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Picture of a fellow about to take up radio servicing

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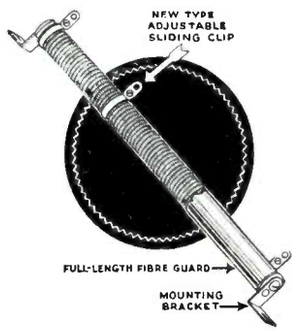

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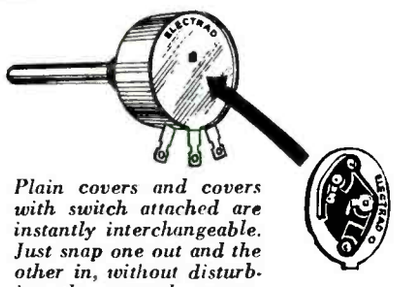

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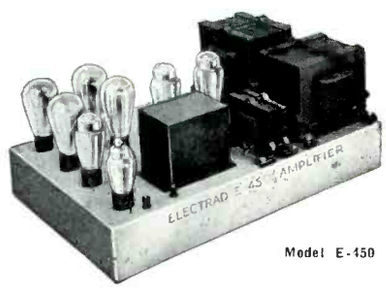

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

MAY, 1933
Vol. 2, No. 5

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Tube changes will not make this instrument obsolete. Separate sockets for every type of tube-base and selective test voltages used in this instrument are the only method ever designed that eliminates rewiring and other complications.

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Fully protected against accident and abuse. The line fuse lamp is located on the panel where it may be instantly replaced.

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THE ANTENNA...

GOVERNMENT CONTROL

THERE are a considerable number of Service Men who have recently voiced their opinions regarding the control of servicing activities. Some feel that the Government should step in and make the licensing of Service Men an absolute necessity. Others feel that it would be much better for all concerned if Service Men continue handling their own problems and thus keep free of any restrictions which might prove disadvantageous in the end.

In any case, the main idea is to establish a stability in the field—which it now lacks, and at the same time promote some protective measure that would eliminate the men who undermine not only the good name of servicing but likewise make the business unprofitable.

There are existing at the present time a few remarkably strong local associations. These associations have been able to take care of their members and make life very disagreeable for the "gyp" and the "mechanic" alike. For this reason, the condition of radio servicing in the cities where these associations exist is decidedly healthy.

Of course, organizations of this sort can do little good if they lack power and a suitable plan of operation which is distinctly for the benefit of the Service Man. Having these requisites, the associations can do a pretty fair job of policing their own districts.

The same is true of a National Association, but in this case the vitality of the center of activity must be transmitted to each and every local unit. Any local unit lacking in aggressiveness cannot exert much influence in the district in which it operates.

A National unit could of course make its influence effective in every locality through political action—and this brings us to the point of a form of Governmental Supervision as a protective measure.

It has been pointed out that the Government is well equipped with sectional branches for the purpose of examination and licensing. These branches are used for examining men for commercial and amateur activity. They could also be used for examining Service Men in each of the nine U. S. districts.

Licensing only those who are really equipped to do service work would of course ease the present situation of overcrowding and inability. However, before going into the thing blindly, it would be well that a thorough study be made of other fields which are so controlled. There are licensed pharmacists, engineers, etc. Has the licensing been of advantage to these men? How does it work, and has it disadvantages? It would be well to look into these points.

• • •

WE have said quite a good deal regarding the complexities of modern receivers and modern tubes. Both receivers and tubes incorporate new functions and in many cases old test equipment proves ineffective insofar as practical measurements are concerned.

Receivers and tubes will continue to become more complex as time goes on—at least more complex in their functions. Circuits, however, may become simplified in structure—more nearly resistance networks than anything else.

We already have a number of seven-pin tubes and there is a strong possibility of a crop of eight-pin tubes being released sometime in the near future. The addition of another pin will again complicate test equipment.

The one consolation—if it is any consolation at all—is that the addition of pins cannot go on forever. We seriously doubt that there will ever be a nine-pin tube for the reason that tube engineers have done about as much combining of tubes in one envelope as they care to. If this be the case, then, when, as and if the eight-pin tubes appear, the socket and adapter situation will clear up. Then the test equipment manufacturers will be able to get down to a few composite sockets and the situation will be licked—maybe!

• • •

THIS brings us to another interesting possibility. There seems to be a growing favor among set manufacturers to give expert stylists a whack at designing ultra-attractive cabinets for radio receivers. The idea seems to hinge on the point that the automobiles that sell are those with attractive lines. This being the case, why should it not work out for radio receivers?

This move—if it gets under way—may tend to temporarily level off engineering development which heretofore has supplied the sales talks. If attractive cabinets are to sell the sets, then the "works" can just as well as not remain as is, for a new double duo-diode pentode is not going to hypnotize the average buyer.

Maybe if all this happened, each of us could catch up with himself. That would be fine for many of us, but we should hate to see engineering development slow up too much. When it does, things get unhealthy.

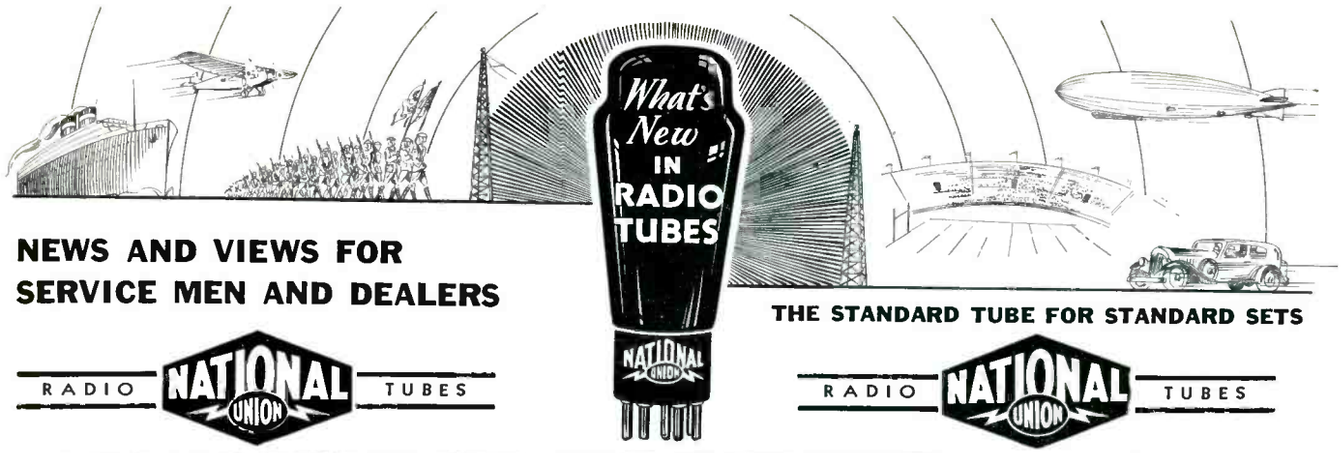
• • •

THE appearance of sets of the remote tuning control type wherein the receiver is separate from the speaker suggests the use of cigar-box receivers for this purpose. The ways in which this can be done are numerous and each manner not only a point of great convenience but likewise of improvement.

We know that in order to get good quality, the speaker should be fairly large and should be mounted on a large and solid baffle. Many of the cigar-box sets have sufficient output to operate very nicely (in the home) a good sized speaker, and this suggests the first way in which the system could be devised.

Or, take it another way; the speaker and a real power amplifier could be mounted separately and fed from the output of the cigar-box receiver if a driver were needed, or from the detector, or intermediate audio stage if there happened to be one.

How about some manufacturer supplying shielded and unshielded transmission lines for this purpose? Something that would go in a home. *John F. Rider.*



NEWS AND VIEWS FOR SERVICE MEN AND DEALERS

RADIO NATIONAL UNION TUBES

THE STANDARD TUBE FOR STANDARD SETS

RADIO NATIONAL UNION TUBES

N. U. 6F7 TWO TUBES IN ONE ENVELOPE

Description, Characteristics and Typical Circuit Given

Among recent developments brought from the National Union Laboratories is the new NU-tube type 6F7. The 6F7 is a vacuum tube consisting of a small triode and a remote cut-off pentode. Both of these tubes are enclosed in the same envelope. The primary purpose of the 6F7 is to serve both as the oscillator tube and the first detector tube in a superheterodyne receiver. The triode elements and the pentode elements are entirely separate except for a common cathode sleeve; the active emitting cathode area for the triode is not the same as the emitting area for the pentode. A 6.3-volt .3 ampere filament is employed to heat the cathode of the tube.

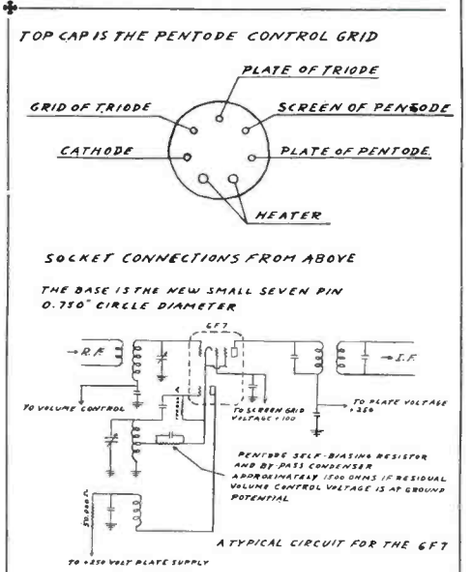
The pentode portion of the 6F7 contains a remote cut-off control grid, thus permitting the output of the first detector unit to be volume controlled. The triode portion of the 6F7, while small, is nevertheless a very satisfactory oscillator tube. The application may well be of the same general type as employed with separate oscillator and first detector tubes. As the triode has its cathode connected to the cathode of the pentode, it will prove convenient to return the cathode circuit through a portion of the oscillator coil to ground, thus introducing into the pentode some of the oscillator voltage and thereby affecting the desired mixing. Inspection of the characteristics table will serve as a guide to the proper design of the oscillator coil. The use of a series resistance to feed the triode plate voltage through is highly recommended as such a resistance will tend to smooth out variations in oscillator performance occasioned by differences in triode characteristics. Reference to the circuit diagram will show that when the supply voltage is 250, the series resistance should be in the order of 50,000 ohms.

