yet recognized as essential for thorough radio servicing . . . now are available *for the first time* in a practical service oscillator, *at a serviceman's price*. The new WESTON Model 776 Oscillator gives you all "four," *plus* 12

additional features and refinements. In addition, it has been styled to match other recent and widely popular instruments in the WESTON line. You will want all the facts on Model 776 . . . a serviceman's oscillator that fully meets WESTON'S high standards of accuracy and durability. The coupon will bring you complete literature.

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City State

GENERAL DATA—continued

which this lead was removed is left vacant.)

Now note the number of a receiver push button which bears the same call letters as a remote unit button. Remove the lead with this number from the pin on the contact segment. Connect to this pin the lead from the remote cable which corresponds to the above-mentioned remote unit button. Fasten the lead with a hex nut and tighten lightly with a pair of pliers or small wrench. Now reconnect the original lead to the pin. Proceed in the same manner until the seven remote button leads are connected.

There are three glass tubes in a row along the back of this receiver. Remove the center one of these tubes which is a 6L6G and place the adapter in the socket. Insert the 6L6G in the adapter.

When the "Remote Touch Tuning Control" unit is connected, as explained above, the action is identical with that of the regular station selection circuit. The remote button unit is in series with the "Remote" button lead on the receiver through lead No. 10 of the remote unit cable. The relay field coil circuit is completed through the set "Remote" button (S-15); the common (No. 10) lead; the depressed control button; its lead to a pin on the contact segment, and to ground through the sliding contactor. *The "silent" button must be in the released position when operating the receiver from either the remote control unit or from the receiver controls, otherwise no audio output will be obtained.*

RELAY ADJUSTMENTS

The following adjustments should be made with relay assembled on the motor bracket, Fig. 3.

(1) Make sure contacts are adjusted to open in correct sequence: center contacts (motor) first, contacts furthest from armature (AFC) second,

contacts nearest armature (silent tuning) last. *It is very important that the silent tuning switch open last.*

(2) Adjust backstop (24) so that the armature snaps closed when the relay coil is energized with 4.5 volts ac. The backstop must make a positive contact with the back of the armature in the open position; otherwise sluggish operation of the relay will result which will cause the motor drive to skip buttons. If the relay will not close at 4.5 volts and still maintain proper travel and sequence, weaken the spring on the rear of the armature plate by bending the stationary spring support (20).

(3) Loosen the setscrew on the motor shaft collar nearest motor (9) and adjust collar so that the pulley dog (8) misses the relay armature extension by .001 in. (relay not energized). All contacts must be closed when the relay armature touches the end of the motor dog; if the motor contacts open in this position, the armature will chatter.

(4) Spring adjustment (7) on slip clutch should be just tight enough so as not to allow slippage when driving the dial mechanism. Loosen setscrew on outside shaft collar (6) and screw the collar on the shaft to tighten slip clutch.

(5) The pole piece of the relay coil is divided in two semicircles. The relay armature should only touch the pole segments toward the motor shaft. There should be a .001 in. clearance between the back segment (21) and the armature when closed; otherwise a buzzing will be heard. Sometimes a front pole segment that is not perfectly flat will cause the same trouble. File off the offending bump.

(6) Backstop setting should be such that the distance (22) is 26/32 in. with the relay closed, and 29/32 in. with the relay open.

(7) Spacing between relay contact

points when open should be .015 to .018 inches for contact No. 1, and .008 to .010 inches for contact No. 2 and No. 3.

INCORRECT OPERATION AND SUGGESTED REMEDIES

Skipping of Stations

(a) "Touch Tuning" buttons' leads not making good contact to adjustable contact pins. Clean contacts and reinsert.

(b) Sliding contactor blade either covered by thin piece of bakelite or dirty. Carefully run fine file over top of sliding contactor, making sure not to leave any sharp corners. Sliding contactor should have small amount of vase-line on beveled surface to prevent chattering.

(c) Nipple too sharp on adjustable contacts will cause sliding contactor blade to jump across. Smooth off with fine sandpaper.

(d) Relay armature out of adjustment causing sluggish operation of relay switch. See paragraph 2 under Relay Adjustments.

(e) Excessive side play in sliding contactor. Loosen the setscrew on the back of the sliding contactor and slide holder together. Final adjustment should allow sliding contactor to rock freely.

(f) Not enough tension on sliding contactor arm. Loosen collar on shaft in rear of contact segment and move sliding contactor arm towards the contactor segment; then tighten collar on shaft.

(g) If the contacts at the rear of the "Touch Tuning" button assembly shafts do not close or make good contact, the motor will continue to scan the dial without stopping at the desired station.

(h) Contact segment may be bent out of shape. This should be perpendicular to chassis deck and parallel to rear chassis apron in order to allow the contactor arm to wipe the adjustable contacts evenly.

No Action When Station Button Is Pressed

(a) Relay remains energized and audio continues to function—push-button escutcheon grounded. Be sure dial and push-button escutcheons are insulated from each other or from the control shafts.

(b) "Off" switch contacts do not close.

(c) If set does not tune automatically unless scan button is also depressed, contacts No. 6, require closer spacing.

(d) Open or shorted motor capacitor—Characterized by motor arma-

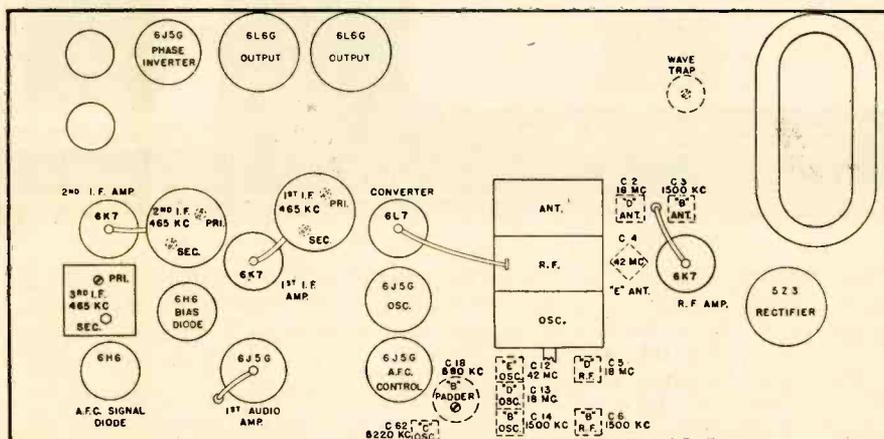


Fig. 5. Chassis layout, G.E.-135.

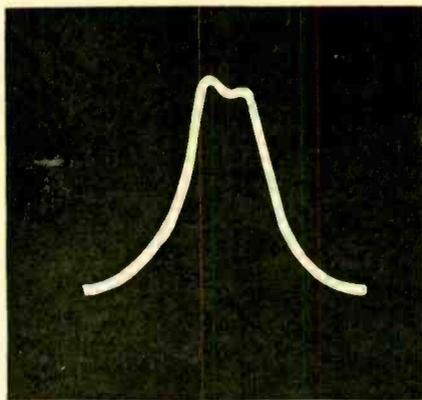


Fig. 6. G.E. F-135 overall i-f curve.

ture humming but no torque. Replace 1000 mfd capacitor C-60.

(e) Open or shorted coil in motor—Characterized by no torque or low torque in one direction. Replace motor or repair coil.

(f) Drive mechanism bound, or too tight for motor to drive.

(g) Not enough friction in Slip Pulley—The friction of the slip pulley is adjusted by tightening the collar on the end of the motor shaft. Care should be exercised that the setscrew does not hit the relay armature.

(h) Belt slippage—The tension of the belt may be increased by raising the motor on the relay bracket. If the belt still slips, reverse belt and use other surface or use belt dressing.

Miscellaneous Adjustments

(a) When a "Touch Tuning" button will not remain in a locked position, it usually indicates that the springs at each end of the latch bar are not in proper adjustment. They should exert an equal pull on each end.

(b) The fork on the tuning condenser should be adjusted so that the motor reversing switch clicks over when the pointer approximately reaches the 540 and 1620 kc markings on the dial scale. With the pointer at the extreme end of calibrations when tuning manually, the reversing switch lever should be set so there is not more than 1/16 inch nor less than 1/32 inch clearance between the lever and the switch trigger after the switch has snapped.

(c) The motor and relay mounting plate should rest parallel to the chassis deck. Do not adjust the spring tension foot; raise or lower motor on bracket, as required. Make sure that there is no electrical connection between the motor frame and the chassis.

(d) The "Off" switch on the "Touch Tuning" assembly should stay

closed for at least one-half the movement of the key, opening only on the final click. If firm contact does not exist between the points, vibration of the set may cause an intermittent noise.

(e) The silent tuning contacts of the "Manual" and "Scan" switches should open last to permit quiet operation.

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. A cathode-ray oscilloscope is preferred for i-f alignment.
3. A screwdriver type alignment tool.

The alignment procedure is given in table form along with the trimmer location drawing, Fig. 5. A "dummy antenna" should be used in all alignments and is the capacitor or capacitor and resistor used in series with the signal generator. The grid lead should not be removed from the tube to which the input signal is applied when aligning the i-f as this would remove the grid bias from the tube.

Automatic Frequency Control Adjustments.

After i-f alignment is completed with output meter, and without disturbing the generator setting, remove the signal generator lead from the grid of the 6L7 converter. Apply the 465 kc signal to the 6L7 grid capacitively through the insulation of the grid lead.

Tune in a weak broadcast station at about 1000 kc and, with the a-f-c switch "off," tune the receiver carefully for "Zero" beat between this carrier and the 465 kc generator signal. Throw the a-f-c switch on and adjust the 3rd i-f secondary trimmer C-31 to zero beat. This adjustment is very critical and must be made with great care. When the alignment is correctly done, there will be no appreciable difference in the beat note with the afc switch "on" or "off."

Another method of afc adjustment, after i-f alignment with an output meter, is to connect a low range voltmeter between the cathodes of the 6H6 discriminator. Leave the signal generator connected to the 6L7 grid, and without disturbing this 465 kc setting of the signal generator, adjust C-31. It will be noticed that the meter reads plus when C-31 is tuned off resonance on one side and negative when tuned on the

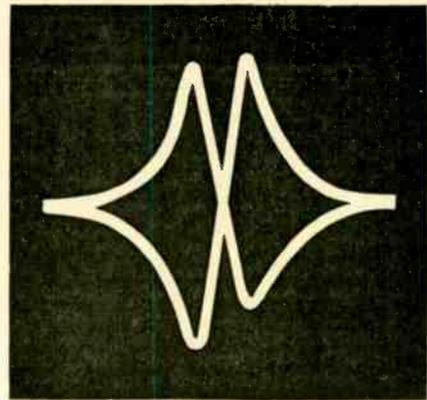


Fig. 7. G.E. F-135 adjustment curve.

opposite side of resonance. The correct adjustment of C-31 is between these positions, when the voltmeter reads zero.

Belmont 589

Tuning: Manual

Ranges: 535-1720 kc; 5.5-18.1 mc

Tubes:

1st Det: } 6A8G
Osc: }

I-f: 6K7G

A-v-c:

2nd Det: } 6Q7G
1st Audio: }

Pwr Amp: 6K6G

Rect: 5Y3G or 5W4

Power Supply: 110/130/230 volts, 40-60 cycle ac. Some models equipped with transformers for other frequencies are so marked.

I-f: 465 kc

Speaker: Electrodynamic

Field res: 2000 ohms

Voltages shown on the schematic diagram, were measured with the volume control full on, and with speaker connected.

In order to prevent signal from acting upon avc and affecting accuracy of voltage measurements, aerial and ground leads should be short circuited while making measurements.

Resistances of coils and transformer windings are indicated in ohms on schematic circuit diagrams.

To check for open bypass condensers, shunt each condenser with another condenser of the same capacity and voltage rating, which is known to be good, until the defective unit is located.

Excessive hum, stuttering, low volume and a reduction in all d-c voltages is usually caused by a shorted electrolytic condenser, open bypass condensers frequently cause oscillation and distorted tone.

ALIGNING INSTRUCTIONS

No aligning adjustments should be attempted without first thoroughly checking over all other possible causes of trouble, such as defective tubes, poor installations, open or grounded antenna systems, defective condensers and resistors.

In order to properly align this chassis, an oscillator (generator) is necessary. All adjustments should be made with a non-metallic screw driver.

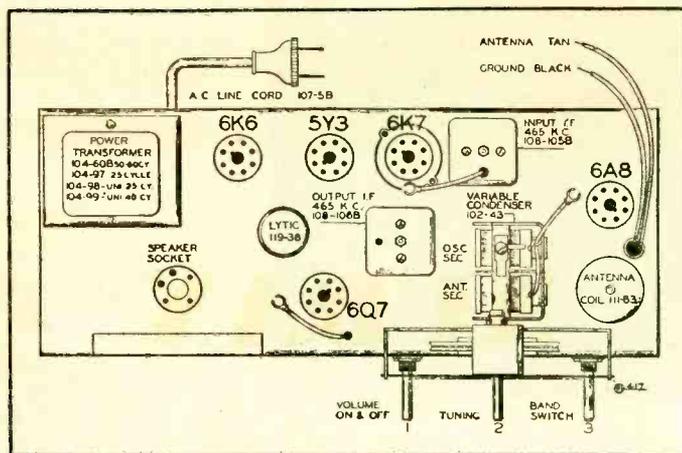
Use as a resonance indicator an output meter connected across the primary of the speaker input transformer or by means of an adapter between the plate and screen terminals of the type 6K6G output tube. Maximum deflection of the meter indicates resonance. Use only enough signal to get a readily readable output. A low range output meter or the low scale of a multi-range meter should be used.

The following dummy antennas are used in aligning and are referred to in the following alignment instructions as "Dummy 1," "Dummy 2," and "Dummy 3."

Dummy 1: (I-f)—Consists of a .1 mfd condenser connected in series with the external oscillator.

Dummy 2: (Broadcast)—Consists of a 200 mmfd condenser and a 20 ohm resistor connected in series with each

Fig. 2. Top side of chassis, Belmont 589



other and in series with the external oscillator.

Dummy 3: (Short-wave)—Consists of a .1 mfd condenser and a 400 ohm resistor connected in series with each other and in series with the external oscillator.

ALIGNING I-F

Part No. 108-106B output i-f transformer.

Part No. 108-105B input i-f transformer.

These transformers have two adjustments, both of which are accessible from the top of chassis.

1. With volume control full on (the extreme right of its rotation), the band

changing switch in the broadcast position (extreme left of its rotation), and with the variable condenser in its minimum capacity position, plates entirely out of mesh, make the following adjustments:

(a) Connect external oscillator set at 465 kilocycles, in series with "Dummy 1," to the control grid cap of the type 6K7G tube, and adjust the output i-f transformer (No. 108-106B) to resonance.

(b) With "Dummy 1" still connected, move oscillator output clip from grid of 6K7G to grid cap of 6A8G and

(Continued on page 36)

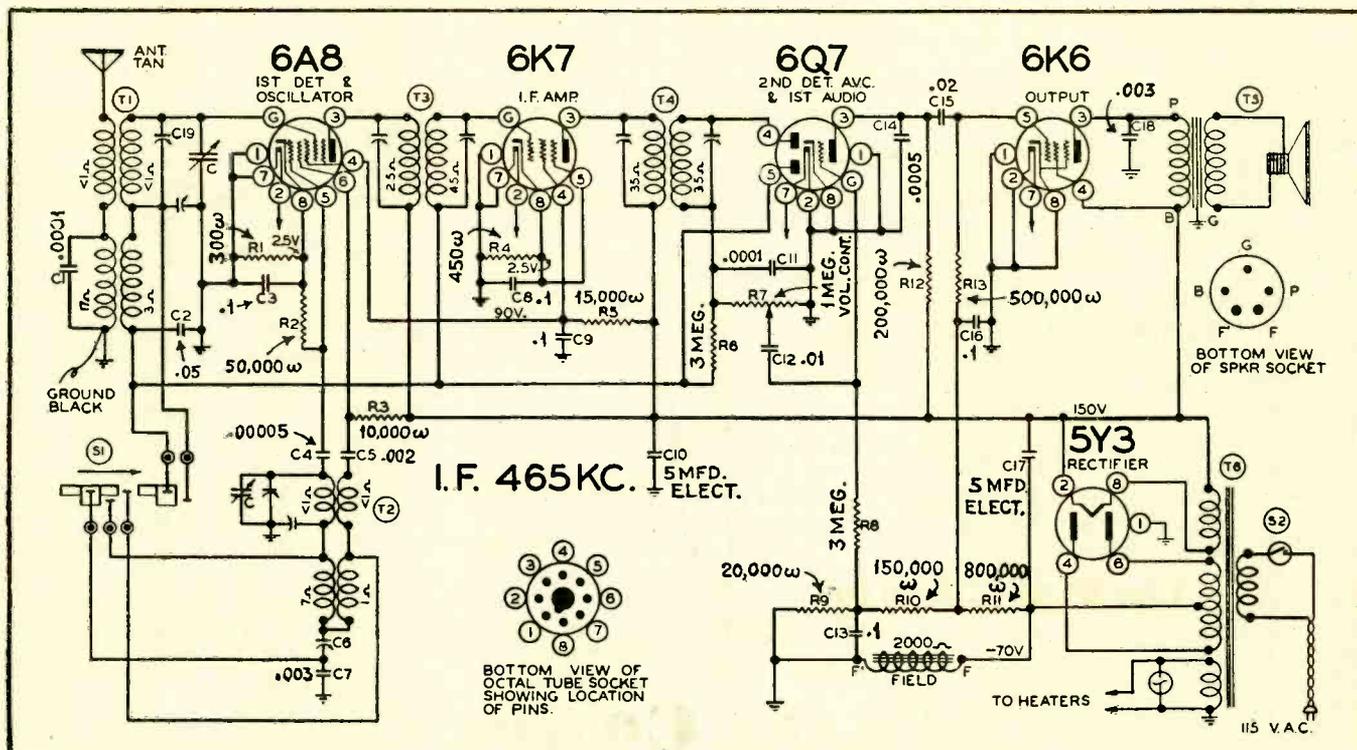


Fig. 1. Belmont 589 circuit schematic.

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*“The Standard
 by Which Others
 Are Judged
 and Valued”*

ENGINEERS and sound technicians will surely welcome this announcement—that practically flat response at “ceiling” frequencies can at last be assured. To 5,000, then to 6,000; then to 7,000—AUDAX has steadily raised the standard, till now the most difficult special studio work, involving real wide range, reproduces with uniformly flat characteristic. All the accustomed *facsimile* realism, the uncompromising conformity to original microphone recording—with this added feature which only AUDAX could provide!



THREE DISTINGUISHED MICRODYNE MODELS AT RIGHT

A pick-up for every purpose, from the humble portable to the most elaborate sound system.

List \$7.50 to \$260.00

MICRODYNE RF-6 Substantially flat to 10,000 cycles; for records up to 18 inches; needle impedance practically nil; feather touch on record; list.....\$125.00

MICRODYNE RF-5 Identical with RF-6, except that its response is not quite so uniformly flat; list..\$98.00

MICRODYNE RF-3 Substantially flat to 8,000 cycles; for records up to 12 inches; very low needle impedance; feather touch on record; list..... \$60.00

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Auto-Radio

RCA 8M

MODEL 8M is a five-tube superheterodyne receiver with loudspeaker and radio chassis in the same case. The receiver is designed to be mounted under the dash panel. The operating controls are integral with the radio and speaker case. Features of design also include magnetite-core antenna and i-f transformers; automatic volume control; and ignition-noise-suppression filter in the power-input circuit.

ALIGNMENT PROCEDURE

Remove all external screws to remove the chassis from the case. Hold the condenser gang in full-mesh position while rotating the dial scale so the low-frequency with the pointer. Loosen the three nuts in the front of the scale assembly for this adjustment. When referring to scale settings hold the front panel in place.

Perform alignment in proper order indicated below, starting with No. 1 and following all operations, then No. 2, etc. Adjustment locations are shown on Figs. 2 and 3.

Cathode-ray alignment is preferable; the connections to the chassis are shown on Fig. 3. If an output indicator is used, connect it across the loudspeaker voice-coil and advance the receiver volume control to full-volume position.

Connect the "low" output terminal of the test oscillator to the receiver chassis for all alignment operations. Regulate the output of the test oscillator so that minimum signal is applied to the receiver to obtain an observable output indication. This will avoid a-v-c action.

The term "Ant. Cable" means test oscillator signal should be applied to the

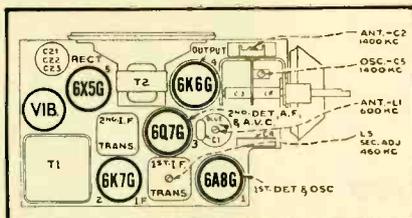


Fig. 2. Chassis layout.

receiver at the connector on the antenna cable extending from the receiver chassis. "Dummy antenna" means the device which must be connected between the "high" test-oscillator output and the point of connection to the receiver in order to obtain ideal alignment. "No signal, 550-750 kc" means that the receiver should be tuned to a point between 550 and 750 kc where no signal is received from a station or the local (heterodyne) oscillator.

(1) Test oscillator connected to grid cap of 6K7G i-f amplifier; dummy an-

tenna, 0.001 mfd; generator frequency 460 kc; receiver dial set for no signal, 550-750 kc; adjust 2nd i-f transformer for maximum output.

(2) Generator connected to grid cap of 6A8G det-osc tube; dummy antenna 0.001 mfd; generator frequency 460 kc; receiver dial set for no signal, 550-750 kc; adjust 1st i-f transformer for maximum output.

(3) Generator connected to "Ant. Cable"; dummy antenna 100 mmfd; generator frequency 1400 kc; receiver dial setting 1400 kc; adjust oscillator trimmer (C5) for maximum output.

(4) Generator connection, dummy antenna, dial setting, as in (3); adjust h-f antenna trimmer (C2) for maximum output.

(5) Generator connection and dummy antenna as in (4); generator frequency 600 kc; receiver dial setting 600 kc (adjust dial for maximum output at or near 600 kc); adjust L1 for maximum output. (The same inductance may be obtained for two different settings of L1. Use either setting).

(6) Generator connection and dummy antenna remain as in (5); generator frequency 1400 kc; receiver dial setting 1400 kc; adjust h-f antenna trimmer (C2) for maximum output.

SERVICE DATA

Loudspeaker: Centering of the loudspeaker is made in the usual manner with three narrow celluloid or paper feelers after first removing the front dust cover. This may be removed by softening its cement with a light application of acetone, using care not to allow the acetone to flow into the air gap.

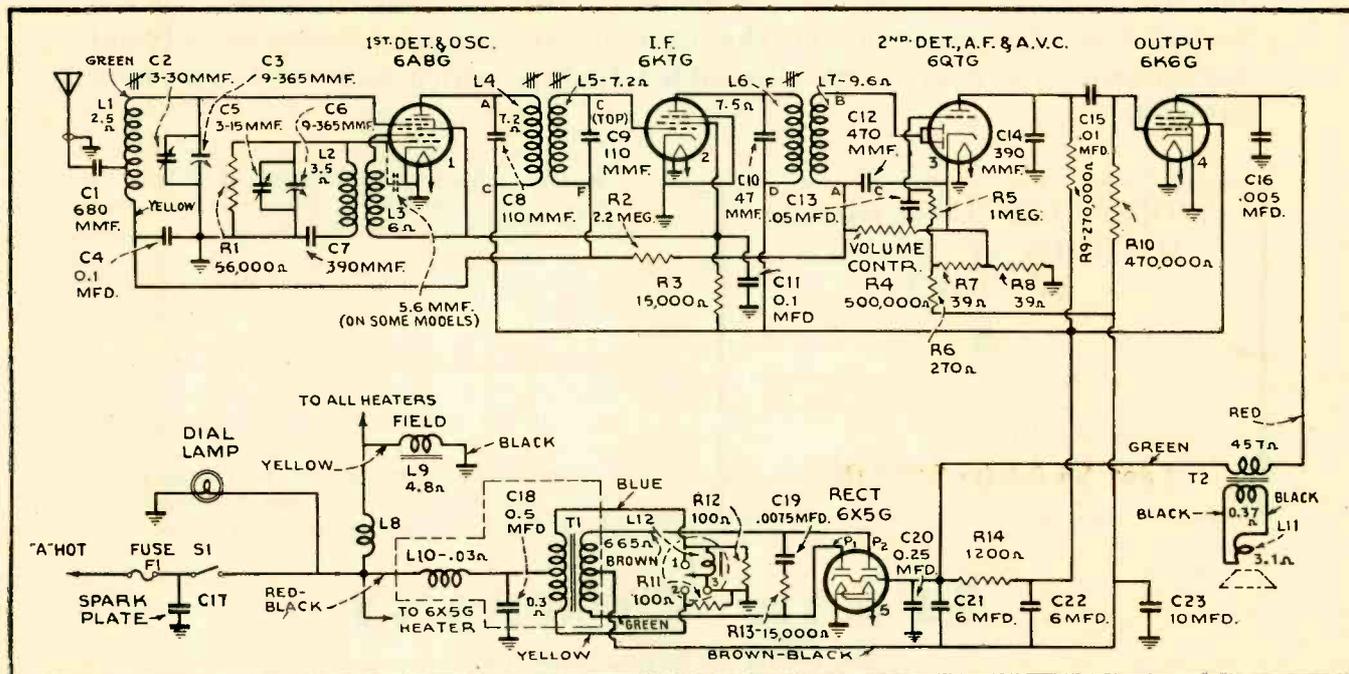


Fig. 1. Schematic diagram, RCA 8M.

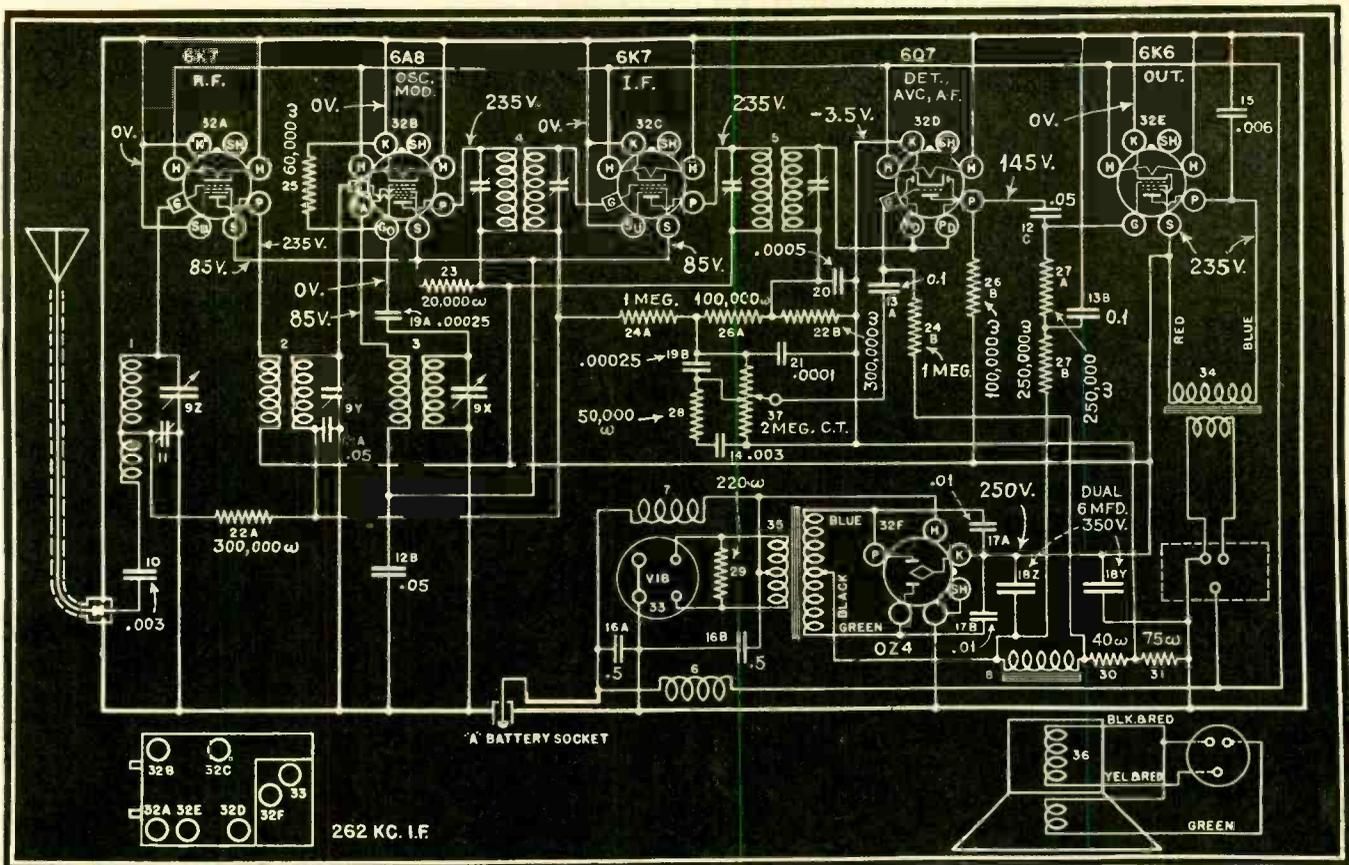


Fig. 1. Schematic of Crosley A-267.

A dust cover should be cemented in place upon completion of adjustment.

Vibrator: The mechanical vibrator used in the power system has a plug-in base for easy removal from the receiver. Its adjustment has been set during manufacture by means of special equipment. In cases of faulty operation a replacement unit should be installed.

Antenna Compensating Capacitor:

Trimmer C2 is accessible from the bottom of the receiver case (near speaker opening) and should be readjusted to give maximum signal output on a weak station or oscillator signal at approximately 1400 kc, after the instrument is installed. The antenna should be connected to the receiver during this adjustment. Refer to alignment operation number (6), above.

Crosley A-267

THE MODEL A-267 auto radio is a single unit, six-tube superheterodyne receiver. The power supply unit is built into a completely shielded compartment and is an integral part of the receiver chassis. The tuning range is from 540 to 1530 kc.

ALIGNMENT PROCEDURE

The receiver chassis should be in its case and a speaker similar to one used with the receiver must be connected to the chassis before making adjustments. It is advisable to use a spare control unit for making adjustments of the volume control and tuning condenser. A standard control unit with short cables (6" to 8") makes a very convenient and useful tool. If it is desired to shorten a pair of long cables it will be absolutely necessary to heavily tin the cables before cutting them. Connect the output meter to P and S of the 6K6G output tube. Be sure the meter is protected from dc by connecting a condenser (0.1 mfd or larger—not electrolytic) in series with one of the leads.

Tuning the I-F Amplifier to 262 Kc

(a) Connect the output of the signal

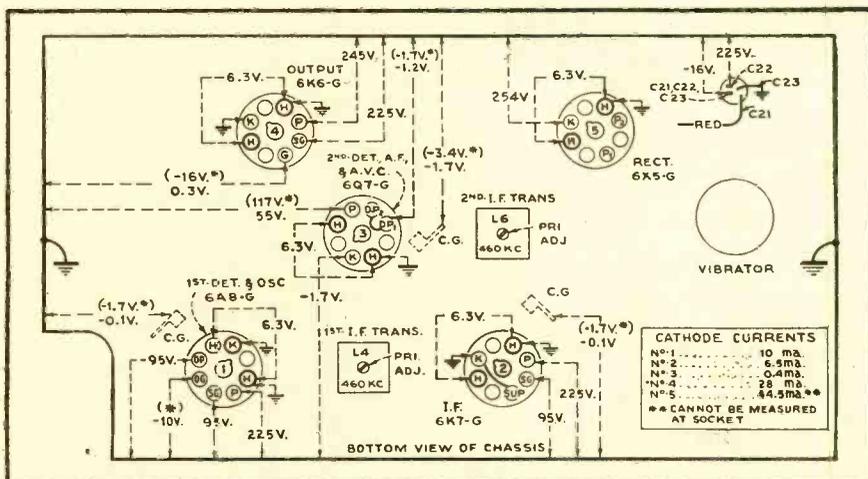


Fig. 3. Tube layout showing voltages, RCA 8M.

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AUTO-RADIO—continued

generator through a 0.02 mfd or larger, condenser to the top cap of the 6A8G osc-mod. tube, leaving the tube's grid clip in place. Connect the ground lead from the signal generator to the receiver chassis frame. Keep the generator leads as far as possible from the grid leads of the other screen-grid tubes.

(b) Adjust the station selector so that the rotor plates of the tuning condenser are completely in mesh, and turn the volume control full on.

(c) Set the signal generator to 262 kc.

(d) Adjust both trimmers located on the 2nd i-f transformer for maximum output.

(e) Adjust both trimmers located on the 1st i-f transformer for maximum output.

(f) Repeat operations (d) and (e) for more accurate adjustments.

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

Aligning R-F Amplifier

(a) Connect the output lead from the signal generator through a 0.00025-mfd

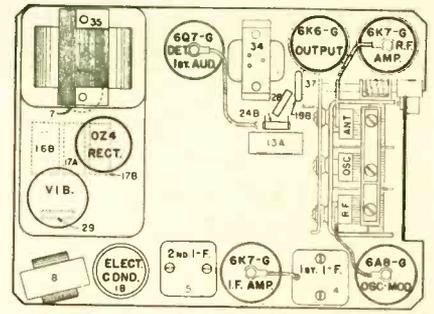


Fig. 2. Top chassis of Crosley Model A-267.

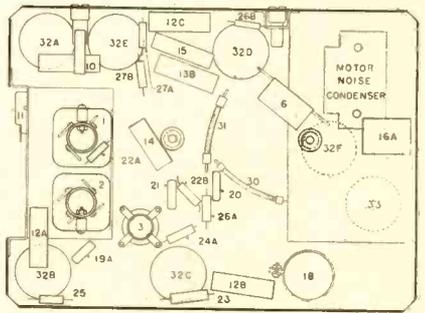


Fig. 3. Underside of Crosley A-267 chassis.

condenser to the "ANT" connection of the receiver.

(b) Set the signal generator to 1530 kc.