PENTODE CHARACTERISTICS MEASURED AS AMPLIFIER	
Filament Voltage	6.3
Filament Current	.3
Pentode Control Grid Bias (Min.)	−3
Pentode Screen Grid Voltage	100
Pentode Plate Voltage	250
Pentode Plate Current	6.5
Pentode Screen Current	1.5
Pentode Mutual Conductance	1100
Pentode Amplification Factor	900
Pentode Plate Impedance	.85 megohms
Pentode Mutual Conductance at −35 volts Control Grid Bias	10 umhos

TRIODE CHARACTERISTICS	
Triode Plate Voltage	100
Triode Grid Bias	−3
Triode Plate Current	3.5
Triode Mutual Conductance	450
Triode Amplification Factor	8.0

TRANSLATOR OPERATION	
Pentode Plate Voltage	250
Pentode Plate Current	5.5
Pentode Screen Voltage	100
Pentode Screen Current	1.5
Triode Plate Voltage Supply (through 50,000 ohms)	250
Triode Plate Current	2.75 ma.
Triode Grid Leak	100,000 ohms
Conversion Conductance	550 micromhos
Plate Impedance	600,000 ohms

MECHANICAL DATA	
Maximum Overall Length	4- 17/32"
Maximum Diameter	1- 9/16"
Bulb	ST-12
Cap	Small Metal
Base	Small 7-pin



A TYPICAL CIRCUIT FOR THE 6F7

INTERCHANGEABLE TUBE CHART FREE

This chart gives brief descriptions of all tube types, filament voltages and comparative type numbers of National Union tubes and those of other manufacturers. It is organized in simple easily readable form. A copy will be sent free on request. Ask for the "National Union Interchangeable Radio Tube Chart."

CONVINCING COMMENTS

Here are a few excerpts from hundreds of letters received by National Union each week . . . all unsolicited . . . all sincere. . . .

"By far the best percentage of tube performance we have experienced in all our years of radio dating back to its beginning" . . . "remarkable performance not obtained from other brands" . . . "In my work at radio servicing I know the true value and service your tubes give" . . . "we are selling more National Union tubes at regular prices than other lines" . . . "am well pleased with tubes."

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You can also get an Oscillator and Output Meter. Two Service Manuals, Unabridge (Resistance Tester), Readrite Tube Tester, Bench Kit box, Hickok Ohm-Capacity-Voltmeter. Equip your shop the easy National Union way at no cost. Small deposit on some items. Write now for profit's sake!

TUBE BASE CONNECTION FINDER

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

This is the National Union carton top.

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ORGANIZE for PROFIT!

PART III

By JOHN F. RIDER

SINCE the publication of Parts I and II of "Organize For Profit," there have been received numerous letters for and against the idea, and also a number requesting more details. It will therefore be the purpose of this last article to cover the points brought up by our readers.

Some readers felt that we intended the plan as outlined to be carried out to the letter. This would be quite impossible, as the same set of conditions do not hold for the entire country. It is absolutely necessary that a certain amount of flexibility be given to any such plan so that it may be altered to meet whatever the local conditions may be.

Plan in Brief

In order to indicate the flexibility of the plan, suppose we merely outline the essential points in a broad manner, without any of the specific mechanics of operation. Here they are:

(1) The formation of local organizations for the purpose of: (a), protecting the public against poor servicing and overcharging; (b), eliminating the unscrupulous and irresponsible element from the field, as well as such men proven to be unfitted for service work; (c), the establishing of credit so that each member may increase the scope of his rightful merchandising activities; (d), coordination of servicing activities on a sound technical basis; (e), formation of a technical reference library for the convenience of all members; (f), the maintenance of prices and quality of replacement parts.

(2) The establishment of rules and regulations applicable to the locality, and the determination of the limits of territory to be covered, based on population and the number of Service Men in a given locality.

(3) Institution of local publicity and advertising for the purpose of "selling" the public on the association and warning them against inferior servicing and overcharging.

(4) The placing into operation a system of guarantee cards which would offer absolute protection to the public on all servicing done by the members of the association.

(5) Determination as to the form of penalties to be placed on members who either fail to do a satisfactory servicing job, or who fail to abide by the rules and regulations of the association—keeping in mind that such penalties are for the purpose of protecting each and every member as well as the public.

(6) The opening of the association to all Service Men, Dealers, Jobbers and Distributors who wish to join—including the beginner, who should in all fairness be given an equal chance—and the process of elimination permitted to operate in its natural course.

(7) A scheme of association government which will not permit the entrance of politics into the functioning of the association.

These points do not necessarily cover all the necessities of a local organization; other points might well have to be included. On the other hand, some of the points listed may be considered as inapplicable to some local organizations. After all, the most important point is financially guaranteeing the work of the members of the association. This alone is a powerful weapon against unfair practices.

Practical Example

One interesting letter received goes to prove that a local association can be of great benefit to its members. Mr. J. A. Mayr, on the Board of Directors of the East Bay Association of Radio Service-Dealers, states that the association has been of great value, and that since its institution in June of 1932, it has been necessary to terminate only two memberships out of a total of twenty-one—which indicates in a practical way that most members adhere to the rules of the association and likewise manage to get along without internal friction.

The East Bay Association of Radio Service-Dealers distributes cards to its members, these to be placed in the radio sets repaired. The card itself tells the story and the data is well worth publication. Here it is:

"Organized for your protection. Our purpose: The Members of this Association are banded together in an attempt to: eliminate incompetent radio service and sharp practice, endeavor to eliminate radio interference, educate and help our employees, and cooperate with each other; to understand and solve radio problems of the future; extend the facilities of radio to the blind, deaf, and all who are physically handicapped; uphold a high standard of practice and inspire public confidence in this profession."

"The following Code of Ethics is a pledge of each Member of the Association. We pledge—To use the highest quality materials; to be thorough in our work; to handle our customers' property with care; to keep our promises; to charge a fair price for our service."

To this is appended a list of all members, and the following: "Should you ever fail to receive satisfaction from the above members, kindly notify in writing the Secretary."

Now, there is a plan both simple and effective. It contains the very essence of the necessary—a system of protection for both the public and the members of the association. There are similar associations in other parts of the country which have been equally as successful.

Existing Service Associations

Two Service Men have wished to know if we recognize existing service organizations, or are we attempting to form a new group. This can be answered without qualifications, or reservations. We most certainly recognize existing service associations and we most certainly are not attempting to form new organizations to take the place of the old. Our recommendation that local associations be formed was addressed to the men in the towns, cities and counties where local associations are non-existent. There are many such places in the United States.

At the same time, we presented the plan of procedure for such existing associations which might find some of the ideas presented of value in their localities . . . the credit angle for example, and the guarantee cards.

(Continued on page 180)

General Data . . .

A-K. 155 Universal

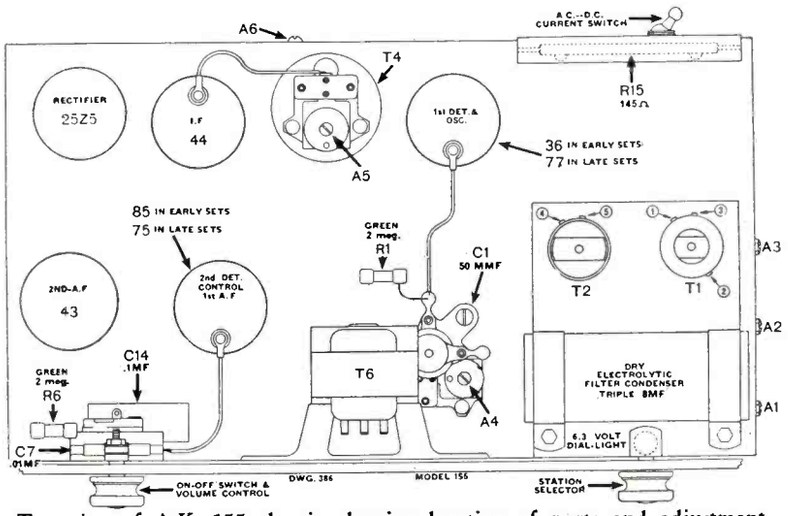
The Atwater Kent Model 155 Universal receiver is a superheterodyne with a peak frequency of 262.5 kc. for the i-f. stage. It is designed for operation on either a-c. or d-c. and all tube heaters are connected in series.

It will be noted that the accompanying diagram of the Model 155 provides not only all resistance values, thus permitting point-to-point analysis, but also voltage data. The average voltages to be expected at the various test points are printed in white on a black background.

The circuit shown in Fig. 1 is for the first type, below serial number 7086900. In these sets a type 85 tube is used as second detector. In the second type, a 75 tube is used as second detector. Some of the first type also use a 36 tube as first detector and oscillator.

The top-of-chassis layout shown in Fig. 2 is the same for both the first and second types. This view indicates the locations of the various adjusting condensers which are marked to agree with the markings in the schematic diagram. In both Figs. 1 and 2, the resistor R1 should be 1 megohm, blue and gray.

Take note of the fact that there is a switch on the rear of the chassis (see Fig. 2) for changing from a-c. to d-c. This switch is also shown in the circuit diagram, and it will be seen that when it is in the d-c. position only a portion of the 25Z5 rectifier tube is in circuit—in this case the portion left in the circuit merely functioning as a resistance. When the switch is in the a-c. position, the rectifier tube is employed as a voltage doubler, so that higher plate voltages may be had on the tubes. The voltages marked on the diagram are based on a line supply of 110 volts a-c.