(c) With the condenser gang all the way open, adjust the "OSC" trimmer condenser so that the 1530-kc signal is heard. It is not necessary that the receiver tune through this signal.

• SERVICE FOR

AUTO-RADIO—continued

(d) Set the signal generator to 1400 kc.

(e) Tune in the 1400-kc signal with the station selector (approximately 140 on the dial) for maximum reading on the output meter.

(f) Adjust the "R-F" trimmer condenser for maximum output.

(g) Adjust the "ANT" trimmer condenser for maximum output.

Do not readjust the "OSC" trimmer condenser.

(h) Repeat operations (e), (f) and (g) for more accurate adjustments.

Adjusting Antenna Compensating Condenser

(a) Set the signal generator to 600 kc.

(b) Tune in the 600-kc signal with the station selector for maximum output.

(c) Adjust the antenna compensating condenser, Item No. 11, Fig. 3, for maximum output.

(d) Repeat operations (b) and (c) alternately until no further improvement can be obtained.

(e) Set the signal generator to 1400 kc again.

(f) Tune in the 1400-kc signal with the station selector for maximum output.

(g) Readjust the trimmer on the "ANT" section of the tuning condenser for maximum output.

It will be necessary to adjust the antenna compensating condenser to the car antenna after the receiver has been installed in the car.

(a) After the installation is complete, tune in a weak station between 55 and 65 on the dial.

(b) Adjust the antenna compensating condenser for maximum volume in the speaker.

Note: It should be noted, in connection with the tube socket voltages given on the schematic diagram (Fig. 1) that the negative bias applied to the first three tubes is -3.5 volts, measured across a 75-ohm resistor (Item 31). The 6Q7G tube has a negative bias of -1.9 volts measured across a 40-ohm resistor (Item 30). The 6K6G output tube has a negative bias of -20 volts applied to the grid and is measured from the high side of the "B" filter choke (Item 8) to chassis.

Philco 602C

Set dead: Shorted trimmer on oscillator tuning condenser. This difficulty is reported frequently on this model.

Willard Moody

Philco 600C

Set dead: Look for broken lead to oscillator coil. If found, install new lead.

Willard Moody

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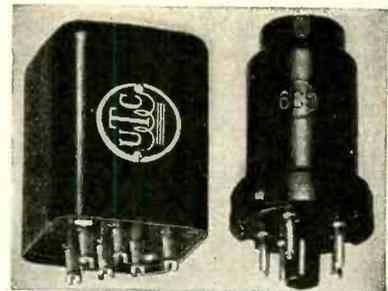
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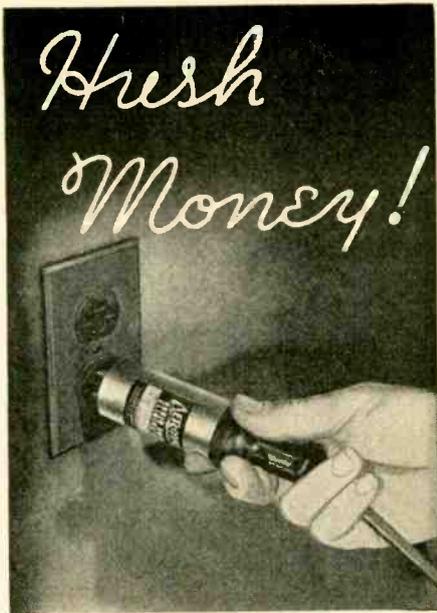
Type No.	Application	Primary Impedance	Secondary Impedance	Your Price
A-10	Low impedance mike, pickup, or multiple line to grid.	50, 125, 200, 250, 333, 500 ohms.	50,000 ohms.	\$6.00
A-12	Low impedance mike, pickup, or multiple line to push pull grids.	50, 125, 200, 250, 333, 500 ohms.	80,000 ohms overall, in two sections.	\$6.00
A-14	Dynamic microphone to one or two grids.	30 ohms.	50,000 ohms overall, in two sections.	\$5.40
A-16	Single plate to single grid.	8,000 to 15,000 ohms.	60,000 ohms, 2:1 turn ratio.	\$4.80
A-18	Single plate to two grids.	8,000 to 15,000 ohms.	30,000 ohms overall, 2.3:1 turn ratio overall.	\$5.40
A-20	Mixing, low impedance mike, pickup or multiple line to multiple line.	50, 125, 200, 250, 333, 500 ohms.	50, 125, 200, 250, 333, 500 ohms.	\$6.00
A-24	Single plate to multiple line.	8,000 to 15,000 ohms.	50, 125, 200, 250, 333, 500 ohms.	\$6.00
A-26	Push pull low level plates to multiple line.	8,000 to 15,000 ohms each side.	50, 125, 200, 250, 333, 500 ohms.	\$6.00
A-27	Crystal microphone to multiple line.	100,000 ohms.	50, 125, 200, 250, 333, 500 ohms.	\$6.00
A-30	Audio choke, 300 henrys @ 2 MA 6000 ohms D.C., 75 henrys @ 4 MA 1500 ohms D.C. Inductance with no D.C. 450 henrys.			\$4.20

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Local AEROVOX jobber has these filters and line noise analyzer in stock. Ask to see them. Or write us for folder CR on line noises.



GETTING ON IN RADIO

(Continued from page 10)

A rather special notation is used when referring to the characteristics of vacuum tubes. The small letter *r* indicates resistance. Thus r_p is the plate resistance of a tube, where *p* (opposite in position to exponent) is called the *subscript* and identifies the particular resistance. Similarly, E_p , E_g , E_f ; and I_p , I_g , I_f indicate the plate, grid, and filament voltages and currents respectively of the same tube. (Table 2)

Finally, many pages of experimental data are abbreviated and put into picture forms by means of curve plots. The information of Table 3, for example, is shown in Fig. 1. The amount of current in amperes is depicted by the equal segments marked off on the horizontal or *x* axis. Voltage is given on the vertical or *y* axis. Numbers in the directions OX and OY are positive. The line drawn through the points (some points are not exactly on the line, indicating a slight experimental error in the original measurements) shows visually the relation between *x* current and *y* voltage at any time. When one increases or decreases, the other does also. If both factors change together, as in a straight line plot, the current and voltage are *proportional*. On the other hand, if one increases as the other decreases, the relation is said to be *inversely proportional*.

Fig. 2 shows the current-voltage characteristic of a copper-oxide rectifier element. To depict the full relation it is necessary to use the complete graph form having four sections or quadrants about the origin. Their order reads counter-clockwise about 0. All points on the axis to the left of the vertical are negative; points lying below the horizontal axis are negative. All others are positive. Thus one reads from Fig. 2:

- Quadrant 1, Point A: $x = +4$ volts;
 $y = +1$ ampere
- Quadrant 2, Point B: $x = -5$ volts;
 $y = +1$ ampere
- Quadrant 3, Point C: $x = -4$ volts;
 $y = -15$ milliamperes
- Quadrant 4, Point D: $x = +6$ volts;
 $y = -2$ amperes

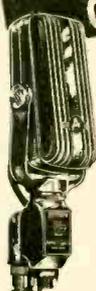
A change in vertical units with a given variation of horizontal units is called the *slope* of a curve. If the curve goes through the origin, the slope is the ratio between the vertical and horizontal values at any point (Fig. 1). In Fig. 3:

$$\begin{aligned} \text{the slope} &= \frac{\text{change in } y}{\text{change in } x} \\ &= \frac{5-2}{8-2} = \frac{3}{6} = 0.50 \end{aligned}$$

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1. Often the mechanism is not locked up tightly enough after setting it up, thus the settings change as the set is used. After the last button has been released by pushing in and pulling out the setup knob, turn the setup knob to the left. The dial pointer will go to the left end of the dial scale. After this, keep *forcing* the setup knob in the counter-clockwise direction. Force it just as hard as it is possible to do by hand.

2. All automatic tuning receivers should be operated on a *good outside antenna* to give maximum signal strength. An inside aerial, while it may permit satisfactory reception for a manually tuned set, will not provide sufficient signal to properly operate the afc during automatic tuning. Many dealers connect several sets to one antenna in their stores. This is liable to result in poor automatic operation, since it cuts down signal strength.

3. Buttons should be set only to *nearby, powerful stations*, since automatic frequency control cannot function properly unless the signal strength is good. Weak or fading stations should be tuned manually. If the user insists on setting up weak stations, he should be advised that automatic tuning of these stations is not as satisfactory as manual tuning.

4. Before setting up, turn the receiver on for at least 20 minutes so that all parts are at their normal operating temperatures.

5. In the Models 1865 and 1866, the true control *must be in one of the first three positions* when stations are being set up. The fourth (fully clockwise) position, broadens the tuning and so *must not be used during setup*.

6. After a button has been set-up and released, do not push this button again until the mechanism is locked up. *Do not try to check the setting of the buttons by pushing them in before being locked*, as this will change their setting.

7. Tune very carefully when setting the stations making use of the visual tuning indicator.

8. When releasing the last button by pushing in the setup knob, do not turn the setup knob. Push it straight in or you will destroy the setting of the last button.

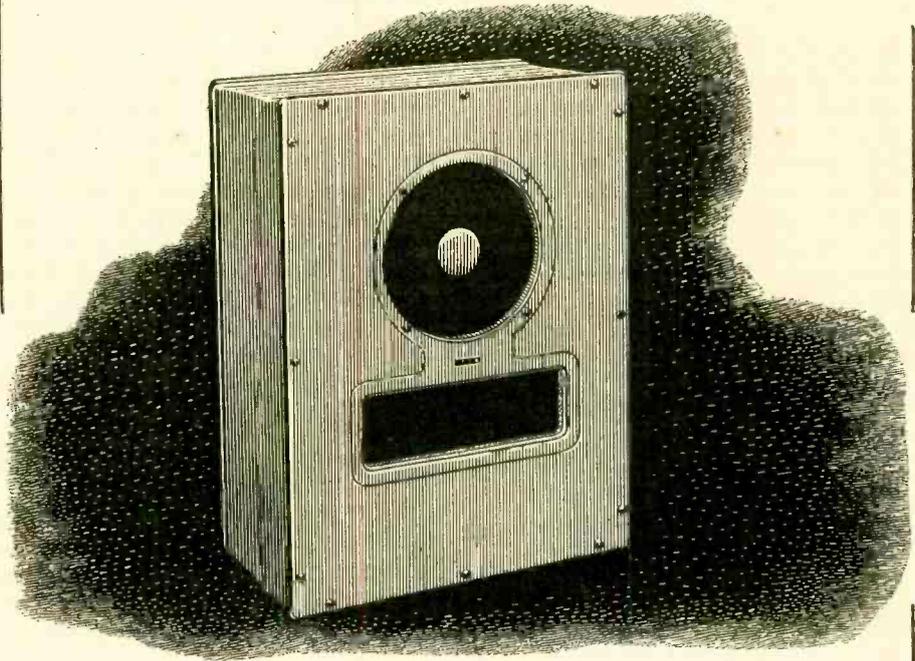
9. Do not set more than one button to the same station. When this is done, and if one, and then the other button is pushed, the mechanism will hum and the clutch will slip. The same thing may happen when the set is tuned manually to a station, and then the button for that station is pushed in. This difficulty causes no harm if another button is pushed to release the mechanism.

10. Set up buttons from left to right.

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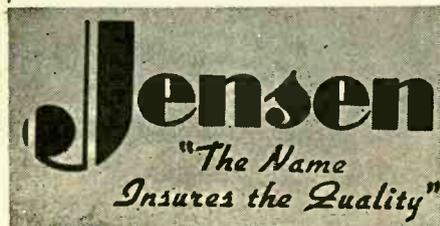
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Sound Service . . .

PROFITS IN SOUND RECORDING

By R. C. POWELL*

IF YOU are now engaged in the sale or rental of public-address equipment, don't overlook the extra profits that can be made in the allied field of sound recording. Hundreds of sound service organizations have added recording turntables to their equipment during the past year and are now actively exploiting the broad money making possibilities of personal recording.

Selling personal phonograph records is ridiculously simple. Just let the prospect hear a short record of himself. He will be amused and intrigued by the sound of his own voice because he has never before heard it as it sounds to others. He will see immediately the amusing possibilities of recording the talks on an evening program, the chances of using the recording idea for "putting across" the entertainment he is planning. And if it happens to be a charity affair he will see the profitable side of selling personal phonograph records to the guests.

Instantaneous recordings never fail to liven the proceedings at conventions, banquets, club meetings and musical gatherings. Let any orchestra or group of singers, amateur or professional, hear a sample recording of their efforts and they will keep you recording for them as long as their money holds out. Sound men find that while price may be the major factor in selling a public-address installation they may get double their price if the recording service is offered in addition.

THE EQUIPMENT

Amazing improvements have been made in sound recording equipment during the past year. A simple recording turntable, costing less than \$100.00 can now be added to any public-address system to make recordings. If the microphone and amplifier are of good quality the reproduction from the recordings will be so faithful that only an engineer familiar with the high-fidelity reproduction obtained from theatre or broadcasting station equipment can distinguish them from the finest recorded music available. Instantaneous recordings actually have less surface noise than commercial phonograph records and they may be played one hundred or more times without showing serious de-

terioration. The cutting head furnished on these low priced recorders requires about one-half watt of audio power and record a frequency range extending from 100 to 4,000 cycles. This is the range reproduced by automatic phonographs and radio sets selling in the popular price range; it is the range of frequencies that nine out of ten people choose to listen to as is indicated by the way they adjust the tone control of their radio sets at home.

Complete recorders including amplifier and microphone sell from about \$150.00 and up. The least expensive high-fidelity sound recorder reproducing the full range which it is possible to obtain from lateral cut recordings (50 to 6000 cps) sells at about \$600.00. The latter instruments make both 78 rpm phonograph records and 33 1/3 rpm electrical transcriptions.

DISCS

Blank records used for making mod-

ern instantaneous recordings consist of an aluminum disc, coated on both sides with a cellulose compound. These are commonly referred to as "acetate" records. Actually they are not cellulose acetate because acetate is so tough that it ruins a cutting needle within a few minutes.

The coating on the disc is about 0.008" thick. The recording needle cuts a groove about 0.003" deep, or about half-way through the coating. As the needle cuts the groove, the sound energy fed to the cutting head causes the needle to vibrate, laterally, creating waves and tiny notches in the walls of the groove. When the record is played back the sound impressions in the walls of the groove cause the playing needle to vibrate. This generates electrical impulses in the pickup which when amplified reproduce the original sound.

Unlike the aluminum and pregrooved records which were at one time used for instantaneous recording, material is actually cut from the surface of the cellulose coated disc. As the groove is cut, a fine black thread of material collects on the surface of the disc. When the record is completed, this thread is brushed off and the record is ready to be played.

Cellulose coated discs are available in 6", 8", 10", 12" and 16" sizes playing

(Continued on page 37)



Moviegoers at the Capitol Theatre, Washington, D. C., give their comments on the picture as they leave the theatre. Their voices are recorded and broadcast on the morning program next day from WRC.

*Presto Recording Corp.

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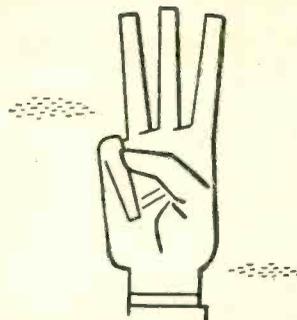


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ASSOCIATION NEWS . . .

RSA

CLEVELAND.—The annual meeting and election of officers was held on January 3rd, at which time the Cleveland Chapter elected the following officers: L. F. Vangunten, Chairman; Horace M. Ricks, Vice-Chairman; Joseph Repar, Secretary; Rudolph Trammell, Treasurer. Mr. A. J. Theriault was designated by the chapter as a candidate for the national board of directors from that district.

A chicken dinner was served, followed by several rounds of boxing. Mr. Neal Bear officiated in his capacity of "Official Photographer" and took many rounds of action pictures of the group. SOHARSM, with its bewildering display of robes and ceremony, was in full swing immediately following the adjournment of the general meeting. Many prominent members of the Cleveland Chapter were initiated in this mystic society.

BOSTON.—Boston Chapter of RSA, a group of servicemen representing the old IRSM and the old RTG of Boston, held a consolidation meeting in Boston on January 10, 1938, and voted unanimously to amalgamate their two old organizations and affiliate with RSA under the name of Boston Chapter of RSA.

The following officers were elected at this meeting: President, Al Wells; Vice-President, Mr. Staples; Corresponding Sec'y, Ingver Paulsen; Recording Secretary, Mr. Shirks; Treasurer, Mr. Kemmes.

CHICAGO.—Chicago Chapter of RSA held a set-chassis show at which fifteen of the leading set manufacturers displayed their latest touch-tuning sets. Service engineers connected with these various manufacturers were on hand to explain the details of the various sets.

Another meeting of the Chicago Chapter was held on January 23rd, at which time S. R. Cowan of SERVICE was a guest speaker. Immediately following Mr. Cowan's address, election of officers was held, at which time the following men were elected: Chairman, Ray Mason; Vice-Chairman, Lew Evans; Secretary, Robert Storey; Treasurer, S. A. Gazinski.

INTERSTATE.—Interstate Chapter of RSA of Davenport, Iowa, will hold its first annual election of officers on February 1, 1938.

The chapter has doubled its membership since it was organized on December 10, 1937.

This chapter is under the leadership of George D. Wooley, Chairman, and B. Ray Williams, Secretary.

NEW JERSEY.—The Radio Servicemen of New Jersey, with headquarters in Newark, is the most recent as well as one of the largest organizations of Service Men to petition the RSA for membership. This group is cooperating with local authorities in and around Newark looking towards the alleviation of the evils caused by misbranding of radio sets by unscrupulous manufacturers.

This newest chapter of RSA is under the direction of Carl Rauber, Chairman; Norman L. Andreatta, Treasurer, and Albert Fasanello, Secretary, who were elected at its last election held in January.

SHOW NEWS

The Exhibition Hall at the Stevens Hotel, where the 1938 National Radio Parts Trade Show will be held June 8 to 11, inclusive, has been laid out as a city, to be known as Radio Parts City. Each street, avenue and boulevard will be named in honor of a deceased outstanding figure in the development of radio, such as Marconi, Ampere, Edison and so on.

The office of Radio Parts Manufacturers National Trade Show announces that all the principal meetings having to do with manufacturers, distributors, and sales representatives will be held concurrently at the Trade Show. By holding all the meetings at 10:00 A. M., on Thursday, June 9, the organization business affairs will be completed early, leaving all forces free to attend the show.

Especial attention is called to the fact that the 1938 National Radio Parts Trade Show will open on Wednesday, June 8, and close on Saturday evening, June 11. The show period does not include a Sunday as in the past.

DULUTH.—The Associated Radio Servicemen of Duluth was one of the first group of Service Men in the country to affiliate with RSA. Under the leadership of M. O. Andresen, President; Eric N. Holmlund, Vice-President, and Edward J. Durand, Secretary-Treasurer, a drive for membership is going on to the point where in the near future the Duluth Chapter should have all of the qualified Service Men living in that area in their ranks.

CALIFORNIA NEWS

Information just received reveals that the Radio Service Association of California, Inc., has been up to its customary activities at the past few meetings. Without being exactly certain *when* each of the following events took place (Editor's note to California: any chance of getting the dope on your meetings in a more complete form? It would be appreciated!) here are a few from the recent past.

A talk about the new Mt. Palomar 200-inch telescope; another one on some RCA tubes, and scheduled for about the time this issue reaches the West Coast, is one by General Motors, presumably, but not inevitably, on radio.

BUFFALO

At a meeting held late in December, 1937, The Association of Radio Service Engineers, Buffalo, N. Y., elected the following officers for 1938: President, A. Schreiber; Vice-President, J. Klemens; Executive Secretary, F. Bestine; Treasurer, V. E. Ball; Sergeant-at-Arms, J. Reese; Librarian, P. Kieffer.

The standing committees for the year 1938 were named by President Schreiber on January 18. These committees and their respective members are:

Speakers: T. J. Telaak, E. Pufpaff, A. Dymac, O. Miller, F. Sturtevant, J. Cummins, G. Franz, J. Hankins, and R. Jennings.

Entertainment: J. Reese, W. Ball, and G. Franz.

Publicity: J. E. Stoffel, R. W. Wagner, and L. Roberts.

Membership and Investigating: K. Kidder, A. Babbitt, and E. Martin.

Finance and Audit: P. Bennett, H. Keller, and G. Gray.

At the same meeting, John Bestine was appointed Corresponding Secretary.

PHILADELPHIA

January 4th we stepped forth gaily in what promises to be another "top" year for the Philadelphia Radio Service Men's Association. New officers ascended the rostrum, new ideas in the air, "big doin's" for the coming months of 1938.

We call your special attention to the great annual electrical exposition to be held in Philadelphia's huge Convention Hall the week of April 17th to 23rd, inclusive. The Electrical Association of Philadelphia says that the 1938 Show already gives promise of being the largest ever held.

Put the date down now and plan to join with PRSMA in actively promoting Philadelphia's "hit" show of the year.

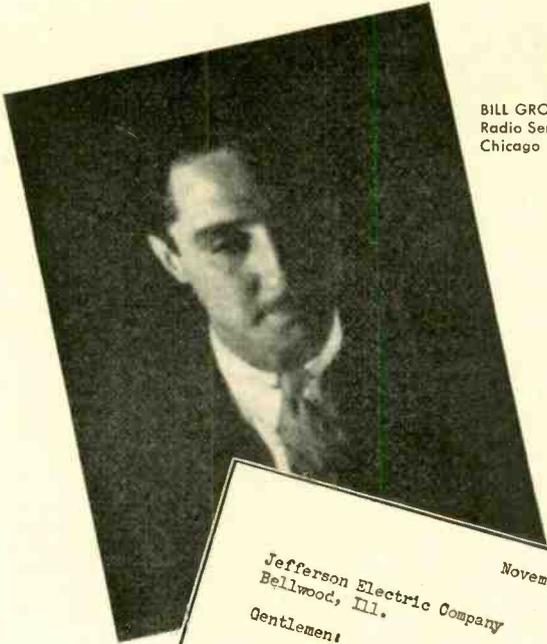
Also, in a recent issue of the PRSMA News, is the following statement from the association's president:

"For the first meeting in January much is to be said. A goodly crowd there at an early hour, but due to some unforeseen circumstances, a bit of delay in getting started. (We'll ask those who know some stories, be on hand well in advance the next time!)

"Once started though, we enjoyed a right smart and snappy meeting and one to give the new year a good push along the right trail. With few changes in the personnel of officers and committees, it lends confidence that meetings will continue to be better and bigger during the year. We have Larry Oebbecke still captaining the Entertainment Committee, and there's no doubt of something worth-while at all of the coming gatherings. Then there's the energetic Bob Thorn still very ably superintending the advent of new members (also reinstatements) and assisting in securing jobs for those who desire them.

"There is not a bit of doubt that our flag will be displayed on time, and other property of the Association will be looked after efficiently since these duties have been placed in the hands of Charlie Brophy. The magazine will continue to look up to Joe Bishop for its future advice. Nevertheless, the machinery for dispatching notices of our meetings seems to require an unusual amount of oil before it will run smoothly.

"In this connection, and for the time being, may I suggest that all our members mark their calendars and remember the dates so that the first and third Tuesdays of every month will be set aside for this purpose. Then, if you fail to receive notice of the meeting, come out anyhow. You will be notified of any change. Let's get there as near 8 o'clock as possible, have our good time, and get home early. Also keep in mind that there are refreshments at our closed meetings as well as the open ones."



BILL GROMMES
Radio Service Engineer
Chicago

November 16, 1937

Jefferson Electric Company
Bellwood, Ill.

Gentlemen:

During the past five years, I have recommended Jefferson Radio Transformers to my customers and friends. That these transformers are technically and electrically correct, is evidenced by the fact that I do not recall a single complaint.

My sales and service work are increasing steadily, which means better income for me.

Respectfully yours,
Bill Grommes

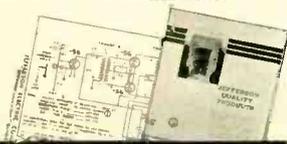
"More Sales— Better Income"

● Good radio men know the value of using dependable replacement parts when servicing sets . . . Giving a customer a replacement job that satisfies is the surest way to future profits.

Mr. Grommes is another of the thousands of radio service experts who have found that Jefferson Transformers help to increase their sales and service work and add to income . . . As Mr. Grommes says—"that these transformers are technically correct is evidenced by the fact that I do not recall a single complaint."

Jefferson Transformers have the backing of an organization specializing in radio work since when it was called "Wireless"—Jefferson engineers have cooperated with the country's outstanding radio set builders—and Jefferson Transformers are used regularly for replacement work and by "ham" operators in all parts of the world.

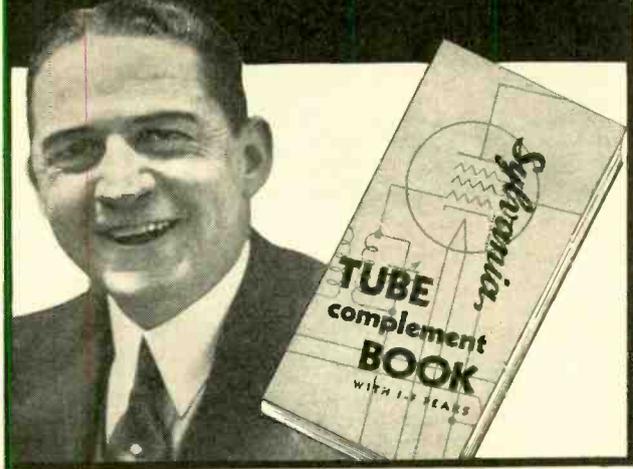
Increase your profits in 1938 by using dependable Jefferson Transformers . . . Write for 1938 Catalog 372-R and Manual of latest Amplifier Circuit Diagrams. JEFFERSON ELECTRIC COMPANY, 904-25th Ave., Bellwood, Ill. Canadian Factory: 535 College Street, Toronto, Ont.



JEFFERSON

Radio Transformers

"I'M THE BOY WHO'S SATISFIED!"



"I paid 25c for a tube complement book that has already repaid its cost in time and money saved!"

The Sylvania Tube Complement Book can save you money, too. For it tells before you leave to service a set, just what tubes you will need. That means no return trips to the shop . . . no wasted gasoline . . . no loss of valuable time.

Servicemen like this tube complement book. It gives the tube complements of 10,386 radio models . . . contains the most complete and largest compilation of i-f peaks available . . . names and addresses of all active radio receiver manufacturers . . . helpful articles dealing with tube selling, etc.

And there are lots of other features too—all designed to be of help to servicemen. So hurry—send 25c and the coupon below for your copy of the Sylvania Tube Complement Book. Or get it from your local jobber.

Hygrade Sylvania Corp. also manufactures the famous Hygrade Lamp Bulbs.

SYLVANIA

Set-Tested Radio Tubes

HYGRADE SYLVANIA CORP.
Emporium, Pa.

S-28

Enclosed please find 25c. Send me my copy of your new Tube Complement Book right away.

Name

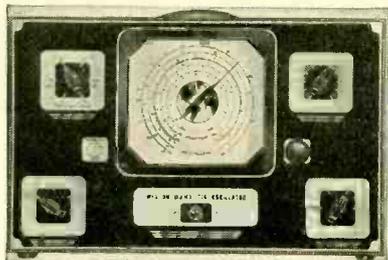
Address

City State

Dealer
 Amateur

Service Man
 Experimenter

THE MANUFACTURERS . . .



WESTON OSCILLATOR

A test oscillator said to be completely new in design, featuring precision control both as to frequency and output level, has just been introduced by the Weston Electrical Instrument Corporation, Newark, N. J. The unit is equipped with a unique circuit providing automatic amplitude control at any required level from 1 microvolt to 100,000 microvolts. It is designed for high-stability operation from any 110-120 volt, 60 cycle, a-c line, with output characteristics independent of fluctuations in line voltage.

The direct reading 330-degree dial, with six frequency scales averaging over a foot in length, is individually calibrated with hand-drawn scale division. The new oscillator covers all frequencies from 50 kilocycles to 30 megacycles in six wavebands.

The wave form generated by the unit is permanently held to the proper characteristics. Provision is made for r-f output modulated at 400 cycles, for continuous wave output, and for audio-frequency oscillation. A wobbler jack permits frequency modulated input to the unit.

Four tubes are utilized in the circuit; a rectifier, the oscillator and amplitude control tube, a buffer and a modulator. Despite the wide-range coverage in frequency and output level, the oscillator is sufficiently compact to be easily portable.—SERVICE.

TUBE SHIELD

Users of Goat form-fitting tube shields will be interested to learn that an improved design is in the offing. It is said that the new shields will incorporate features which will probably find a ready acceptance. Further details will soon be available from Goat Radio Tube Parts, Inc., 314 Dean Street, Brooklyn, N. Y.—SERVICE.

SOLAR TRANSMICA LINE

Illustrated here is the high voltage, heavy current-carrying Transmica line of mica dielectric transmitting capacitors engineered by Solor Mfg. Corp., 599 Broadway, N. Y. City.

Clamp, anchored into case, is said to eliminate hum. Hermetically sealed glazed porcelain case. Full specifications may be had by writing to this manufacturer.—SERVICE.

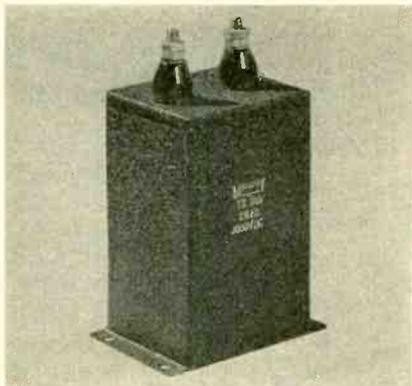


MALLORY HIGH-VOLTAGE CONDENSERS

P. R. Mallory and Company, Inc., Indianapolis, Ind., announces a new line of condensers, types TX and TZ, for radio transmitter and high-power amplifier applications.

Mallory TX Transmitting Condensers are housed in compact rectangular metal cans, finished with a durable black crackle enamel that matches the other standard transmitter components. Two ceramic stand-off terminal insulators are provided.

Mallory TZ Condensers are dual purpose units designed for use in either transmitter filters or heavy duty power-amplifier circuits. These condensers are supplied in round aluminum cans having threaded necks for inverted mounting. Upright mounting can be employed by using a standard ring bracket.—SERVICE.



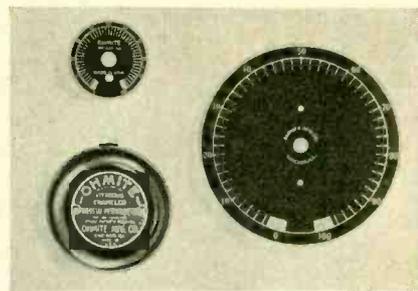
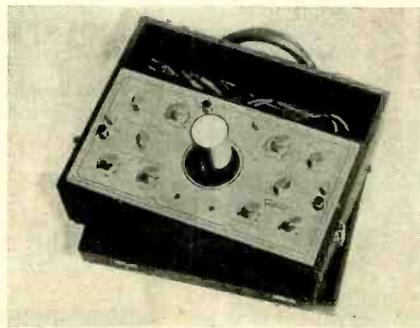
TURRET-TUBE OSCILLOSCOPES

The Triplet Electrical Instrument Co. now offers new oscilloscopes with two-inch and three-inch screens, both incorporating the exclusive Triplet turret-tube mounting feature.

This development in tube mounting is said to permit easy adjustment of the tube up or down, or to either side, so that the screen is always in direct view of the operator. An adjustable shield permits easy reading in brightest daylight.

These new oscilloscopes meet requirements for the visual study and adjustment of circuit problems. Linear sweep from 15 to 20,000 cycles.

Model 1690 2" oscilloscopes, shown here, is furnished in two case styles—DeLuxe leatherette, or metal with black wrinkle finish. The 3" oscilloscope, slightly larger, is in the metal case only.—SERVICE.



OHMITE RHEOSTAT DIALS

Specially designed dial plates are available for Ohmite Vitreous Enameled Rheostats, to provide easy and accurate setting of the rheostat—a large 5½" size for Ohmite Rheostat Models N, R, and U—and a smaller 2 3/16" size for Models H, J, K, and L.

The plates are brass and etched black. The dials are calibrated numerically and read directly in percentages of resistance in the circuit. Areas instead of lines indicate the zero and the one hundred positions enable the dials to be used on rheostats with slightly different angles of rotation.

The large dial has two holes for mounting to the panel. The small dial is held to the panel by the same nut which holds the rheostat and is automatically aligned by means of a hole which fits over the projecting lug from the rheostat non-turn washer.

A sturdy 3¼" knob (for 3/8" shaft) of black bakelite with a brass insert is also available and may be had with a pointer as shown above for use with 5½" dial, or without pointer when so desired.

Various knobs for ¼" shafts for use with the small dials are also available. Ohmite Manufacturing Company, Chicago, Ill., is the source of these dials.—SERVICE.

RCA 884

Differing essentially in heater voltage from its well-known predecessor, the 885, the RCA 884 is a gas-type triode. With the heater rated for operation at 6.3 volts, the use of the 884 with other 6.3-volt tubes will be facilitated. Among the suggested applications is in the design of sweep-oscillator equipment. Further details may be obtained from RCA Manufacturing Co., Inc., Harrison, N. J.—SERVICE.

AMERICAN DYNAMIC MICROPHONE

Claimed to be exceptionally small in size, the D7 and D7T microphones, made by American Microphone Co., 1915 South Western Avenue, Los Angeles, Cal., are only 1½ inches in diameter. The microphone is available in either low impedance (D7) or high impedance (D7T) models. These microphones are said to be especially adaptable to airplane, marine, police, and amateur services.—SERVICE.