Top view of A-K. 155 chassis, showing location of parts and adjustment screws. Note that the antenna and oscillator trimmer condensers A1, A2 and A3 are on the side of the chassis

Hum in Universals

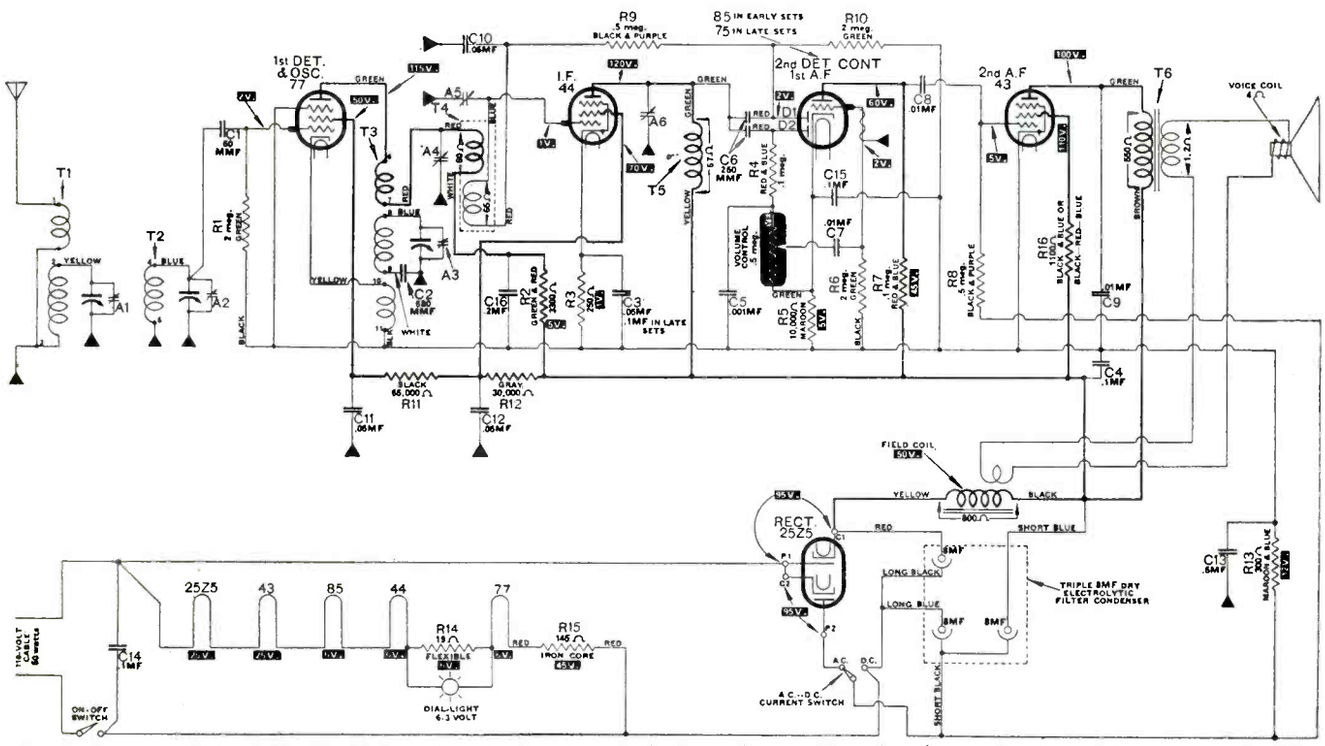
The first step in the elimination of hum is naturally the location of its source. By shorting first the input and then the output of each stage successively, hum originating in any one stage can be isolated. If hum persists after the input to the last radio stage has been shorted, the source of trouble probably lies in the power-supply system. To determine if hum is due to ripple voltage in the speaker field, short the output transformer or the speaker voice coil and note the results. Any hum which continues is due to ripple voltages in the speaker field.

This form of hum-trouble shooting can be applied to most any receiver.

Power-Supply Hum

There are a number of steps to be tried in the elimination of hum originating in the power-supply system.

(1) In many cases, balancing both sides



Circuit diagram of the A-K. 155 Universal, with all values, including voltages. Note that the rectifier is used in a voltage-doubling circuit when the set is operated on a-c.

of the line to the chassis through condensers will materially reduce hum. The capacity of these condensers should be about 0.1 mfd.

(2) In circuits which employ separate loads for the two halves of the 25Z5 rectifier tube (see the Fada "RN" in this issue, for example) an increase in the capacity of the condenser by-passing the speaker field may reduce hum. Of course, in sets using both plates and cathodes of the 25Z5 in parallel, the filter condenser and the condenser by-passing the speaker field are the same.

(3) Perhaps the most effective, but also the most expensive, method of reducing hum due to the power supply is to increase the capacity of the filter condenser. The maximum permissible size and cost of the condenser must be taken into consideration when this is done. However, increasing capacity of the filter condenser has the further advantage that an improvement in the regulation of the power supply will result.

RE-RADIATION HUM

Modulation hum in small universal sets frequently is due to the fact that the power lines carry the signal voltage into the rectifier tube. Here the signal voltage is modulated with the rectified a-c. hum voltage, and then, either re-radiated to the antenna, or to other circuits in the receiver.

A 0.05- to 0.25-mfd. condenser across the power line will usually remedy this difficulty. (*This data supplied by RCA-Cunningham*)

●

Stewart-Warner 109 Chassis

The Model 109 Chassis is used in receiver Models 1090 and 1099 and makes use of a six-tube superheterodyne circuit embodying AVC through the action of its type 55 detector tube. An incoming signal is tuned first by a pre-selector circuit to increase selectivity and reduce image-frequency interference and then fed into a tuned first detector stage, where it beats with the output of the oscillator to produce a 177.5-kc. i-f. signal. This odd frequency is chosen to further reduce any image-frequency interference.

The i-f. signal is amplified in an exceptionally high gain stage, and then fed to the diode section of the 55 tube where it is rectified. This rectified signal appears across the 500,000-ohm potentiometer (No. 12 in the accompanying diagram) not only at radio frequencies but also as an audio voltage. Any desired portion of this audio voltage is picked up by the sliding arm of the potentiometer and fed to the triode section of the 55 tube, which functions purely as a standard a-f. amplifier. Thus, this potentiometer is made to act as the volume control.

The necessary AVC operating potential is developed by the virtue of the radio-frequency drop across the potentiometer resistance. This potential is smoothed out by a resistance-capacity filter (26 and 29) and applied as a bias to the grids of the first detector and i-f. tubes. Thus as the incoming signal increases or decreases in strength the bias is raised or lowered proportionately and the audio output of the set maintained constant.

ALIGNMENT

The simplified top view of the chassis is shown along with the schematic diagram and indicates the names and locations of the various aligning adjustments. The following brief discussion of what actually happens during alignment should be carefully read, using the sketch as a basis before actually commencing the work.

The incoming signal is tuned first by the pre-selector "A" stage and then fed into the first detector "B" circuit, where it is tuned again to improve selectivity. These circuits are brought into exact alignment by the two trimmer condensers "A" and "B," so marked in the sketch. The tuned oscillator circuit is so designed that it tunes to a frequency exactly 177.5 kc. higher than the incoming signal. This circuit is kept in exact step with the other two by means of the oscillator condenser trimmer "O."

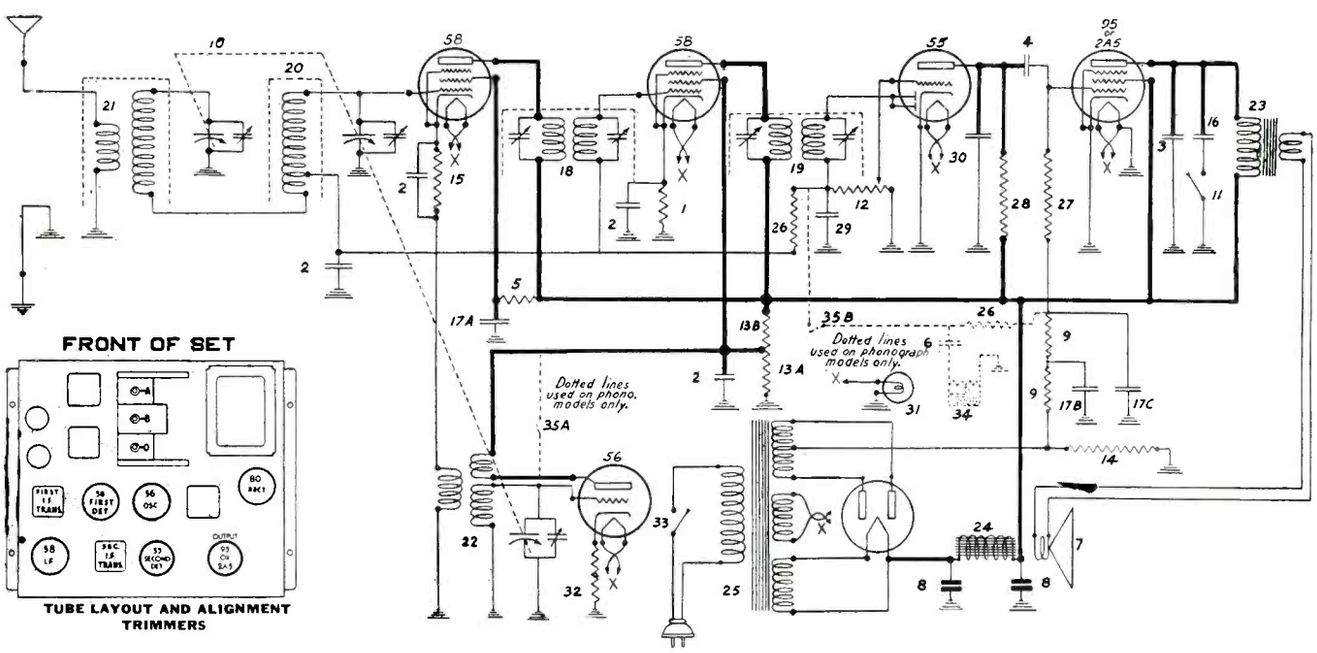
The first i-f. transformer is in the steel shield at the right side of the set, while the second i-f. transformer is at the rear of the chassis. The i-f. trimmer adjusting screws can easily be reached through two small holes at the base of each shield, the primary circuit adjustment in each case being at the left and the secondary adjustment at the right.

In aligning this chassis it is essential to use a high grade oscillator and sensitive output meter. The r-f. signal fed into the receiver must be very weak or it will cause the AVC circuit to function, making correct alignment impossible. The output meter must

STEWART-WARNER 109 VOLTAGE DATA

Tube	*Fil.*	*Plate*	*Screen*	*Bias*
Osc.	2.40	88	..	9.6
1st Det.	2.40	208	92	5.0
I-F.	2.40	208	92	3.4
2nd Det.	2.42	18	..	..
Output	2.38	200	208	16.5*
Rect.	5.00	..	..	..

* This reading taken across metal-clad bias resistor.



Circuit diagram and chassis layout of the Stewart-Warner Model 109 receiver

be sufficiently sensitive to give a satisfactory reading with this low signal. These notes are true in connection with most of the modern, sensitive receivers using AVC.

Before starting the alignment procedure see that the volume control is full on, and the output meter connected either between the pentode plate and ground *through a 25-mfd.* condenser, or across the voice coil, depending on its sensitivity.

Now proceed as follows:

Set up the oscillator, and tune it to exactly 177.5 kc. Then connect the oscillator output between the grid cap of the first detector tube and chassis. Now peak the i-f.

Next twist the aerial and ground wires of the set together to reduce noise pickup. Connect the aerial wire to the output of the oscillator and *ground both set and oscillator.* Adjust the oscillator frequency to 1,400 kc. and carefully tune the receiver to give maximum output. Adjust the oscillator output to produce about one-half full scale deflection of the output meter.