(Continued on page 41)



• SERVICE FOR

Just Off The Press

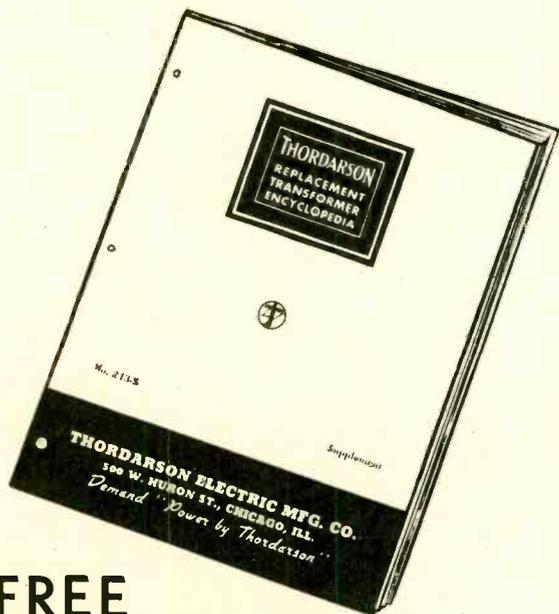
TRANSFORMER REPLACEMENT DATA ON ALL 1938 RADIOS

Covers Rider's Vol. VIII

FREE SUPPLEMENT THORDARSON TRANSFORMER ENCYCLOPEDIA

No. 243-S

A quicker, better way to spot correct replacement transformers for every 1938 model radio listed in Volume VIII of Rider's Manual.



FREE

This supplement supplied free to all owners of Thordarson's Transformer Replacement Encyclopedia No. 243. Get your supplement today from your parts jobber or write Thordarson.

THORDARSON ELECTRIC MFG. CO.
500 W. HURON ST., CHICAGO, ILL.
Demand "Power by Thordarson"



HERE'S THE LOWDOWN

on the HIGH PERFORMANCE of UTAH SPEAKERS

- ➔ Voice coils are matched to any output impedance through universal matching transformers.
- ➔ New methods of impregnation give UTAH cones and voice coils extremely long life. This is particularly evident under adverse atmospheric conditions.
- ➔ Enclosed field coils, on High Fidelity models, keep out dirt and moisture.
- ➔ All UTAH speakers will carry much greater inputs than their rated capacity.
- ➔ You get more *useful* volume per dollar.
- ➔ Even moderately priced models give true high fidelity reproduction.
- ➔ You *always* get the right speaker for the job. The UTAH line is the most complete ever manufactured!

A wide variety of UTAH speakers are specifically designed to make replacement easy and more profitable for servicemen.



See your jobber, or
address department S-2
for Speaker Catalog.



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

BUENOS AIRES — UCOA RADIO PRODUCTS CO.

"16 YEARS OF LEADERSHIP"

RADIO SERVICEMEN OF AMERICA INC.

● INCORPORATED NOT FOR PROFIT

304 SOUTH DEARBORN STREET

CHICAGO, ILLINOIS

President - - - - T. P. Robinson
 Vice President - A. C. W. Saunders
 Secretary - - - - Ingvar Paulsen
 Treasurer - - - - Lee Taylor
 Executive Secretary - Joe Marty, Jr.

To Qualified Servicemen—

RADIO Servicemen of America, Inc., developed from a desire of outstanding radio servicemen in all parts of the country to have an association qualified to assume its rightful place in the industry. The entire aim and desire of RSA is to provide an organization of such character that servicemen will be proud to belong to; that the radio industry will consider an integral part of its structure; and that the public will accept because of the high business and professional character of its membership.

The first step taken was to insure, through its by-laws, that the control of the policies and business affairs of the organization should be forever vested in its qualified members, anyone of whom is eligible for service on the board of directors. The by-laws further guarantee that the organization shall be independent and free from subsidy or domination.

An equitable method of representation based directly on radio set population has been worked out whereby the country has been divided into twenty districts. Before June of 1938, members in each district will elect a director to represent them on the national board of directors. As specified in the by-laws, the directors thus elected will constitute the governing body of RSA and will carry on and expand the work thus far done by the first organizing board. The term of office of directors is two years, at the end of which time new directors will be elected by the members in each of the districts.

Qualifications for membership are determined by the local chapters of RSA. Further provision has been made that wherever a local affiliated chapter exists, an applicant must become a member of such local chapter and must be certified to the national office by the proper chapter officers before he can be accepted as a member of the national body; likewise, when a member-at-large moves into an existing chapter area, he must become a member of the local chapter. RSA feels that local problems can best be solved by a united local group acting in the best interests of the majority.

In carrying out these expressed aims and desires, RSA is definitely not interested in a quantity membership, as such. This organization will continue to build its membership from the ranks of radio servicemen who are willing to assume the responsibility of leadership in their profession, true to the ethics of good business and to the welfare of the public they serve.

RSA is the only national service organization that has ever enjoyed the support and cooperation of outstanding individuals as well as all the organized groups within the industry.

Upon acceptance of applications, a member will immediately receive a certificate of membership suitable for framing and a pocket membership card. Regular mailings will be made of advance circuit diagrams which we are receiving by virtue of the cooperation of set manufacturers. A monthly house organ containing interesting news and editorials will be mailed to members. We stand ready at all times to help local chapters and individuals solve problems that affect their welfare. We are embarking upon a program designed to educate the public to the need of reliable radio servicing and will use such media as newspapers, periodicals and local broadcasts in towns where local chapters already exist. Through the pledged cooperation of publishers, manufacturers and trade journals, we offer our members accurate, expert information and technical advice at no cost. Through these same contacts, a National Speakers Bureau is being established to provide outstanding speakers for all chapters desiring experienced lecturers. Education in actual service problems as well as technical theory is planned for the immediate future.

All of the above services are rendered to our members at only \$2.00 per year for national dues for 1938. Fill out the application form herewith and send it to the national office at once. Where a local affiliated chapter exists, your application will be sent to the proper local Secretary for certification and upon your admission to the local chapter and upon payment of local and national dues for 1938, you will receive immediately your membership card and other material mentioned above.

Radio Servicemen of America, Inc.

(Incorporated Not for Profit)

304 South Dearborn St., Chicago, Ill.

APPLICATION FOR MEMBERSHIP

Gentlemen:

I hereby make application for membership in the Radio Servicemen of America, Inc.

Affiliated with Local Chapter in.....

Personal Name

Home Address

City State.....

Firm Name

Address

Telephone (home)..... (firm).....

Years Experience..... Age.....

Membership in other Associations.....

Whole or Part Time Radio Serviceman.....

If Part Time, what portion is devoted to Radio Servicing (¼, ½, ¾, etc.).....

What are your other duties.....

Education other than Radio.....

Radio Training or Courses.....

Testing Equipment

.....

.....

It is my sincere desire to become a member and adhere to your principles of fair competition and ethics and if accepted do solemnly swear (or affirm) that I will faithfully fulfill my obligation as a member of the Radio Servicemen of America, Inc.

Signed
 Applicant

Approved: Chapter Secretary.....

Executive Secretary



Fill in necessary information—tear out—mail to RSA, attention of Joe Marty, Jr., Executive Secretary, 304 S. Dearborn St., Chicago, Ill.

USING AN INDICATOR TUBE IN NON-AVC RECEIVERS

(See Front Cover)

ACCORDING to an article by L. C. Waller in the *RCA Review*, it is possible to use a cathode-ray type tuning indicator tube (the 6E5) with receivers that do not have avc or a diode detector.

The arrangement shown in the diagram on the front cover is applicable to t-r-f sets and to superheterodynes which use cathode-resistor-biased detection. Potentiometer R2 is set at the detector cathode potential; this places a positive voltage, equal to the no-signal bias of the detector, on the grid of the 6E5, opening the shadow. Cathode resistor, R1, in the 6E5 circuit is then adjusted so that the shadow just closes to a narrow line.

When an r-f signal is tuned in the plate current of the detector increases, causing an increase in the voltage drop across R2 and R3; this, in turn, causes the shadow angle to open. Detuning the receiver from the signal will cause the shadow angle to close up.

The 6E5 is thus acting as a tuning indicator, but in the reverse direction to that commonly experienced. This, however, should not be objectionable in the least; it is simply a case of "the larger the shadow, the better the tuning." Persons with no experience with a tuning indicator tube can just as easily learn to tune for *maximum* shadow angle.

Tuning in an unusually strong signal may cause the shadow to open fully and lose its indicating value. This is due to excessive voltage across R3. In this event, move the slider of R2 toward the ground end, and readjust R1 for a closed pattern with no signal.

Airline 62-425

Hum and oscillation. Almost invariably the filter condensers which are unsatisfactory in this model.

Francis C. Wolven



"Model 502 has almost super-human ability to separate 'Good' or 'Bad' tubes regardless of type, number of elements, or filament termination"

LEE DE FORRES

"I am particularly glad to see SUPREME introduce so efficient and reliable an instrument as the Model 541 Set Tester."

KARL W. MILES,
Chief Engineer,
The Hallcrafters, Inc.

"I was really amazed at the excellence and flexibility of Model 5E1 Analyzer considering its very low price."

McMURDO SILVER,
President,
McMurdo Silver Corp.

GOVERN YOUR NEXT INSTRUMENT PURCHASE BY THE OPINION OF

Men Who Know!

Read what 6 famous radio engineers have to say of Supreme instruments! Then—see these very same instruments at your parts jobbers. Look them over carefully. Test them to your heart's content—We know you'll be a Supreme booster, too, after that!

EASIEST INSTALLMENT TERMS!

And, remember, you can buy any Supreme instrument on Supreme S. I. C. terms—the world's easiest installment terms! See your jobber!

JUST OFF THE PRESS!

FREE ILLUSTRATED 1938 CATALOG. Write for it.

SUPREME INSTRUMENTS CORP.

GREENWOOD, MISSISSIPPI, U. S. A.

Export Dept., Association Exporters Co., 145 West 45th St., New York City
Cable Address: LCPRIH, New York.



"Supreme is to be congratulated on the fine instrument they have built in the Model 501 Tube Tester."

HENRY L. ARGENTO,
Field Engineer,
Raytheon Production Corp.

"Model 581 Signal Generator is a distinct and important contribution to rapid, intelligent and scientific radio service work."

ALFRED A. GHIRARDI,
Radio Technical Consultant,
Radio & Technical Publishing Co.

"I have found that the Supreme Model 586 Oscilloscope is one of the most complete, accurate, perfectly engineered service instruments I have ever used."

WM. L. DUNN,
Chief Engineer,
Belmont Radio Corp.

HEADLINE NEWS FOR 1938

FEBRUARY

ST. PAUL, MINNESOTA

ATR SMASHES VIBRATOR PRICES

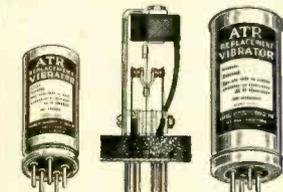
DRASTIC PRICE REDUCTIONS EFFECTIVE IMMEDIATELY ON COMPLETE ATR REPLACEMENT VIBRATOR LINE

Examples of ATR price reductions:

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

New prices subject to normal discounts.

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



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

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

Insist on ATR VIBRATORS, the Best by Test.

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

Manufacturers of D.C.-A.C. Inverters, Inverter Vibrators, "A" Battery Eliminators, and Battery Chargers.

AMERICAN TELEVISION & RADIO CO.
128 East Tenth Street St. Paul, Minnesota

MADE BY

Engineers FOR
Engineers



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

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

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

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



RADIO-WIRE
products

SERVICE MEN

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

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

GENERAL DATA—continued

adjust input i-f transformer (No. 108-105B) to resonance.

SHORT-WAVE ALIGNMENT

1. With band changing switch in the short-wave position, extreme right of its rotation, and with external oscillator set at 17 megacycles and connected in series with "Dummy 3" to the antenna and ground leads, make the following adjustments:

(a) Move dial pointer to 17 megacycles and adjust short-wave oscillator trimmer to resonance.

This adjustment is the trimmer mounted on the top of rear section of the variable gang condenser.

(b) Adjust short-wave antenna trimmer (Adjustment Number 1), to resonance.

BROADCAST ALIGNMENT

1. With band changing switch in the broadcast position, extreme left of its rotation, and with gang condenser in its minimum capacity position, plates entirely out of mesh, and with external

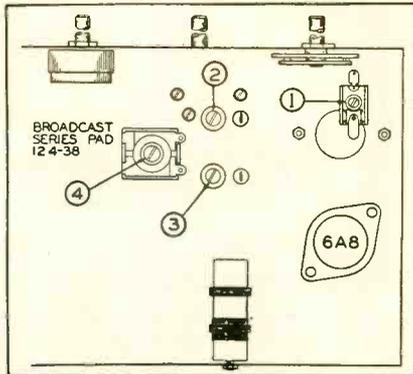


Fig. 3. Under side of chassis, Belmont 589.

oscillator connected in series with "Dummy 2" to antenna and ground leads make following adjustments:

(a) Set external oscillator to 1720 kc, and adjust broadcast oscillator trimmer to resonance.

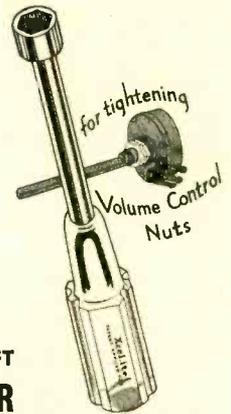
(b) Re-set external oscillator to 1400 kc, rotate variable gang condenser and pick up signal. Adjust broadcast antenna trimmer to resonance.

(c) Reset external oscillator to 600 kc, and adjust broadcast series pad to resonance by rotating condenser to approximately 600 kc, rocking it slowly to and fro until by adjusting series pad maximum output is attained. This adjustment is located on the bottom of the chassis directly under the variable gang condenser.

(d) Repeat adjustments "a" and "b" until sensitivity is at its maximum.

(e) Check for tracking and sensitivity at 1400, 1000, and 600 kilocycles. Under no circumstances bend plates of variable condenser sections to correct tracking.

SERVICE



XCELITE HOLLOW SHAFT NUT DRIVER FOR VOLUME CONTROL

The new Xcelite Hollow Shaft Nut Driver turns one of the most troublesome and often costly jobs into ordinary child's play. With this remarkable little tool you can install and remove volume controls instantly with no fear of damaging panels, chewing up nuts or sloppy jobs. Furnished in 1/2" and 9/12" sizes, these are genuine Xcelite wrenches in every respect. Made of special alloy steel, they are equipped with beautiful amber break-proof and shock-proof handle. Order a pair from your jobber today. Jobbers—Write today for attractive proposition on our line of Xcelite fast-selling radio tools.

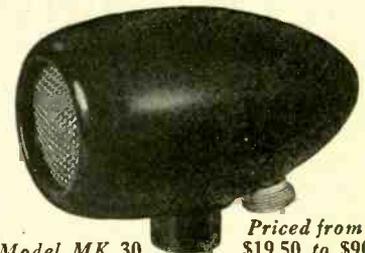
PARK METALWARE CO., Inc.
Orchard Park, N. Y., U. S. A.

87%

. . . of the movie sound studios and broadcasters

DEMAND DYNAMIC MIKES!

You can have the same dynamic microphone quality so much in demand by movie and broadcast experts who insist on "higher fidelity" . . . at a price you can afford! How? By using Transducer "Bullet" microphones. "Bullet" dynamic models are built to the rugged exacting standards of high quality telephone equipment. They challenge comparison against the field model for model. You owe it to yourself to get the best when it costs no more. Find out! Send for a free microphone comparison chart.



Model MK 30 Priced from \$19.50 to \$90

'BULLET' MICROPHONES

Made only by

TRANSDUCER CORPORATION
30 Rockefeller Plaza, New York, N. Y.

• SERVICE FOR

SOUND SERVICE—continued

1½, 2½, 3½, 5 and 15 minutes continuously on each side. The selling prices of completed recordings may range from \$1.50 for the 6" size to \$15.00 for the 16" size.

The uses for recording equipment are practically unlimited. One enterprising sound engineer went back stage in a vaudeville house one evening and connected his recorder to the theatre public-address system. He recorded all the acts at the final show and at the conclusion of each act, sent a record to the actor's dressing room with a note telling him that he had recorded his performance and would be around later to play the record. He cleared \$75.00 on the records and the next morning one of the performers bought his machine for cash.

POSSIBILITIES FOR STEADY BUSINESS

There are many other sources of steady business for the firm equipped to give recording service. All advertising agencies that produce radio programs have their productions recorded off the air. Entertainment bureaus and artists' managers use records to sell the services of their clients. Radio artists have their programs recorded frequently so that they can study their own work and keep the records for reference purposes. Ministers record sermons to send to other churches. Detectives use recorders to obtain evidence. An attachment is available that makes it possible to record two-way telephone conversations without tapping the wires. Doctors

make records to study speech defects and to record heart and chest sounds. Lawyers record wills and other statements of legal importance. Court reporters frequently make records of testimony; recording is more accurate than shorthand. Musicians and music students record their own work for criticism and self analysis. Night clubs use recorders to entertain their patrons. Many amusing acts have been built around a recorded voice that heckled the entertainer. Schools frequently engage the services of a recording firm to record students in the speech classes. Industrial organizations have recordings made in connection with their sales training courses.

The manufacturers of instantaneous sound recording equipment furnish sales campaign plans and sample advertising material to p-a and radio Service Men who plan to enter the recording field. This material can be obtained by writing to SERVICE.

Some Pointers on P-A

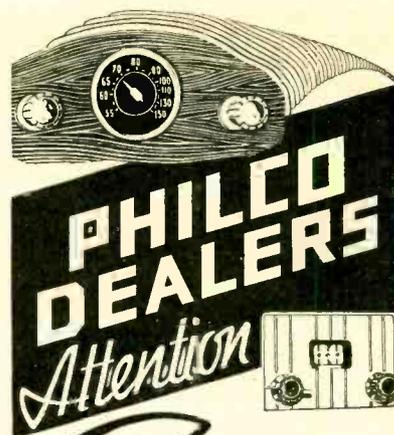
THERE ARE tricks in every trade, and the sound equipment men have their full share of them. Presented herewith are some few of those which have come to our attention recently. More of these will be made available from time to time as space permits.

ATTENUATORS

The need frequently arises for an attenuator, or "pad," with a fixed loss. The p-a man may have one or more



Telephone operators at the Willard Hotel, Washington, D. C., make records to check up on their work.



Crowe FIVE-POINT PROGRAM

For Crowe
On-the-Panel Controls

YOUR Philco Distributor—again in 1938!—has a special Crowe Program to help you increase your sales of Auto Radios.

This Crowe Five-Point Program insures quicker sales and increased profits with Crowe ON-THE-PANEL Kits—at no extra cost.

Crowe 1938 On-the-Panel Kits embody these features:

- Exact custom styling
- Official Philco specifications
- New no-glare dials
- Improved anti-backlash design
- Adaptable to any car
- Quickly installed—easily moved

Ask for Crowe Bulletin No. 205

PARTS JOBBERS!

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

Ask for Bulletin No. 206

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

EVERY SOUND MAN NEEDS THIS

3 in 1 Microphone



*Uni-Directional
Bi - Directional
Non-Directional
Response All In
One Unit*

★
**SHURE
"TRI-POLAR"**

Crystal Microphone

With this amazing new "TRI-POLAR," you have true directional control when and as you need it. You can instantly select uni-directional, bi-directional, or non-directional response—pick up the sound you want, free from feedback and background noise, even under extremely adverse acoustic conditions.

The "TRI-POLAR" is rugged, light, compact. No delicate moving parts. Smooth, high-quality wide-range response from 40 to 10,000 cycles.

Model 720A, complete with 25 ft. cable. List Price..... **\$39.50**

See your Jobber or Write us for current issue of Shure Technical Bulletin.

NEW LOW PRICE

Shure Zephyr Crystal Pickup

NOW ONLY \$10 LIST!

Improved Model 99B Zephyr Crystal Phonograph Pickup formerly \$12, now only \$10 list. At your Jobber.

Shure Patents Pending. Licensed under patents of the Brush Development Company.



The Replacement Parts Market Is Thriving . . .

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

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

SOUND SERVICE—continued

variable attenuators available, and he may not! Here's the solution, using resistors of the so-called adjustable type. They can be set to the appropriate values closely enough by means of an ohmmeter.

The "pad" is of the T-network type, shown schematically in Fig. 1. This particular attenuator is for use in a 500-ohm circuit. Various degrees of attenuation (properly, insertion loss) can be obtained by making the arms "A" and "B" have the values of resistance given in the table below. These resistances can be calculated by a relatively simple series of algebraic equations, or they can be obtained from tables such as that which appeared in RADIO ENGINEERING, June, 1936. However, the values given in the table below cover most requirements which will be met.

Table of resistance values for T pads of various losses

Loss, db	"A"	"B"
1	29 ohms	4332 ohms
3	86 ohms	1420 ohms
6	165 ohms	670 ohms
9	238 ohms	405 ohms
20	410 ohms	101 ohms
30	470 ohms	32 ohms

These values are correct, for the indicated insertion loss, for 500-ohm circuits only, but it is easy to find the proper values for circuits of other than 500 ohms. Suppose we want a 20-db pad for a 200-ohm circuit. According to the table, for a 500-ohm circuit, the "A" arms would each be 410 ohms and the "B" arm would be 101 ohms. We simply multiply these values by the ratio of 200 to 500; that is, the values for both the "A" and "B" arms would be multiplied by 200 divided by 500, or 0.4. Hence, for a 200-ohm pad with a 20-db loss, "A" would be 164 ohms, and "B" would become 40.4 ohms.

In a like manner, for a 6-db loss in a 50-ohm circuit, first obtain the resistance values for a 6-db loss in a 500-ohm circuit and multiply by 50 divided by 500, or 0.1.

"PHANTOM" CIRCUITS

It is to be hoped that the situation described below will never again be met by a p-a man, but just in case, here's one possible way out of the difficulty.

There were two microphones located on the stage of an auditorium; two mike cables were installed (this was a permanent installation, with all cables neatly run in rigid conduit) between the stage and the point, some 500 feet distant, where the amplifiers were located.

One night, about 30 minutes before a show was to go on, the p-a operator learned that he had to have another

NOW!

PUSH BUTTON TUNING for EVERY Radio



Every customer you have is a prospect for a push button installation. This device makes ANY radio a modern, up-to-the-minute push button set. Installed in a few minutes. Increase your profits by selling this compact, fool-proof unit! Write today for complete details!

Model B6 for 2 Gang Var. Cond. Receivers

LIST **\$660**

Serviceman's Net Price

\$395

Model B6JA for 3 and 4 Gang Var. Cond. Receivers

LIST **\$725**

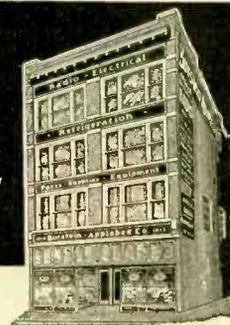
Serviceman's **\$425**
Net Price

- Only 3 leads to connect.
- 6 Push Buttons.
- Compact 5 1/4" wide, 1 1/2" high, 2 1/2" deep.
- Adaptable for remote control.
- Manual control of re-

- ceveras well as push button control.
- Completely shielded by metal container.
- Unit complete with instructions, es- cutcheon, station tabs, hardware, etc.

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COMPLETE STOCKS READY FOR YOU

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

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

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

SOUND SERVICE—continued

mike on the stage, a total of three—and all of them had to be “on” at the same time.

It was too late to run a third cable for the extra mike; in fact, the cable wasn't even on hand, and it was far too late to obtain more. The rather ingenious solution to this is shown in Fig. 2.

First of all, there were four transformers available; these were of the so-called universal type, i. e., practically any impedance within reason could be matched by properly connecting the various taps. The microphones already on the stage were connected to the lines through the transformers, as shown in the diagram. The transformer secondaries were connected to work into 500-ohm circuits (the impedance of the lines between the stage and the p-a equipment) and each had a center-tap. At the stage, the third microphone was connected, as shown, to the center-taps of the two transformers.

At the amplifier location, transformers were also cut into the lines and connected as shown, the connection of the third microphone to the mixer being taken from the two center-taps of the transformers.

This gave what is known as a “phantom” circuit. “Phantoms” are used in telephony to some extent, but in general they are not favored because of the danger of crosstalk and circuit unbalance. However, in this particular instance, the “phantom” saved the day. It is true that impedances were considerably mismatched at several points, but

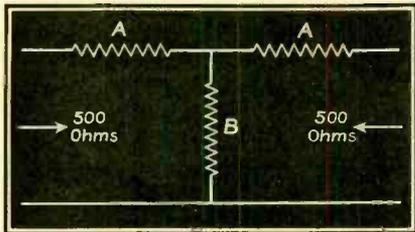


Fig. 1. T-pad, or attenuator.

by judicious use of the gain control, the operator avoided any “singing” or other trouble.

Such a setup as this cannot be recommended for permanent use, but in an emergency it was justified. It is entirely possible that if the microphone lines had not been inherently balanced to ground—by reason of being run together in conduit—this phantom circuit would have been far too unstable for use. But, if the balance to ground—by this term is meant that the capacity between each wire of the two circuits and ground was practically identical—is

good, there is no reason why the phantom cannot be used.

It is interesting to trace out the circuits in a phantom; in so doing, it will be seen that each side of the phantom is actually two wires in parallel. For this reason, the transmission over the phantom is somewhat better than over its side-circuits. However, the danger of crosstalk is great, and despite the

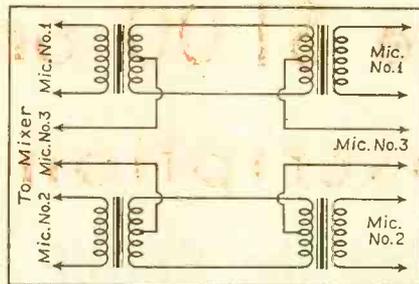


Fig. 2. A “phantom” circuit used in an emergency to connect an extra microphone.

greater transmission efficiency—which begins to get noticeable over great distances—phantoms are not generally used for program transmission.

VOLUME COMPRESSORS

There are two very good reasons for using a volume compressor with p-a equipment.

First, one can run the level of the system higher than usual without danger of a sudden peak in the input starting the system to “singing.” Using a compressor may mean an additional 3 db in your output—but figured in actual power, that means doubling the output of the system. That's worth striving for, especially if you are operating your equipment in a location with a noisy background.

The other reason: you won't have to be so much on the alert for these peaks that you can't watch the rest of the equipment. Of course, these two points are more or less tied together, but either one is sufficient reason for seriously considering the use of a compressor.

It ought to be especially important to those of you who will be renting your equipment to politicians—those boys can let go with some awfully sudden and loud blasts of oratory. A compressor will take care of that for you!

Ford V-8

MOTOR NOISE: May be due to resistor in series with high tension coil; this resistor is located under the dashboard. Shielding the resistor may eliminate the noise, especially if it is noise that isn't licked by the usual means.

RCA Service Tip File

(Above) A FAST SELLER! WARD'S new “CHALLENGER” hinge-type aerial sells at only \$1.95, and still makes you a handsome profit! Features: New Easy-Tilt Contour Bracket; Rust-resisting; Fits all cars, no drilling; Telescopic.

WARD offers you everything you need to cash in on the big, profitable auto aerial business. There are models at prices to suit every prospect. Each model fits all cars with no “top drilling” required. And WARD backs up this “all-star” line with a complete set of dealer helps—furnishing everything you need to cash in!

Send today for complete details on this new money-making opportunity.

FREE!

See what's new in car Aerials for 1938. Write today for FREE Catalog!



The WARD PRODUCTS Corp.
WARD BUILDING CLEVELAND, OHIO

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YOU JUST CAN'T AFFORD TO MISS A WORD OF THIS!



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Practically all technical data published in **SERVICE** should be filed for reference guidance during the years to come.

To help every service man, dealer and jobber obtain his own individual yearly subscription to **SERVICE** for \$1.00 (or one half the regular rate of \$2.00 a year) the Group Subscription Plan was formed. When four or more men sign up at the same time, the subscription rate is only \$1.00 per year each. (The occupation of each subscriber must be given.)

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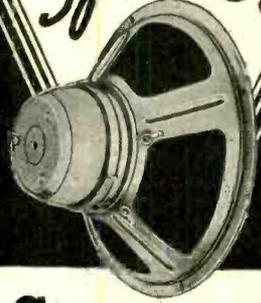
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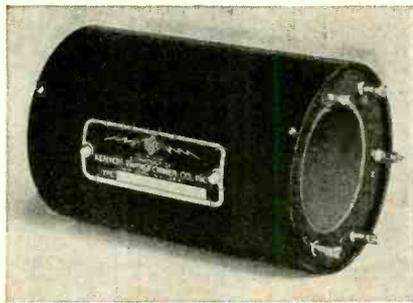
—extensively utilized by all leading radio receiver and P. A. equipment manufacturers—are available in a complete range of sizes from 5½ to 18 inches, to meet your every radio requirement.

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



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MANUFACTURERS—continued



DEFLECTING YOKE AND TRANSFORMERS FOR TELEVISION

Deflecting Yoke type T-700 recently introduced by Kenyon Transformer Co., Inc. New York, N. Y. is said to be designed for use with cathode ray tubes of the electromagnetic deflection type.

Special care is taken in the winding and placement of coils in this yoke to reduce to a minimum any distortion which may occur due to unbalanced magnetic flux or non-uniform fields. By means of the type of construction, coupling between high and low frequency coils has been reduced to a negligible value. An internal shield is effective in reducing the effects of external fields on the image to be projected.

The low frequency coils are so constructed that a low-impedance line may be run to them from the new output transformers type T-112. This helps to minimize pick-up and eliminate coupling condensers.

More than ample deflection with negligible distortion is obtained from the type T-700 yoke on nine-inch tubes at a plate voltage of 6000.

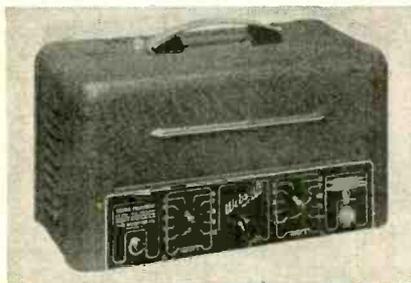
The new type T-111 high-frequency sweep output transformer is wound with low capacity coils in order to effectively pass the higher harmonics of 13,200 cycles necessary for the production of a linear deflection.

The power transformers T-203, T-204, and T-208 are carefully insulated for the high voltages at which they must operate and at the same time compactness is retained.—SERVICE.

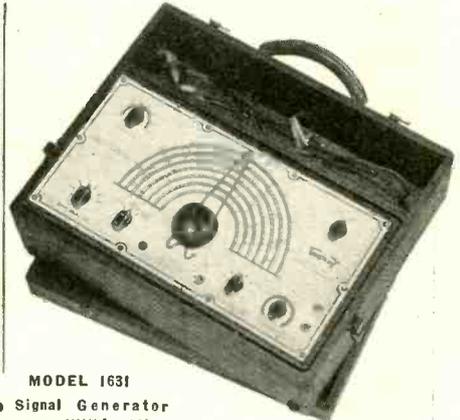
WEBSTER-CHICAGO 14-WATT SYSTEM

Webster-Chicago has just announced a new 14-watt Portable Sound System, using inverse feedback circuit. It is claimed that within its rated output, distortion has been kept within two percent.

This model features a full length microphone stand with screw-type microphone connections, tone control and two p-m speakers, all stowed in a single leatherette covered carrying case. Webster-Chicago report that Model PA-714 has been tested and approved by the Underwriters' Laboratories.—SERVICE.



Now Ready
ELECTRONIC WOBBLATOR
plus **A.C. OSCILLATOR**
in one Tester



MODEL 1631

- Signal Generator Accuracy Within 1%
- Continuously Variable Modulation 5 Cycles to 40 K.C.
- Triple Shielded

DEALER PRICE

Leatherette Case \$59.00
Metal Case \$55.00

Model 1631 combines a new model electronic wobbulator with Model 1630 DeLuxe Signal Generator. A.C.—60 cycle operation.

The electronic frequency modulator does away with amplitude distortion and modulation introduced by mechanical sweeps.

Width of sweep can be varied 5 cycles to 40 K.C. irrespective of frequency of generated signal; beat frequency type of oscillator holding fixed frequency at 2,000 K.C. eliminates beats and unwanted oscillations in broadcast band.

Uses double trace method for aligning sets with scope or can be used for conventional output meter alignment. Ladder type attenuation, 6 bands. Can be externally modulated.

Signal Generator is triple shielded for zero leakage, using both magnetic and electrostatic shielding. Accuracy within one per cent. Each coil is individually calibrated and tracked for linearity over the entire range. Reads 100 K.C. to 30 M.C. Scale length 52¾".

Complete with all necessary accessories. Silver and black etched panel.

Model 1630—Signal Generator—
Same as above, but does not have electronic wobbulator.

Dealer Net

In Leatherette Case Only \$49.00

In Metal Case Only \$45.00

A DELUXE TRIPLETT MODEL



The Triplett Electrical Instrument Co.
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..... Please send me more information on Model 1631; Model 1630.

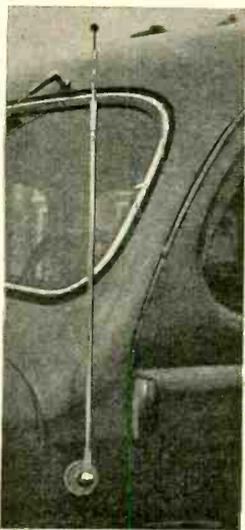
Name

Address

City State.....

BURTON-ROGERS AERIALS

The Burton-Rogers Company of Boston, Massachusetts, manufacturers of Tops-All Automobile Aerials announce a new line of hinge type and side-panel aerials. The outstanding feature of Tops-All Aerials is said to be the fact that they are made of stainless steel and will not rust under any condition. All extension rods and extension sleeves are made of this special material, while the base sleeve and fittings are brass heavily chrome plated.—SERVICE.



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Brown Devils**

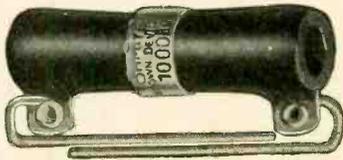


Take the best resistance wire, wind it accurately on the best available ceramic forms, completely seal it against moisture and corrosion with special OHMITE VITREOUS ENAMEL—that's an OHMITE BROWN DEVIL! It's the simple story of a perfected design, conscientiously built to give the ultimate in resistor performance. Behind it, of course, is a long history of painstaking research for the best in materials and processes.