Now carefully tune the "A" trimmer for maximum output reading. Due to the fact that the variable condenser is mounted on rubber cushion supports, pressure of the aligning tool will usually cause it to shift slightly and throw it out of tune. It is therefore *necessary to retune the set repeatedly while adjusting any variable condenser trimmer.*

Next retune the set and adjust the "B" trimmer for maximum output. The "O" trimmer should not be touched unless the set is badly out of calibration at the high-frequency end of the dial, in which case it can be recalibrated as follows: Set the tuning dial at the frequency reading of some station *between 1,200 and 1,500 kc. only,* whose exact frequency is known and which can be picked up without any difficulty. Adjust the oscillator trimmer "O" until this station is brought in with maximum volume. Then *readjust the "A" and "B" trimmers,* since these are always affected by any change in the oscillator tuned circuit.

Values and Voltages

Voltage readings are given in the accompanying table. All d-c. voltages measured with respect to ground, using a high-resistance voltmeter of 1,000 ohms per volt. Readings will of course vary, depending upon the voltage range of the meter, being higher for higher range meters. This variation is most marked for second-detector plate voltage.

The various units in the circuit diagram are numbered. The values of these units are as follows:

1 —500 ohm, .25 watt
2 —.1 mfd., 200 volt
3 —.01 mfd., 600 volt
4 —.02 mfd., 400 volt
5 —100,000 ohm, .5 watt
6 —.1 mfd., 200 volt
8 —8 mfd., 485-volt elect.
9 —150,000 ohm, .5 watt
11 —Tone control switch
12 —500,000 ohm vol. control
13A—10,000 ohm } One
13B— 7,500 ohm } Unit
14 —315 ohm, wire wound
15 —1,000 ohm, .25 watt
16 —.04 mfd., 600 volt
17A—.5 mfd., 200 volt }
17B—.25 mfd., 100 volt } *
17C—.25 mfd., 100 volt }
26 —980,000 ohm, .5 watt
27 —160,000 ohm, .5 watt
28 —110,000 ohm, 1. watt
29 —.00026 mfd.
30 —.00051 mfd.
32 —1,500 ohm, .25 watt

* In same case.

It might be added that the 109 Chassis is similar in most respects to the 104 Chassis except that a type 55 tube is used instead of the Wunderlich, and a 95 (or 2A5) cathode-type output tube is used instead of the 47 filament type pentode previously used. Using the cathode-type pentode permitted the elimination of the filter choke as used in the 104 Chassis.

Another minor simplification is the elimination of the oscillator low-frequency padding condenser.

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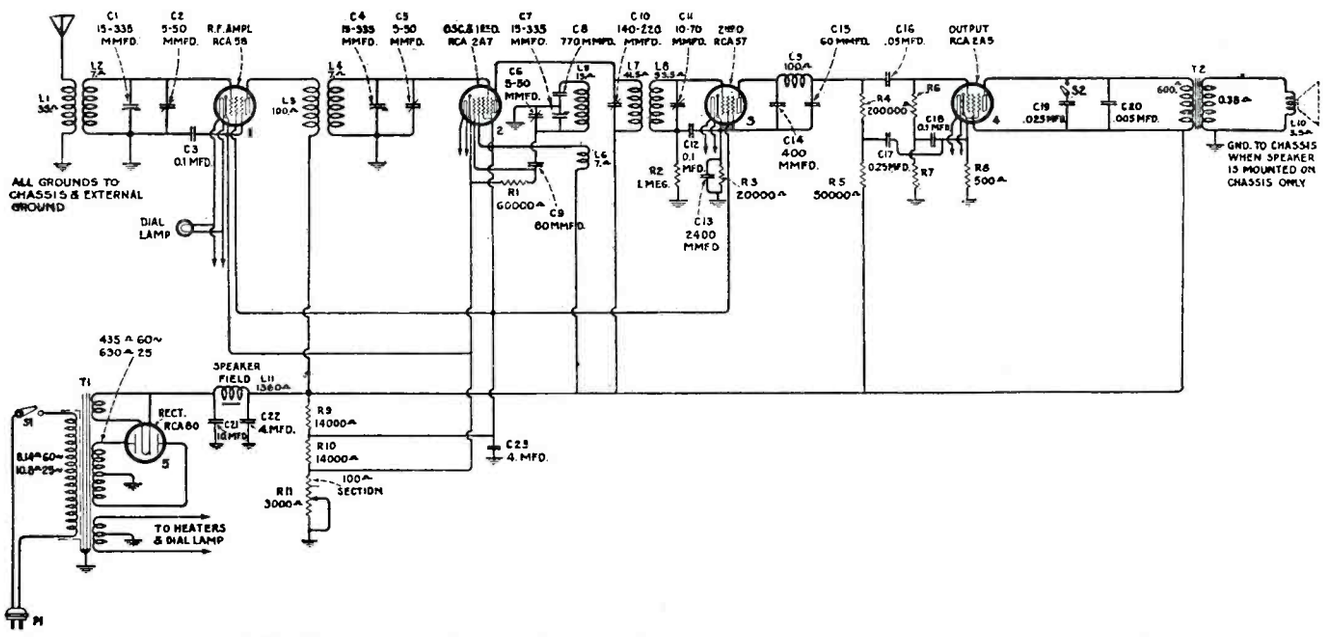
RCA Victor R-28

This is a superheterodyne operating on an intermediate frequency of 175 kc. and with a tuning range of 540 to 1,500 kc. The power consumption of the receiver is 70 watts and the undistorted power output is 1.75 watts.

A glance at the circuit diagram will show that a type 58 tube is used in a stage of tuned r-f., this stage in turn feeding into a type 2A7 tube which is employed as a combination mixer and electron-coupled oscillator. The mixer feeds directly into the second detector through an i-f. transformer, and the second detector, which is a type 57 tube, is resistance-capacity coupled to a 2A5 cathode-type power output pentode.

Volume (sensitivity) is controlled by the variable resistor R11, which alters the bias on the r-f. tube *and on the mixer tube.* Tone is controlled by the switch S2 which cuts in and out the condenser C19. When this condenser is shunted across the output of the 2A5 tube the high frequencies are attenuated.

Service work in conjunction with this receiver will be similar to that of other superheterodynes of the small type. The line-up adjustments are made in conjunction with an external oscillator and an output meter in the usual manner. The trimmer condensers on the gang condenser are adjusted for maximum output when the oscillator is coupled



Circuit diagram of the RCA Victor R-28 which, it will be noted, uses a type 2A7 as combination mixer and oscillator and a type 2A5 power pentode in the output. The former tube feeds directly into the second detector

RCA VICTOR R-28 VOLTAGE DATA

Tube	*Grid*	*Screen*	*Plate*	*Plate MA.*	*Heater*
R-F.	3.0	95	250	5.0	2.33
Mix.-Osc.	3.0	95	250	3.0	2.33
2nd Det.	6.0	89	170	0.3	2.33
Pwr.	18.0	235	220	32.0	2.33
Rect.	(275 volts plate to plate, 60 ma. total)				4.82

Measurements made from cathode to element.
Total cathode current, 11 ma.

to the antenna and the set and oscillator are both set at 1,400 kc. The trimmer condensers C10 and C11 on the primary and secondary of the i-f. transformer are adjusted so that the transformer peaks at 175 kc.

All resistance values are given on the diagram so that it is possible to carry out a point-to-point resistance analysis. The resistor R6 has a value of 250,000 ohms and R7 a value of 50,000 ohms. Each of these has a rating of 0.5 watt.

Voltage data is given in the accompanying table. The values are based on a line voltage of 115. Readings should be taken with volume control full on and no signal.

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Philco Model 19

In all these models with bass compensation tone control the cathode of the output (type 42) tube was grounded to the subbase at the tube socket. This eliminates any tendency towards oscillation on point 4 of the tone control.

Atwater-Kent 60 Series

This receiver was produced in three types. The first type has a single volume control regulating the screen-grid voltage. The second and third types have dual controls. The second type employs its dual control to regulate the r-f. energy transfer between the 1st and 2nd r-f. tubes and also the screen-grid voltage. The third type employs the dual control to regulate the r-f. energy transfer between the antenna circuit and the 1st r-f. stage and also to control the r-f. control bias voltage. These three types can further be recognized by locating the local-distance switch. In the first type it is between the 1st and 2nd r-f. tubes. In the second type it is between the 2nd and 3rd tubes and in the third type it is ahead of the 1st r-f. tube.

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A-K. Peak Frequencies

The new Atwater Kent Models 155, 246, 266 and 555 employ an intermediate frequency of 262.5 kc. In the Model 448 the intermediate frequency is 130 kc.

Clarion 420 Universal

This is an a-c., d-c. superheterodyne employing a 6A7 as combination mixer and electron-coupled oscillator, a type 78 in a stage of high-gain i-f., a type 75 used as second detector in half-wave connection, dual-automatic volume control and high-gain audio amplifier. This tube is resistance coupled to a type 43 power pentode.

The frequency of this receiver is from 1720 to 540 kc.

As seen from the accompanying diagram, the rectifier is a 25Z5, the heater of which is connected in series with the other heaters. This tube is employed as a double half-wave rectifier, one section supplying the speaker field and the other section supplying the voltages for the tubes.

Note that the voltage-reducing resistor connected in series with the tube heaters is a part of the power-supply cord and is not in the chassis.

The manual volume control is a potentiometer in the audio circuit of the type 75 diode-amplifier. This section of the 75 tube, as well as the mixer-oscillator and i-f. tube, are tied in the automatic volume control system.

The center coil of the three in the antenna circuit is for image-frequency suppression. This system was covered on page 97 of the March issue of SERVICE.

Further data on this receiver will be published when available.