Try OHMITE BROWN DEVILS now. In 1 to 100,000 ohm units rated at 10 and 20 watts — they simply can't be beat!

See Your Jobber or Write for Catalog 16.

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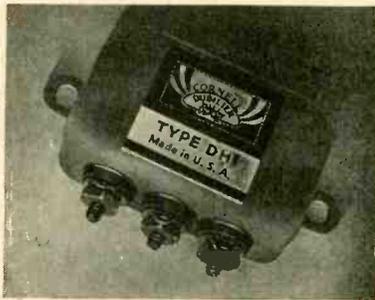
OHMITE
RHEOSTATS RESISTORS TAP SWITCHES

UNIFIED SOUND SYSTEM

Transformer Corporation of America, 69 Wooster Street, New York City, has introduced a new model to its line of Clarion "Unified" Sound Systems; the 30 to 40-watt Master Sound System.

Capable of handling, it is said all but the most gigantic sound reinforcement situations, the new system consists of a new "beam-power" amplifier unit, velocity microphone and floor stand, two 12-inch concert type heavy-duty speakers with flare baffles, and all necessary speaker and microphone cables, shielded plugs, etc. All components have been especially matched to each other for optimum results.—SERVICE.

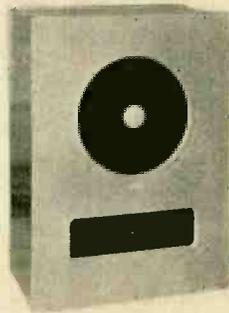
MANUFACTURERS—continued



AIRTIGHT CAPACITORS

The Cornell-Dubilier type DH Dykanol capacitors are said to be designed to operate efficiently under any humidity and temperature conditions. Their light weight, compactness and convenient construction makes them suitable for use in aircraft, submarine and marine radio equipment. These capacitors are impregnated and filled with Dykanol. A special test given these capacitors calls for immersion under boiling water for a minimum period of fifteen minutes. The type DH series is available in a capacity range from .05 to 2 mfd, at voltages of 400, 600 and 1,000 d.c.

Further details available from Cornell-Dubilier Electric Corps., South Plainfield, N. J.—SERVICE.



JENSEN OFFERS BASS REFLEX ENCLOSURE FOR 18-INCH AND AUDITORIUM SPEAKERS

The enclosures for the speakers have been so designed that they can be used with 18-inch and Auditorium Speakers that are now being used in the field. The enclosure is shipped knocked down and all that is necessary to do is to set up the enclosure and put the speaker unit in place.

All Jensen public address speakers—8", 10", 12", 15", Auditorium and 18" speakers are now offered as complete reproducers, no baffles necessary.

For further information on the new Auditorium and 18-Inch Bass Reflex Enclosures, write for special folder to Jensen Radio Manufacturing Company, 6601 South Laramie Ave., Chicago, Ill.—SERVICE.

CARBON MICROPHONE

Said to have several innovations, the Model 75 microphone of the Electro-Voice Mfg. Co., 332 E. Colfax Avenue, South Bend, Ind., has just been announced. Button current may be as low as 3-5 ma for close talking, and 10-15 ma for normal service. Further details may be obtained from the manufacturer.—SERVICE.

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

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

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

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SPRAGUE PLUG-IN TYPE NOISE FILTER

Sprague Products Company, North Adams, Mass. has introduced a new unit having a number of important features. Tests have shown it to be effective in reducing radio interference caused by electric razors, heating pads, hair dryers, and practically all fractional horsepower electrical motor or vibration devices commonly used in homes or business houses.

Made in convenient size, 2" long by 1-7/16" diameter, the new Sprague filter can be plugged into any socket conveniently—even in double wall receptacles where the larger size of old style square or oblong filters sometimes interfere with use of the second socket.

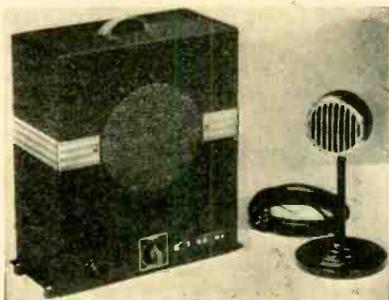
The filter is designed either for installation directly at the power line outlet of the radio so that no interference will enter the line cord and be radiated to the set or antenna system or at the power outlet to which the noise-making electrical appliance is to be attached.—SERVICE.

SOUND SYSTEM PLANNED TO OPEN NEW MARKETS

Those who specialize in selling sound installations know that once a system is installed, little need be done to convince the buyer of its value.

Vocograph engineers are said to have just completed the design of a unit, listing at a remarkably low price, complete with microphone, amplifier, tubes, speaker, and speaker housing. The Model 30-05 not only offers low price, but also extreme simplicity to allow easy temporary installation for demonstrations and rentals.

Literature describing this and the complete Vocograph "Hushed Power" sound equipment line may be secured by writing Vocograph Sound Systems, 164 N. May St., Chicago, Ill.—SERVICE.



JEFFERSON ADDS MORE FILAMENT TRANSFORMERS

To more completely meet the requirements for all types of transmitter, receiver and rectifier tubes, Jefferson Electric Company of Bellwood, Ill., have added three more filament transformers. They are all insulated with ample factor of safety to withstand dependably the high voltages encountered in this service. Of the three new transformers the 464-461 has a secondary of 5V/CT at 12a, and is insulated for 3,000 volts. The 464-451 is similar except that it has a secondary of 5V/CT at 20 a. The 464-441 has a secondary of 10V/CT at 4 a and is insulated for 2500 volts.—SERVICE.



MILLION VOLT-OHMMETER

Million Radio and Television Laboratories, 685 West Ohio Street, Chicago, Ill., have announced a pocket volt-ohmmeter known as Model S. The instrument is said to have a sensitivity of 1000-ohms-per-volt; ranges of 0-5-50-500-1000 volts dc; 0-1000 ohms back-up scale; 0-500,000 ohms series scale; 0-1 milliamperes.

Further details may be obtained from the manufacturer.—SERVICE.



BALL TYPE MICROPHONE ANNOUNCED BY TRANSDUCER

In addition to their "Bullet" microphones, Transducer Corporation announced this month from their New York City headquarters a new Ball Type dynamic microphone. Model MK-35.

The new "Ball Bullet" is housed in a spherical metal case 3" in diameter, finished in "satin black." It is equipped with a swivel bracket and can be used as either a directional or non-directional microphone. Sensitivity of the "Ball Bullet" is -52 db; impedance, high, approximately 50,000 ohms, or low, approximately 200 ohms; frequency response flat, from 30 to 10,000 cycles. It is equipped with cable connector and 25 feet of cable.—SERVICE.

MODERNIZE YOUR SHOP FOR GREATER PROFITS . . . at almost no cost to you! . . .



. . . with the ARCTURUS EQUIPMENT DEAL

You profit three ways with the Arcturus Equipment Deal. You get needed shop equipment of standard make—immediately—at almost no cost. You get Radio's finest, best engineered tubes. This means real customer satisfaction on every sale. Last but not least, you get these tubes at standard prices, less standard discounts. Not one cent has been added to allow for the shop or test equipment you get. Arcturus brings it to you practically FREE!

- QUICK DELIVERY TO YOU!**
- SMALL DOWN PAYMENT**
- TUBES AT STANDARD LIST PRICES**
- ARCTURUS HELPS YOU SELL**
The finest line of dealer helps on the market today. Write for descriptive catalog.

You Can't Lose!

If you need new radio test equipment, typewriters, etc. . . .
If you want to make yours the best equipped shop in town . . .
Then get the facts today. Join with the countless servicemen and dealers who are already profiting from Radio's finest, fairest and easiest deal!

MAIL THE COUPON!

ARCTURUS

ARCTURUS RADIO TUBE CO., Newark, N. J. S-4
Without cost or obligation on my part, send details of your new equipment deal.

Name

Street

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

I am a dealer I am a serviceman

My jobber is.....

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

HIGHLIGHTS . . .

DU MONT GRANTED NEW TUNING-INDICATOR PATENT

An ingenious cathode-ray tuning indicator which indicates resonance or non-resonance by means of different colors, is the subject of the U. S. Patent No. 2,098,231, issued to Allen B. DuMont and assigned to the Allen B. DuMont Labs., Inc., Upper Montclair, N. J., of which he is President.

It may be recalled that the DuMont organization recently sold certain cathode-ray tuning-indicator patent rights to Radio Corporation of America, for the so-called Magic Eye. The latest cathode-ray indicator covered by the present patent calls for a plurality of fluorescent screens glowing in different colors as the cathode-ray beam, swung over different sections of the screen by deflection plates, indicates resonance or other desired function in different colors.

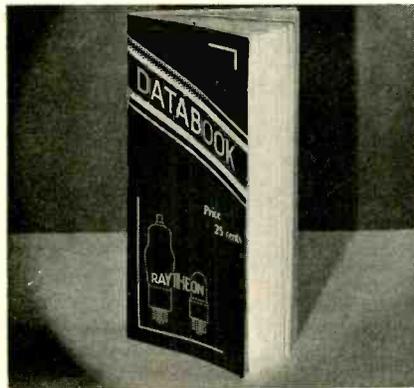
PODOLSKY JOINS SPRAGUE PRODUCTS

Leon Podolsky, formerly associated with the Wirt Co., Philadelphia, Pa., as research engineer, has joined the staff of Sprague Products Co., North Adams, Mass., as research and sales engineer.

RAYTHEON ANNOUNCES NEW 200-PAGE TUBE "DATABOOK"

E. S. Riedel, General Sales Manager of the Raytheon Production Corp., has just announced what he considers a most complete data book containing the chief technical data on all tube types—from the oldest tube to the newest. Prepared in the form of a compact 200-page pocket size book, it includes a wealth of information on tube applications and uses—maximum ratings, values of essential characteristics and the more important characteristics in operating curves for each active tube.

The information on these curves is even more valuable and useful than the ratings and nominal characteristics. Much of this information has previously been obtainable only by a limited number of receiver design engineers. Data are given on all tubes that have been at all widely used in the past in receivers and amplifiers that are still handled in the trade as replacements; also on all types announced up to the end of 1937. For completeness there is included the necessary data on resistor, radio receiving, special receiving tubes, and panel lamps.



MALLORY ENCYCLOPEDIA IN DEMAND

It is learned that the Radio Service Encyclopedia, published by P. R. Mallory and Co., Indianapolis, Ind., is enjoying a constant demand from the service field. Fitting in, as it does, with the present tendency toward high educational standards in the servicing industry, the Encyclopedia should prove of great value both in theoretical and practical approaches to the radio field.

CINAUDAGRAPH MOVES CHICAGO OFFICE

Cinaudagraph Corporation, Stamford, Connecticut, announces the opening of their new Chicago offices located in the Northwest Tower Building, 12th floor, 2018 W. North Avenue, Chicago, Ill.

Mr. Roy W. Augustine is Cinaudagraph's midwestern representative.

LUND & BARR ORGANIZED

Robert L. Barr, for several years a principal executive of the Clough-Brengle Co., announces the formation of the firm of Lund & Barr, sales engineers, with headquarters at 2815 W. 19th Street, Chicago, Illinois. Associated with Barr is Russell O. Lund, Clough-Brengle representative for many years in midwestern territory.

The new firm will engage not only in sales but also in consulting engineering, and at the same time represent Clough-Brengle test equipment and Vocagraph sound systems in nine midwestern states, with the addition of other non-conflicting lines in the near future.

RADIART DISPLAY CARDS

Promoting its 1938 line of Auto Radio Aerials, The Radiart Corporation offers to jobbers and dealers striking display panels upon which may be mounted actual samples of the aerials. Each display features one type of aerial mounted on the panel, but several other popular types are also illustrated. The panels are of heavy wallboard, brilliantly painted in four colors and varnished. The displays may be hung on the wall or may be set up on the counter or in the window by means of ingenious wire easels which are furnished. A feature of these displays is that the sample aerial is mounted in its correct position against a painting of the car.

EXACT-DUPLICATE REPLACEMENT-CONDENSER WALL CHART

A wall chart which, at a glance, indicates the condenser requirements of practically all standard radio sets, is now being distributed by Aerovox Corporation of 70 Washington St., Brooklyn, N. Y., to its jobbers and other interested parties. The new and revised chart lists the various standard radio sets alphabetically and by model numbers. The set manufacturer's part number, capacity, d-c working voltage, type container, dimensions and list price of the replacement condenser are given in each instance. Copies of the wall chart may be had by those who handle such replacements.

WRIGHT-DECOSTER BULLETIN

Bulletin A-17 on the subject of extension speakers, has just been announced by Wright-Decoster, Inc., St. Paul, Minn. The bulletin, which may be obtained from the company, describes in detail the means for connecting extension speakers to radio sets, etc.

VIDEOTRON TRADE NAME FOR NU C-R TUBES

National Union Radio Corporation announces that concurrent with the enlargement of research and production facilities concerned with National Union's activity in developing and manufacturing cathode-ray tubes, they have established the trade name of "Videotron," as descriptive of these tubes. National Union Videotrons with viewing screens of 1", 2" and 3" are now being manufactured and supplied through National Union distributors for oscillograph applications.

Further development work concerned with special Videotron types for television applications is being carried on at the National Union Laboratories, under the guidance of M. P. Wilder.

It is believed by National Union that the name "Videotron" is accurately descriptive for the type of tube to which it has been applied, since such tubes are used exclusively for video or sight work.

WILSON ADVANCED BY OPERADIO

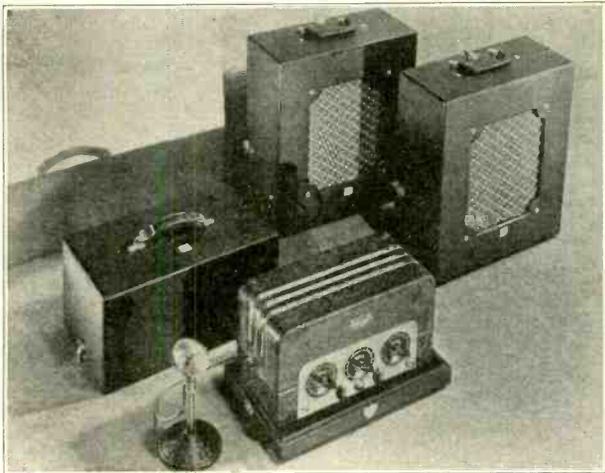
The Operadio Manufacturing Company announce the promotion of Howard A. Wilson to the position of Sales Manager of the Public Address, Sound and Amplifier Trade Division according to a statement issued by Larry King, General Sales Manager.

This new position has been created because of the rapid growth of this portion of the business which includes all of the equipment which is sold through jobbers and dealers.

Howard Wilson has been with Operadio for several years, acting as Division Manager calling on the jobbers and dealers in the Eastern and Southern territories. His new position now puts him in active charge of all sales to the jobbers and dealers for the entire United States and Canada.



BELL LEADS THE FIELD



A MODERN 24 WATT P. A. SYSTEM

With Features Wanted Today and Demanded Tomorrow

Manufactured Under License Arrangement With E.R.P.I.

Modern appearance combined with the newest developments and finest performance. . . . That's the new model 424 P. A. System. Built to Bell's usual high standard of quality and designed for any type of installation, permanent or temporary. Note these superior features: High gain amplifier. Octal series tubes. beam power output tubes, three in-pu channels, provision for mixing two microphones and one phono pick-up, new type crystal microphone, twin 12" heavy duty permanent magnet speakers, bass and treble compensator controls, as well as many other features of quality. Easily portable, easy to operate and easy to service. In fact, it has everything! . . . Including an attractive price. Write for complete details on Bell's complete line of sound equipment and in-er-office communicating systems.

BELL SOUND SYSTEMS, Inc.

61-62 East Goodale Street, Columbus, Ohio

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

Under ONE roof



Everything in Radio

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

RADOLEK

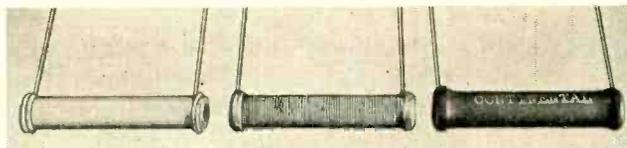
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Send me the Radolek Radio Profit Guide FREE.

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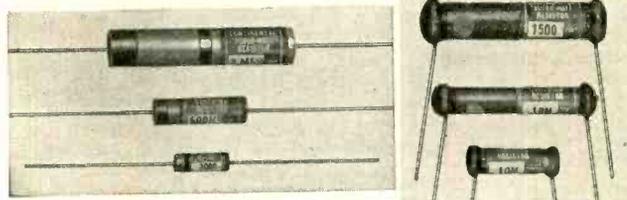
Address

Serviceman? Dealer? Experimenter?



A Better Wire-Wound Resistor!