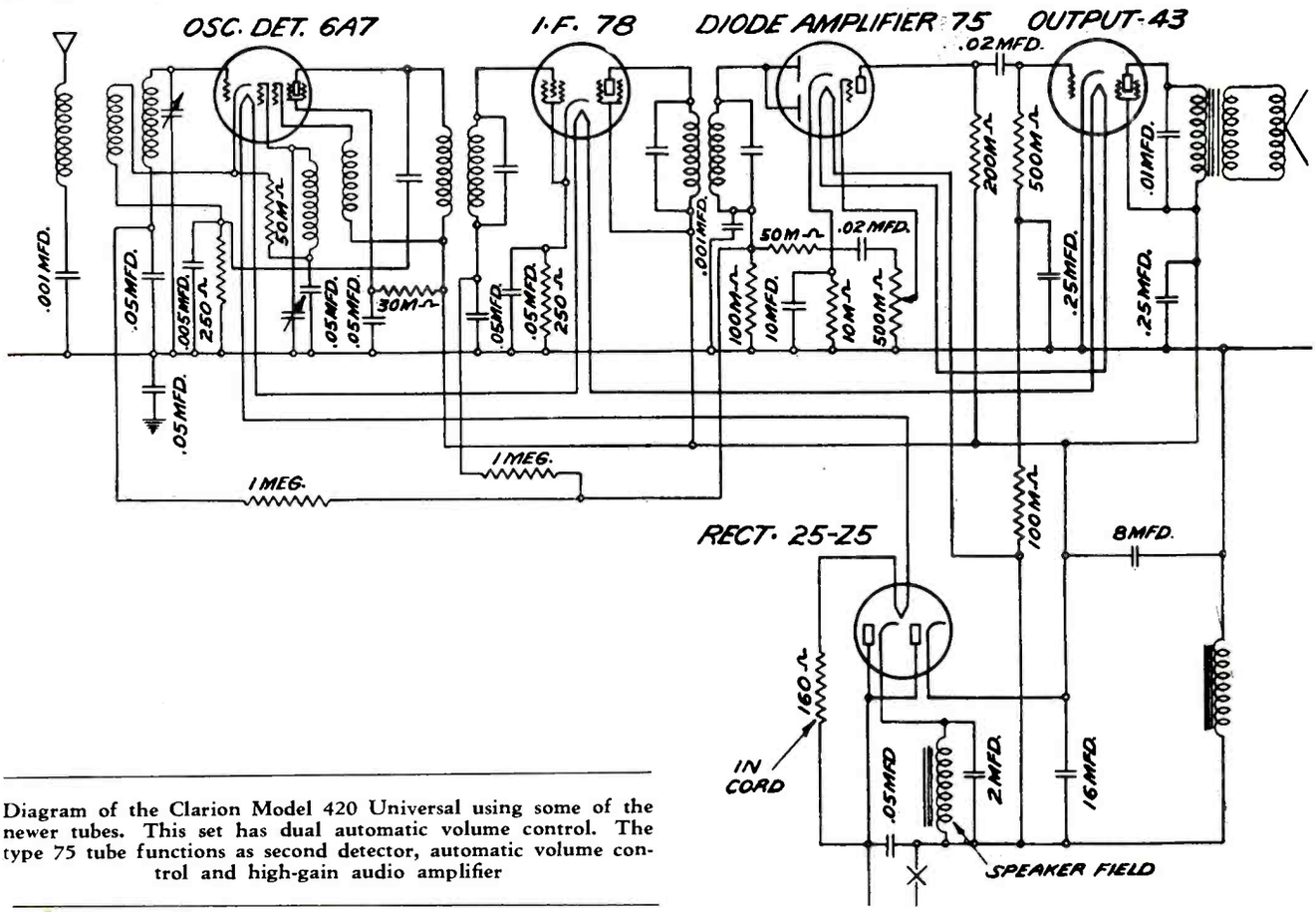

Diagram of the Clarion Model 420 Universal using some of the newer tubes. This set has dual automatic volume control. The type 75 tube functions as second detector, automatic volume control and high-gain audio amplifier

Tiffany Tone Model 15M

This receiver is made by the Herbert H. Horn Radio Manufacturing Company, Los Angeles, California.

The chassis consists of three stages of tuned radio frequency amplification, a power detector and a transformer coupled pentode audio amplifier, as indicated by the accompanying schematic diagram. Type '35 variable-mu tubes are used in the three r-f. stages, a type '27 as power detector and a type '47 as power pentode.

In case of the use of a type '24 screen grid tube as power detector, the supplementary diagram in the dotted line box should be followed. A type '24 tube is used in those models having resistance coupling between detector and pentode.

Adjustment

A modulated oscillator variable over the broadcast frequencies should be used in the alignment of the receiver. The use of an output meter will insure accuracy where the ear might tend to be inaccurate.

Turn the condensers on the r-f. coils to maximum and then turn each one-half turn back. This adjustment should not vary except on a long aerial which may necessitate unscrewing them further.

The condenser trimmers should be adjusted at approximately 1,300 kc. The maximum sensitivity for the rest of the band should be obtained by spreading the split rotor plates. It may be necessary to go over the trimmers and plate spreading several times before the gang is properly balanced.

Voltages and Values

Normal voltage readings to be expected are given in Table 1. The only value not given is the grid bias for the '47 pentode. This should be minus 16 volts.

The values of the units used in the Model 15 are given in Table 2.

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Philco "All-Purpose" Tester

The Philco Radio & Television Corp., Philadelphia, Pa., have brought out an all-purpose set tester specifically designed for use by Service Men. It is entirely self-contained and consists of a modulated oscillator covering all frequencies from 105 to 2,000 kc., a multi-scale meter having the following uses; five a-c. voltmeter scales, five d-c. voltmeter scales (these two with a sensitivity of 2,000 ohms per volt), three d-c. milliammeter scales, three ohmmeter scales and five a-c. output meter scales. The same meter may also be used as a capacity meter.

A series of insulated tip jacks are provided for the various voltage and current ranges, both a-c. and d-c.

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Hey, You!

Will the guy who continually writes in for the circuit diagram of the Armstrong Regenerative Receiver quit writing in and go jump in the lake.

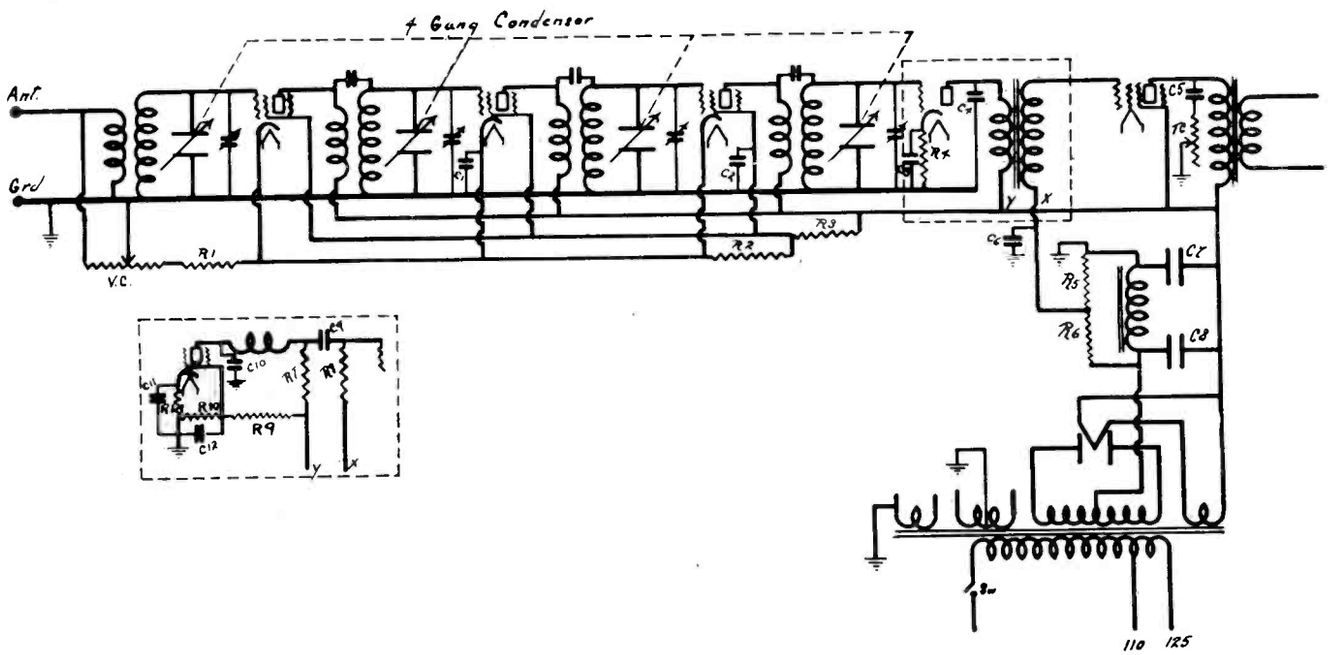
TABLE 1

Tube	*Plate* (Max.)	(Min.)	*Screen* (Max.)	(Min.)	*Cathode* (Max.)	(Min.)	*Heater*
'35s	233	218	128	92	17	3	2.3
'27	218				10	10	2.3
'47	232	215	220	—			2.5
'80	350 a-c.						

TABLE 2

R1 — 300 ohms, 3 watts		C1 —0.1	mfd.
R2 — 10,000 " 1 watt		C2 —0.1	"
R3 — 10,000 " " "		C3 —0.25	"
R4 — 20,000 " " "		C4 —0.002	"
R5 — 50,000 " " "		C5 —0.1	"
R6 —250,000 " " "		C6 —0.5	"
VC — 3,000 " " "	(Variable)	C7 —8.0	"
TC — 10,000 "	"	C8 —8.0	"
R7* —500,000 " " "		C9* —0.02	"
R8* —500,000 " " "		C10*—0.00025	"
R9* —2 megs.	" "	C11*—0.5	"
R10*—.25 meg.	" "	C12*—0.1	"
R11*— 50,000 "	" "		

* These items used in the Model 15 previous to the change to audio transformer coupling. This is shown on the schematic diagram.



Circuit diagram of Tiffany Tone Model 15M. In some models a type 24 tube is used as power detector. The connections for this arrangement are shown in the dotted line box above

THE STORY OF RECEIVER DESIGN

Part III

LAST month we discussed oscillators and mixer tubes, together with their circuits. Now we will discuss the intermediate-frequency amplifier, which will bring us back into oscillator territory again, as the two have a close relationship.

The intermediate frequency for any superheterodyne receiver must be carefully chosen; otherwise squeals and signal distortion may result at numerous signal frequencies. Of course, the intermediate frequency may be higher or lower than the received signal band, but usually it is made lower for a number of reasons, two of the most important being:

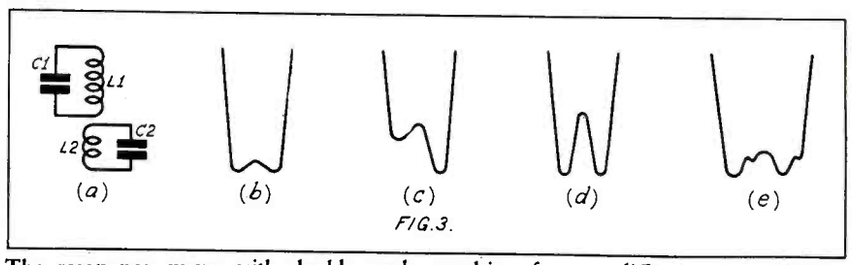
(1) It is possible to obtain higher gain per stage and less instability at low frequencies.

(2) Harmonics of the signal produced by the mixer tube might fall on the intermediate frequency if it were above the broadcast band, and of course this cannot occur at low frequencies for the simple reason that any harmonics produced by the mixer tube would be higher in frequency than the fundamental signal wave.

In order to produce the i-f. signal, the oscillator may be tuned either above or below the received signal band so that if the signal were, say, 1,500 kc. the oscillator could be tuned to either 15,175 kc. or 1,325 kc. to produce an i-f. signal of 175 kc.

Tracking

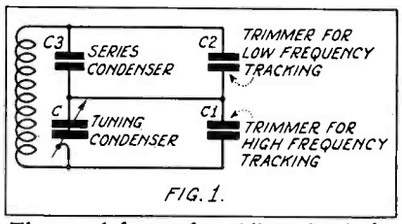
However, the oscillator is most always tuned to the frequency above the broadcast signal because this simplifies the problem of making the oscillator tuned circuit "track" with the others, and because an oscillator condenser of smaller capacity than the tuning condenser in the r-f. mixer circuit may be used, or one of identical capacity. As an example, suppose we wished to receive the broadcast band of 550 to 1,500 kc. and we were to use an intermediate frequency of 200 kc. If the oscillator were to be tuned below the broadcast signal, the oscillator would have to vary from 350 kc. to 1,300 kc., whereas if the oscillator were tuned above the broadcast signal the variation would then be from 750 kc. to 1,700 kc. The frequency spread is of course the same in each case; i.e., 950 kc., but tuning capacity *varies inversely as the square of the frequency*. Therefore we have to consider the ratios.



The resonance curves with double peaks resulting from a difference between the resistance, etc., of primary and secondary circuits, or from mistuning

With the above examples, we have:

Frequency Ratio		*Capacity Ratio*
$\frac{1500}{550}$	= 2.73	$(2.73)^2 = 7.45$
$\frac{1300}{350}$	= 3.71	$(3.71)^2 = 13.4$
$\frac{1700}{750}$	= 2.27	$(2.27)^2 = 5.13$



The usual form of padding circuit for a superheterodyne oscillator

Obviously the capacity ratio of 13.4 is impractical and for this reason is never used in broadcast superheterodyne receivers.

There are two methods of procedure, both of which are commonly used, to track the oscillator at a frequency interval corresponding to the intermediate frequency above the signal frequencies. One is the use of an oscillator condenser of different plate shape from that of the tuning condensers. The other is the use of a padded condenser circuit for the oscillator such as that shown in Fig. 1. You have seen plenty of these before.

Padding

In this figure, C is the main oscillator tuning condenser which is identical with the other tuning condensers. C-1 is a trimmer which is adjusted to make the oscillator track at the high-frequency end of the band. C-2 is a trimmer adjusted for tracking at the low-frequency end of the spectrum, and C-3 is a series condenser equal to or greater in capacity than twice the value of condenser C.

The choice of a best intermediate frequency is somewhat of a problem. The following reasons will make this clear:

(1) The higher the intermediate frequency, the more difficult it is to obtain high selectivity and high gain.

(2) The higher the intermediate frequency the less the possibility of encountering image-frequency interference due to higher selectivity of the amplifier tuned circuits off the resonance frequency.

(3) The higher the intermediate frequency, the greater the trouble likely to be encountered from intermediate-frequency harmonics being fed from the second detector or i-f. amplifier circuits back into the mixer circuit. The obvious reason for this is that the amplitude of lower harmonics is usually greater than that of the higher harmonics. Thus, the second harmonic will usually have a much larger amplitude than the fourth harmonic, etc.

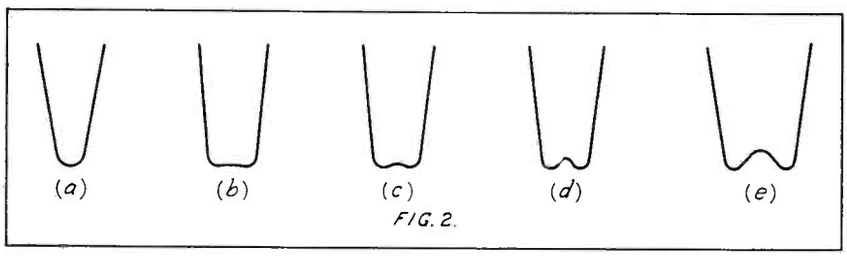
(4) The higher the intermediate frequency, the smaller the possibility of interference from two stations whose frequency separation is equal to the intermediate frequency. This is one form of "phantom" image-frequency interference.

Since there are good and bad points in each case, it is necessary that a compromise be effected between the above conditions. Fortunately 175 kc. happens to be quite free from interference difficulties and therefore has been used considerably. However, many other intermediate frequencies are used, as you well know, and quite often these odd frequencies are employed to get away from some form of i-f. interference, such as radio beacons, etc. Then, too, quite often the selection of a certain i-f. has to do with the particular design of the receiver.

I-F. Transformers

Excellent selectivity may be obtained with ordinary universal or duolateral wound coils at 175 kc. As a matter of fact, the band width will usually be too narrow for good fidelity if good coils are used. This is obviated by tuning both the primary and secondary of the i-f. transformers and adjusting the coupling between them until a double peak appears. In this manner the band width is preserved yet good selectivity retained.

The amount of coupling at which the dou-



Showing the various sorts of resonance curves produced in an i-f. amplifier with a change of coupling between primary and secondary

ble peak begins to appear has been termed "sufficient coupling." Fig. 2 shows the shapes of the i-f. characteristic as the coupling between primary and secondary circuits is increased. Fig. 2 (a) shows the curve for very weak coupling, 2(b) for sufficient coupling, which is broader than (a) and the double peak beginning to appear, and 2 (c) the characteristic usually employed nowadays in which two peaks are clearly noticeable but of smaller amplitude.

There are two types of coupling between tuned coupled circuits. (See page 97, March SERVICE.) These are inductive and capacity coupling. Both are used in intermediate-frequency amplifiers although the former is far more common—almost universal we might say. One type is probably as satisfactory as the other, although somewhat more selectivity may be obtained with carefully designed capacity-coupled systems. Suppose we consider for the minute two tuned circuits coupled inductively as shown in Fig. 3. Let the two circuits be identical, then the symmetrical curve of Fig. 3 (b) results. Suppose, however, that one of the two circuits has a higher resistance than the other, which might be due to a poorly soldered connection, or to broken strands of wire if the coils are wound with Litz. Then the curve of Fig. 3 (c) results. This curve has approximately the same band width as (b) but is very unsymmetrical.

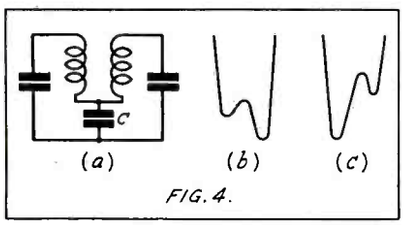


FIG. 4.

The circuit (a) shows capacity coupling between primary and secondary of an i-f. transformer, and (b) and (c) the possible resonance curves of such a transformer

Suppose the curve of Fig. 3 (d) had resulted. This would probably have been due to too close coupling and the band would be somewhat wider than (b). The curve of Fig. 3 (e) is due to misalignment or mistuning of some of the intermediate-frequency transformers. In this case it is seen that the band is very broad, which means poor selectivity. At the same time there is no definite peak to the transformer curve and the amplitude of what little peak there is, is considerably less than in the other examples.

CAPACITY COUPLING

Now suppose we had the circuit of Fig. 4 (a), which is capacity coupled. Again assume the circuits are identical and there will result a symmetrical curve such as previously shown in Fig. 3 (b). But suppose now that the condenser C in Fig. 4 (a) was of a poor grade, or one which had a low power factor. It sometimes happens that the power factor of both paper and mica condensers of poor manufacture have poor power factors when they become warm. In such a case the curve of Fig. 4 (b) would result. It is essential in this type of circuit that every effort be made to keep the resistance component of C as low as possible. A curve such as that of Fig. 4 (c) would probably be due to excessive regeneration in the amplifier.

It becomes evident that the shape of the resonance curve of a single i-f. transformer, or the resultant curve of an entire i-f. amplifier can have an appreciable effect on the quality of the receiver. If the i-f. amplifier is too "sharp" it is likely to cut the signal sidebands—that is, attenuate the higher frequencies. Distorted curves, such as some of those shown in the accompanying sketches, likewise have an effect on the signal frequency, attenuating certain bands and increasing the amplitudes of other bands.

ALIGNMENT

The alignment of intermediate-frequency amplifiers having pronounced double peaks is usually a ticklish job unless adequate equipment is at hand. Usually it should not be attempted outside a well equipped laboratory. However, it may be accomplished in receivers without AVC by inserting a microammeter in the detector plate lead and with a small signal from a microvolter tuned in by adjusting each i-f. trimmer for maximum on one peak of the i-f. Then, by retuning the microvolter slightly so that the signal falls on the other peak of i-f. and again carefully adjusting all i-f. trimmers. This must be repeated a number of times until both i-f. peaks are of equal amplitude. The same procedure may be applied to sets with AVC if a small enough signal is used to avoid affecting the AVC.

Tubes used in the i-f. amplifier are usually of the variable-mu screen grid, or r-f. pentode type. There are several reasons for this. We pointed out last month (See page 134, April SERVICE) that if maximum selectivity is to be obtained it is essential that the plate impedance of the amplifier tube must be so much larger than the impedance of the load (i.e., tuned plate impedance) that a constant current circuit is attained. This is one reason. Another lies in the fact that such tubes permit very high gain without appreciable regeneration or instability. Still another lies in the fact that large signals must not cause cross modulation or distortion. Thus the reason for the variable-mu feature.

Usually one or two stages of i-f. are used in superheterodyne receivers, though a few receivers use as many as three stages. In this latter case it sometimes happens that the plate circuit noise of the modulator or mixer is appreciable when the sensitivity control is reduced or when the AVC does not control the gain of the i-f. tubes sufficiently to reduce the gain as fast as that of the r-f. amplifier. When this is encountered, and it is very rare, the initial bias on the first i-f. tube should be increased slightly.

With the advent of the 2A7 and 6A7 tubes, it is now possible to control the gain of the mixer along with the r-f. and i-f. stages, which is an improvement from the viewpoint of circuit noise and also overloading.

G. S. GRANGER.

(To be continued)

Pilot Light Resonance Indicator

Some of the Columbia Phonograph Co. and some of the Majestic receivers employ a pilot light type of resonance indicator. If this light glows with steady brilliancy during the tuning operation, check the electrolytic condenser connected in shunt with the control winding (middle) of what is known as the "reactance resonance indicator." When this condenser is shorted, it limits the operation of the lamp indicator but does not interfere with the passage of the signal through the receiver; the operation of the AVC circuit, etc. However, the same is not true if this condenser is open circuited. The pilot light indicator will glow in varying degree depending upon the closeness to resonance, but a pronounced hum may develop. In fact the receiver may oscillate. If this condenser leaks badly, it may have a varied effect upon the operation of the pilot light tuning indicator, one of which may be non-uniform action of the light with respect to the tuning.