In the new 10-watt CONTINENTAL W10 wire-wound resistor, resistance wire of very low temperature coefficient is wound on a ceramic tube to which the leads are firmly bonded. The entire resistor is covered with a firm ceramic jacket, impervious to moisture, which protects the wire from corrosion and oxidation. The W10 resistor is inherently quiet and stable. It is especially suited for final stage bias in powerful amplifiers and as a bleeder resistor. And the list price is only 40¢, in values from 1 to 25,000 ohms, tolerance $\pm 5\%$. Available from your CONTINENTAL CARBON distributor.



Bakelite insulated carbon resistors for auto and midget sets: M3, 2" x 1 1/2", 13/32", 3 watt, 30¢; M1, 1 1/2" x 9/32", 1 watt, 20¢; M1/2, 3/8" x 7/32", 1/2 watt, 17¢. All values to 10 megohms. Ceramic insulated carbon resistors for replacement: E2, 2" x 3/8", 3 watt, 30¢; D2, 1 1/4" x 1/4", 1 watt, 20¢; G4, 1" x 1/4", 1/2 watt, 17¢. D2 is also available in 5% tolerance at 30¢.

CONTINENTAL CARBON Inc.

13912 LORAIN AVENUE - - - - CLEVELAND, OHIO
IN CANADA - - - - - TORONTO, ONTARIO

Halldorson

Vacuum Sealed Transformers

Model 67 will take care of the replacement demands of 847 different makes of radio sets, as to power supply transformers.

Do You Know six Halldorson models will take care of 90% of all replacement demands for both power and audio transformers of all makes of radio sets?

For better, more satisfactory results, specify Halldorson.

Ask Your Jobber. Write for New Catalog.

THE VARI-VOLT Exclusively Halldorson

0 to 256 v. in 1-volt steps; 0 to 128 in 1/2-volt steps. Simplifies radio service work.



FREE

to Servicemen on Halldorson Deal.

THE HALLDORSON CO., 4500 Havenswood Ave., Chicago, Ill. S-2235

Please send me . . . New Catalog; . . . Information on Free Vari-Volt Deal.

Name
Address
City
State

DAYCO CATALOG

The Dayco Radio Corp., 201 Hickory Street, Dayton, Ohio, has just released a catalogue of the radio test equipment manufactured by the company. Copies may be obtained by writing to the corporation at the address given.

RECORD-BREAKING JANUARY BUSINESS REPORTED BY ARCTURUS

As a bright spot in the day's industrial news comes word from the Arcturus Radio Tube Company of Newark, N. J., that tube volume for January, 1938, exceeds any January since 1929. Substantial orders from the radio manufacturing, jobbing and export trade have been reflected in a full time production schedule. Many new employees have been added during the month. Company officials report the outlook for February as equally favorable with every indication of continuing steady business.

Sales Manager Jack Geartner, just back from a trip through the Middle West, states that the recently inaugurated Arcturus tube equipment deal has met with widespread favor, jobbers reporting a steadily increasing number of servicemen and dealers who are taking advantage of this opportunity to obtain the latest shop equipment, etc. at a minimum of cost to themselves.

POLARITY CHANGER BULLETIN

A bulletin describing the new line of polarity changers being produced by Electronic Laboratories, Inc., 122 West New York Street, Indianapolis, Ind., has just been made available. Copies may be obtained from the manufacturer.

MANUFACTURERS' REPRESENTATIVE

Harold I. Danziger, 130 East 40 Street, New York City, is now a manufacturer's representative. Mr. Danziger was formerly Vice-President of Danziger Jones, Inc., and later Vice-President and General Manager of the Condenser Corporation of America. More recently he was associated with the engineering and production departments of Sprague Specialties Co. Among the many lines handled by Mr. Danziger will be the Henry L. Crowley line of ceramics in the states of New Jersey, New York, Connecticut, Rhode Island and Massachusetts.

UNITED ELECTRONICS BULLETIN

Complete descriptions and engineering information on the United line of transmitting and rectifying tubes is contained in a new 55-page bulletin issued by the United Electronics Company, 42 Spring Street, Newark, N. J. Copies of this bulletin may be secured by writing to the above organization.

ALDEN PRODUCTS BULLETINS

Alden Products Company, 715 Center Street, Brockton, Mass., have recently issued two interesting bulletins. One bulletin covers detachable pilot lamp sockets, while the second is concerned with "Flat Wove" extension cable for power and doublet antennas. These bulletins are available from the above organization.



H. L. Dalis, Vic Mucher, and Adolph Langer (left to right) at the Clarostat party.

CLAROSTAT ENTERTAINS DISTRIBUTOR'S SALESMEN

As the saying goes, "A good time was had by all" when H. L. Dalis, well-known radio parts jobber in the New York metropolitan area, and his twelve salesmen spent an entire Saturday afternoon and evening in the Clarostat plant a couple of weeks ago.

The visit covered a sight-seeing tour through the Clarostat plant in Brooklyn, a session with Clarostat engineers who answered many questions, a sales promotion conference, and finally the social functions. The visiting merchandisers were shown the various production departments of the Clarostat plant, that turn out the extensive line of wire-wound and composition-element controls, resistors, ballasts and other products bearing the Clarostat label. Great interest was displayed in the new midget controls now being made available to the jobbing trade.

The social functions included a splendid dinner prepared in the Clarostat kitchen, plenty of good cheer, and finally a rifle and pistol shooting contest in the Clarostat rifle range.

ACME ELECTRIC LITERATURE

The Acme Electric and Manufacturing Co., 1444 Hamilton Ave., Cleveland, Ohio, have made available literature on the following equipment: Acme Voltrols, for laboratory and factory testing; Acme insulation breakdown testers; variable voltage adjusters, for over-seas operation of electrical equipment where the voltage differs from the American standard; transformers, for high-intensity mercury-vapor lamps; and Autopaks, for lighting neon signs from 6-volt storage batteries.

NEW RMA SERVICE PROVIDED FOR AMPLIFIER MANUFACTURERS

A new engineering and merchandising service for RMA companies manufacturing amplifiers, requested by the Association's Amplifier and Sound Equipment Division, was approved by the Association's Board of Directors at its Chicago meeting on November 17. Chairman Peter L. Jensen of the Division presided and the RMA Board authorized a plan to promote the interests and sales of amplifier companies who are members of the Association by their use of an official RMA seal on their products certifying to definite RMA engineering standards.

THORDARSON PROMOTIONS

Charles P. Cushway, General Sales Manager of the Thordarson Electric Mfg. Company, 500 West Huron Street, Chicago, Illinois, has announced several promotions in the Sales Department. Roy E. Davy, formerly Chief Sales Engineer, has been advanced to the newly created position of Industrial Sales Engineer, while Jerome H. Kleker becomes Chief Sales Engineer, in addition to his present duties in the Sound Division. Douglas ("Doug") Fortune, W9UVC, has been promoted from the engineering staff to the Sales Engineering Department, in charge of amateur activities. Leland S. Hicks is Sales Engineer in the Replacement Transformer Division.

NEW TECH REPRESENTATIVE

The appointment of Henry P. Segel, of Segelsound, Incorporated, Gardner, Massachusetts, as representative for New England, is announced by Tech Laboratories, 7 Lincoln St., Jersey City, N. J. Segelsound, Incorporated, have discontinued their manufacturing business, and are specializing in the sale of sound equipment.

NATIONAL CARBON APPOINTMENTS

R. P. Tolles, former assistant manager of the Eastern Division of National Carbon Company, Inc., has been promoted to the management of the Pacific Coast Division, with headquarters in San Francisco. At the same time, the corporation announces that C. O. Kleinsmith, Sales Manager of the Atlanta District, has been transferred to the New York office, where he will serve as Assistant Manager of the Eastern Division.

GEORGE J. IRVING DIES

George J. Irving, Sales Promotion Manager and Sales Correspondent of The Webster Company of Chicago, died suddenly on December 22, 1937. Mr. Irving had been ailing for some time, due to recurring effects of injuries received in action during the World War.

DAWES & DUNN ELECTED TO RCA BOARD OF DIRECTORS

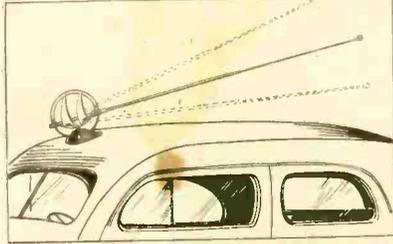
General Charles G. Dawes, former Vice-President of the United States, author of the Dawes Plan, and subsequently Ambassador to the Court of Saint James; and Gano Dunn, noted scientist, engineer, administrator and President of The J. G. White Engineering Corporation, were elected to the Board of Directors of the Radio Corporation of America at the regular meeting of the Board held January 28, it was announced by David Sarnoff, the President. They fill vacancies due to the recent deaths of Frederick Strauss, banker, and Newton D. Baker, former Secretary of War.

Mr. Sarnoff further announced that at the meeting of the National Broadcasting Company Board, held the same day, Dr. James Rowland Angell, former President of Yale University, and now in charge of educational program development for the NBC, was elected a Director of that company. General Dawes and Gano Dunn were also elected as Directors of the NBC.

• **SERVICE FOR**

INSULINE CORP. OF AMERICA
20 SMART NEW MODELS
AUTO-RADIO AERIALS
 EFFICIENT AS THEY ARE
 BEAUTIFUL

Toppers - Hinge Whips - Side Cows - BUMPER



QUALITY antennae built to furnish better pickup, less static and all-round fine reception. Highest grade materials and workmanship guaranteed.

THE RANGER as shown at left; telescopic; streamlined; perfect insulation; smart ship design; ALL BRASS, triple chromium plate, non-rusting.

Complete illustrated catalogue of Antennae and Auto Radio Accessories will be sent upon request.

INSULINE CORP. of AMERICA
 25 PARK PLACE NEW YORK, N. Y.

MILLION ALL-WAVE OSCILLATOR

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

19.95 NET

Write for literature on our complete line of test instruments.

MILLION RADIO AND TELEVISION LABORATORIES
 671 W. OHIO STREET CHICAGO, ILL.



THE NEW "CLIPPER" DYNAMIC

Another AMERICAN Moving-Coil Microphone, Featuring

HIGH OUTPUT—SMALL SIZE
 RUGGEDNESS—FIDELITY
 TRIM—EFFICIENT DESIGN
 LONG LIFE—STABILITY



D7T—High Impedance 10,000
 List Price \$22.50
 D7—Low Impedance 30 to 50 Ohms
 List Price \$20.00

D7 and D7T Microphones come complete with 12 1/2' B/J cable and Amphenol plug. Chrome finish. 3/8-27 Connector. Over-all height, 2 1/2". Diameter, 1 1/2". Net weight, 8 1/2 ounces.

Request Catalogue No. 27 for Complete Details

AMERICAN MICROPHONE CO., Inc., Los Angeles, Calif.

A GOOD NAME GOES A LONG WAY

More customer satisfaction, when you install Ken-Rad Tubes. The name, Ken-Rad, stands for quality manufacture and perfect performance.

KEN-RAD TUBE & LAMP CORPORATION
 OWENSBORO, KY.

KEN-RAD
 DEPENDABLE RADIO TUBES



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Simply turn the screw at the top of the shield to accurately track with other coils in the set. With only three coils you can exactly duplicate the inductance of an endless variety of coils in dozens of different kinds of receivers.

LIST PRICES
 7413 Antenna List \$2.50
 7558 R. F. List 2.50
 7500 Oscillator List 2.25

Have You Our Catalog?

Oscillator Coils without ordering special transformers.

Meissner Ferrocort Permeability—Tuned (Variable Inductance) Coils give you accurate tracking with a screw-driver. By turning the screw head you move the Ferrocort Iron Core up and down under the secondary winding, varying the inductance within a wide range.

You do a quicker job, your customer gets better service—you have less money tied up in coils, and you can handle more work at a profit.

TRY A FEW COILS—Your regular distributor has Meissner Coils in standard shields. Try them on a few jobs. See what a difference they make in your service work. Use them in your experimental work.

AT ALL GOOD PARTS DISTRIBUTORS

ANOTHER Meissner IDEA
 MEISSNER MANUFACTURING CO.
 160 BELLMONT AVENUE MOUNT CARMEL, ILL.

CAN YOU REPAIR ANY MAKE OF RADIO SET?

"YES MA'M!"

... is your answer if you get **FREE EQUIPMENT** the **EASY NATIONAL UNION WAY**

Man, it's a great feeling to know that you are set up to handle even the toughest service job. That feeling of confidence will keep you alert, pepped up to go after more business. You'll be able to take it, too ... and make more money!

No need to wish you might have the fine modern equipment you see advertised ... you can have it. National Union will give it to you with purchases of National Union radio tubes and condensers. It's easier now than ever with both tubes and condensers to apply against your purchase agreement. Find out ... Ask your distributor. If you don't know who your nearest N.U. distributor is, send coupon or write—right now!

N.U. TUBES and CONDENSERS ARE QUALITY PRODUCTS

Thousands of top notchers in the Radio Service Engineering profession are depending on National Union quality. It's the kind of precision and value that makes good friends for you. National Union quality will never let you down. ... The National Union guarantee is your assurance.

NATIONAL UNION RADIO CORP., 570 Lexington Ave., New York City
 Who is the nearest N.U. Distributor? S-238

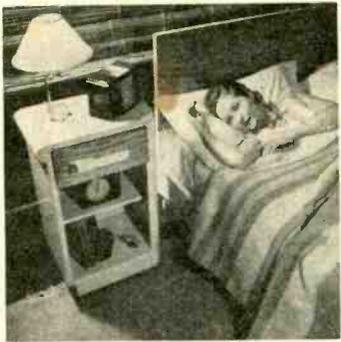
Name

Address

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

An Accessory for Profit...

YOU'LL FIND the Brush "Hushatone" (pillow speaker) a profitable accessory because it is a new item that appeals to the desire for comfort and carries a price that promotes a large volume of business.



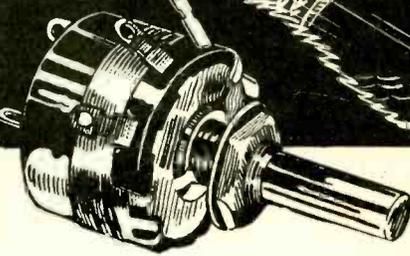
In the home the "Hushatone" is ideal for use in bed, on a couch or a comfortable chair.

In hospitals and sanitariums it has a natural use. Convalescents and bedridden patients welcome the "Hushatone" because of the pleasure and convenience it gives them.

Get in your order today and increase your profits by recommending the "Hushatone" for personal radio sets.

The **BRUSH DEVELOPMENT Co.**
 3318 PERKINS AVE., CLEVELAND, OHIO

Immune!



- New composition element positively moisture-proof.
- Metal parts heavily cadmium-plated against corrosion.
- Casing properly fitted to keep out dust and dirt.
- Smaller controls for bigger work.

• Yes, sir, CLAROSTAT engineers have done it! They've developed a new element that's immune to humidity and other climatic conditions. Our humidity-chamber tests prove it. And from now on, our new midget controls, working in all climes, will confirm it.

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New 208-page pocket-sized CLAROSTAT SERVICE MANUAL is yours for the asking. Get it from your jobber—or from us direct. Meanwhile, try a CLAROSTAT!

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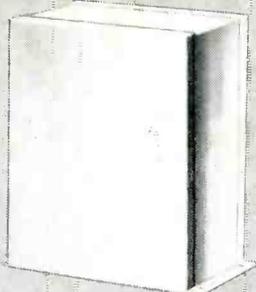
RCA Television Parts FOR KINESCOPE DEFLECTING CIRCUITS



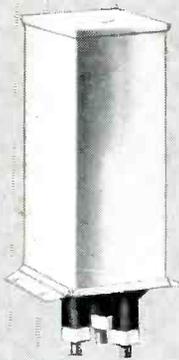
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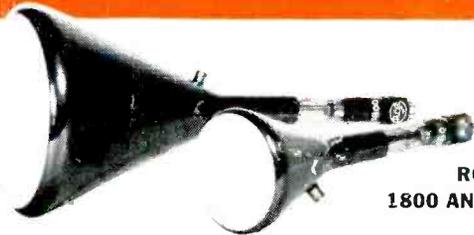
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RCA KINESCOPES
1800 AND 1801

Again RCA encourages the amateur and television experimenter by making available the basic units for the construction of Kinescope deflecting circuits. These parts are of traditional RCA design, include the finest engineering features—manufactured to give long service. They are for use with RCA 5- and 9-inch Kinescopes, Types 1800 and 1801.

DEFLECTING YOKE . . . For RCA 1800 and 1801 Kinescopes. Has windings for both horizontal and vertical deflecting circuits. Designed to have uniform flux distribution. Size: Outside diameter, 2 1/2 inches; Inside diameter to fit RCA 1800 and 1801 Kinescopes. Length: 3 1/4 inches. Stock No. 9831. Net Price **\$10.00**

POWER TRANSFORMER . . . Includes all windings necessary for a complete power supply for the deflecting circuits of RCA 1800 Kinescope. Insulated for high voltage. Plate winding of 6,000 volts and two 2.5 volt heater windings. Stock No. 9832. Net Price **\$12.50**

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VERTICAL OSCILLATION TRANSFORMER . . . For low frequency blocking oscillator circuit. Gives best efficiency at 60 cycles. Stock No. 9834. Net Price **\$3.00**

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