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High and Low Resistance Voltmeters

What with the many receivers which employ high values of resistance in different parts of the receiver and various values of voltage across the respective points, voltage measurements are oftentimes confusing. At least, discrepancies are noted between observed and rated values. In many cases, these discrepancies are due solely to the difference in internal resistance of the voltmeter employed to make the factory voltage measurements for the voltage table and the internal resistance of the voltmeter employed by the Service Man. Then again two different readings will be obtained when the voltage is checked with two ranges of the same instrument. The difference in total meter resistance between the two readings is the cause. The higher the resistance of the voltmeter the more closely will the reading indication approximate the actual voltage in the circuit. However, it is necessary to give heed to the effect of such resistance variations when the d-c. resistance of the voltmeter is stated in the voltage table and the meter used is of a different rating.

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Testing Electrolytics

Capacity of electrolytic condensers can be simply measured by connecting these condensers in series with a 120-volt a-c. voltmeter and 115-volt a-c., 60-cycle line. If the condenser is shorted, the voltmeter will read the full 115 volts. The normal reading for an 8-mfd. unit in this test is usually (with 115 volts) about 109 volts. If the capacity is reduced to 4 mfd. the reading will then be about 105 volts.

•

Sonora 74

If this receiver oscillates and the screen-grid voltage is high, look to the 25,000-ohm resistance in the screen-grid circuit. In all probability it is partially or wholly shorted. By partially shorted is meant a reduction of resistance, due to any one of a number of causes, the major of which is deterioration.

Fada "RN" Universal

The Fada "RN" a-c., d-c. chassis is used in the "Super-Fadalette" receiver. It has a total tuning spread of from 75 to 550 meters, the first spread being from 75 to 200 meters. The switching is done in the oscillator circuit.

Since this receiver employs the very latest in tubes, a short description might be worth while. Referring to the accompanying circuit diagram, the antenna circuit feeds into an image-suppression circuit composed of two coupled coils, one of which is shunted by a variable condenser. The signal then reaches the primary circuit of the input r-f. transformer. It will be seen that the primary circuit is composed of two coils, one of which has an open end. This open end coil provides capacity coupling to the secondary in addition to the inductive coupling offered by the other primary coil. The capacity coupling is most effective at the high-frequency end of the broadcast band and the inductive coupling at the low-frequency end of the band. (See page 97, March SERVICE.)

Now we have reached the 6A7 pentagrid converter tube, which functions both as first detector or mixer and electron-coupled oscillator. The oscillator coils are at the lower part of the diagram. There are two pick-up coils in series, one for the 75- to 200-meter band and the other for the 200- to 550-meter band. There are likewise two secondary coils. Neither of these coils are in any way coupled to that portion of the 6A7 tube which functions as the mixer. The coupling, if one could say that it really existed, is in the tube itself—that is to say the electron emission is oscillatory and therefore the incoming signal is modulated, or better said, the result is a modulated plate current.

The result is a beat frequency in the plate circuit of the 2A7. The intermediate frequency in this receiver is 470 kc. and therefore the two i-f. transformers are peaked at 470 kc.

The type 78 tube is used only as a high-gain i-f. amplifier and this tube feeds the 6B7 tube. The 6B7, being another multi-purpose tube, acts as second detector, automatic volume control and intermediate a-f. amplifier. In the diagram this tube is sort of spread out, the upper portion showing only the cathode and the two diode elements which are connected together so that half-wave rectification is obtained. Now the diode voltage is impressed on the control grid of the pentode portion of this tube and it will be seen that the control grid connects directly to the arm of the one-megohm potentiometer volume control. The diode current in this circuit is also used for providing the automatic volume control to the 6A7 and 78 tubes through the two-megohm resistor.

Now, going back to the 6B7 tube, we see that the rest of the tube is shown below the diode portion, though it is understood of course that the cathode is common to both sections. As a matter of fact, it can be seen that the suppressor grid is tied into the cathode circuit. Now this portion of the tube functions as an a-f. amplifier and is resistance-capacity coupled to a type 43 power pentode.

Now we come to the power-supply circuit. All heaters are connected in series in the usual manner they are employed in a-c., d-c. receivers. The 25Z5 rectifier has both plates connected together, but not the cathodes. It is in effect, two half-wave rectifiers, one supplying the 4,000-ohm dynamic speaker field only, and the other supplying the voltages for the receiver proper through a 6 henry filter choke.

The X in the oscillator circuit represents one part of the wave-change switch. The other portion will be found just above the input r-f. transformer. It is used here only to cut out the image-suppression circuit when the receiver is in the 75- to 200-meter band.

All resistance and capacity values are given in the diagram; no voltage data is available as yet.

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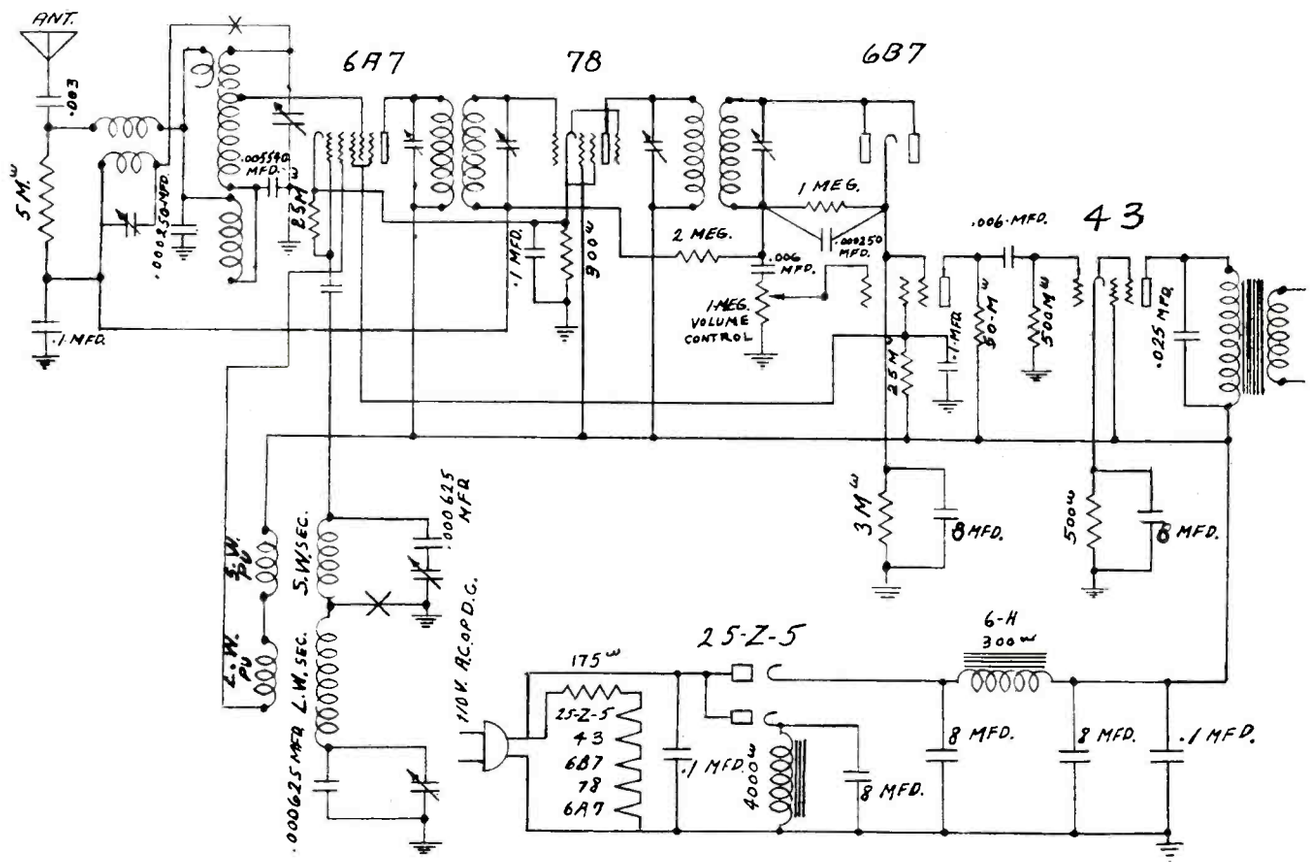
Crosley Names and Chassis

To the best of our knowledge, the following models classified by names apply to the following Crosley chassis numbers. The Sextet and Sextet Lowboy are chassis 150. The Fiver and Fiver Lowboy are chassis 148. The Totem and Totem Deluxe are chassis 147. More to follow later.



Circuit diagram of the Fada "RN" Universal which covers a band of 75 to 550 meters

New Tubes

We have had a quiet spell in tube announcements. Only a few have appeared this month, but it is believed that another group is on the way.

THE 6A4

The 6A4, which is also identified as the type LA (Raytheon) is a power amplifier pentode for use in the power output stage of automobile radio receivers and in other receivers employing a 6-volt storage-battery heater supply.

This tube has the usual 6.3-volt drawing 0.3 ampere. The tube has an amplification factor of 100 at from 100 to 180 volts plate, and a maximum power output, with 9 per cent total harmonic distortion, of 1.4 watts. At a plate voltage of 180, the grid bias should be —12 volts. The screen voltage is the same as the plate voltage in all cases.

The recommended load resistance with a plate voltage of 180, is 8,000 ohms. Transformer or impedance input-coupling devices are recommended. If, however, resistance coupling is employed, the grid resistor should be limited to 0.5 megohm.

THE 53

The type 53 tube is similar in most respects to the previously-announced type 79 tube and is a Class B twin amplifier, actually being two tubes in one. It has a medium seven-pin base and, unlike the type 79, requires a heater voltage of 2.5 at 2 amperes. It is therefore suitable for use in standard broadcast receivers operating from 110 volts a-c.

When used as a twin Class B amplifier with 300 volts plate, it has a power output of 10 watts. Under these conditions there is a dynamic peak plate current (per plate) of 125 milliamperes. The tube operates at zero grid voltage for Class B work.

The recommended load resistance, plate-to-plate, at 300 volts is 10,000 ohms.

This tube may also be used as a Class A driver, with the two grids and the two plates tied together. Under these conditions, with a plate voltage of approximately 294 and a grid voltage of —6, the amplification factor is 35 and the plate resistance 10,000 ohms. The plate current will be about 7 milliamperes.

The above data was supplied by RCA-Cunningham.

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Tone

The usual type of tone control attenuates the high frequencies and therefore makes the lows appear more pronounced. Lately many of the manufacturers have turned to the old system of tone compensation wherein certain bands of the audio-frequency range are given rising characteristics.

Since it is possible to increase the amplitudes of either the bass or treble, and if controls are provided for both bass and treble, the set owner can adjust his receiver to "fit" his ears.

We believe such arrangements might prove welcome on many of the older sets—and it might be that you fellows could make some nice jobs out of this system.

We are working on this data now and will present it next month.

•

Speaker Fields and Bias

Many receivers having the speaker field in the negative leg of the power system and wherein the drop across the field is employed as the bias for the power tubes, may produce effects not attributable to poor tubes.

In such arrangements the main supply for the speaker field is the total plate current of the tubes, mainly the power tubes. Let the power tubes get a bit seedy and the field current decreases. At the same time the bias on the power tubes is altered.

One condition intensifies the other until things get so bad the set hardly functions at all. New tubes will immediately bring things back to normal.

So—little volume and distortion may prove to be nothing more than a couple of power tubes only partially shot. The same tubes used in another receiver might still work fairly well.

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Crosley Model 147

The Crosley Model 147 chassis is used in the Totem and Totem DeLuxe receivers. It is a four-tube tuned radio-frequency job for operation on either a-c. or d-c. lines of 110 volts.

As with the usual arrangements of this type circuit, the heaters of the receiving tubes and the filament of the rectifier tube are connected in series and operated direct from the line through a limiting resistor.

In the earlier models of this chassis, a type KR-1 rectifier tube was used. In later models a type 37 tube is used as the rectifier.

Note that the antenna and r-f. coils employ a combination of inductive and capacity coupling. Also note that a few turns of wire around the aerial lead function as a capacity and in this rôle permits a certain amount of feedback from the detector plate circuit. This regeneration boosts the sensitivity of the receiver and adds somewhat to the selectivity.

Voltage data for both an a-c. and d-c. power supply is given in the accompanying table. These voltages should be measured with the receiver in an operating condition but with no signal. Plate voltages should be measured from plate to cathode; screen voltage from screen to cathode and bias voltage from cathode to negative of the "B" supply.

•

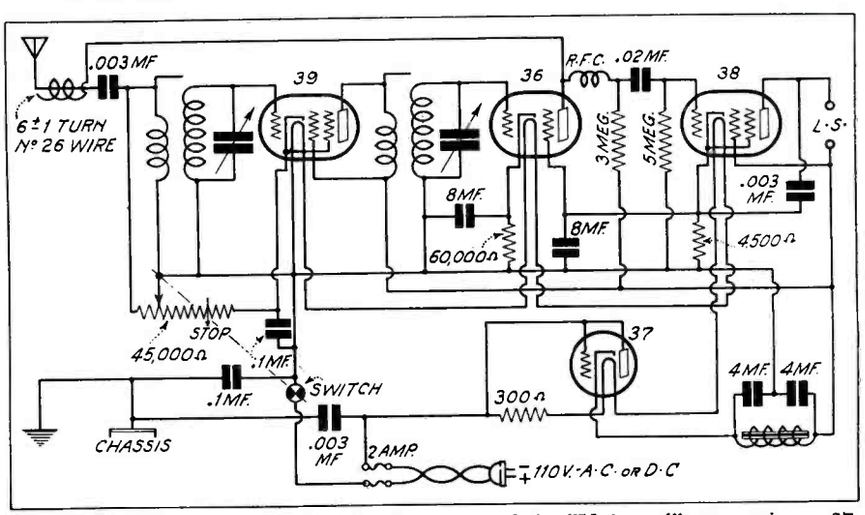
R C A Power Transformers

The power transformer used in the RCA 33-AC is also suitable for use in the Radiola 18-AC, 51-AC and in the Victor 7-11. The power transformer used in the RCA R-11 is also suitable for use in the RE-18, RAE 26, RE 18-A and R-21. The power transformers in the RCA R-42 and R-48 are the same.

CROSLEY MODEL 147 VOLTAGE DATA

Tube	*Plate*	*Screen*	*Bias*	*Filament*
	WITH A-C. POWER SUPPLY			
R-F.	104	104	1.3	5.6
Det.	5	7	1.2	5.6
Output	92	95	14.0	5.6
Rect.*	..	..	118.0	5.6
	WITH D-C. POWER SUPPLY			
R-F.	100	100	1.2	5.6
Det.	5	7	1.0	5.6
Output	92	95	12.0	5.6
Rect.*	3	..	102.0	5.6

* Type 37 tube.



The diagram of the Crosley Model 147 receiver of the "Universal" type, using a 37 or KR-1 tube as rectifier. Note that combined inductive and capacity coupling is used in the r-f. transformers

Public Address . . .

CLASS B AMPLIFIER WITH TYPE 53 TUBES

By I. A. Mitchell*

THE development work done on Class B tubes has brought this system of amplification to a point where it has many advantages. Unfortunately, unlike Class A amplification, load impedances and matching units used in Class B operation are fairly critical and due to lack of care in the choice of these units many an amplifier constructor has unjustly condemned Class B amplifiers.

An intensive oscillograph study was made of the amplifier described below and the actual harmonic level was found to be 7.3% at 10 watts. While ideally perfect reproduction has zero harmonic content, 7.3% is sufficiently low to be of negligible value in so far as the average ear is concerned. At lower power levels, the harmonic content is naturally reduced, being less than 5% for power outputs under 6 watts.

The Type 53 Tube

The 53 tube used in this amplifier consists of two triodes in one envelope. The filament is designed for a-c. operation and takes 2.5 volts at 2 amperes. The rated plate voltage is 300 for Class B and 294 for Class A. These values have been exceeded somewhat in the amplifier described for the sake of the lower harmonic content thus made possible. The tube can be used for Class A operation, by paralleling grids and plates, in which case the tube draws 7 ma., has an amplification factor of 35, and a power output of 400 milliwatts. In Class B, the static plate current is approximately 17.5 ma. per plate and the maximum average plate current approximately 30 ma.

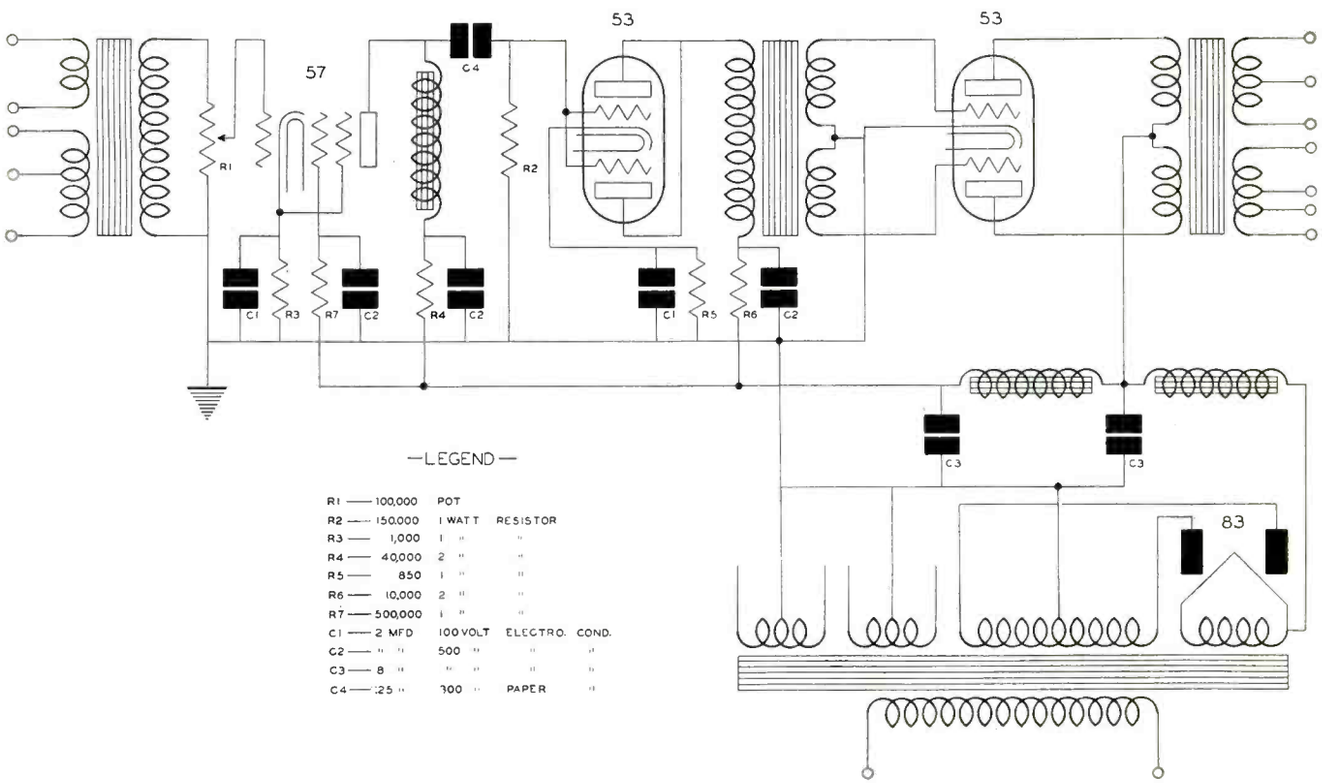
The amplifier itself is of standard type. Either of two universal input transformers can be used without altering the layout. The first transformer has two primary windings, one for a detector plate or high-impedance pickup, the other for a double-button mike or low-impedance pickup. The second transformer has facilities for connecting a 50-, 200-, or 500-ohm line; a single button, a double button, or parallel microphones; three 200-ohm lines used simultaneously; three 500-ohm lines used simultaneously; or one 500-ohm and one 200-ohm line used simultaneously. These universal features lend themselves admirably to the non-elaborate mixer systems required in the P.A. field. The input transformer feeds to the first grid through a 100,000-ohm potentiometer volume control. This first tube is a 57, and with the impedance coupled circuit shown, a very high amplification is obtained. This high amplification plus the high amplification in the Class A 53 following brings the overall gain of the amplifier to a high value; sufficiently high to work standard microphones directly to the input. The 53 Class A tube is worked into the Class B tube through a special transformer with high stepdown ratio and low leakage reactance. The Class B tube works into an output transformer with universal windings. This transformer has a 500-ohm output and also a low-impedance output of 15 ohms tapped at 8 and 4. In this way one or two speakers can be placed right with the amplifier and a 500-ohm line run to one or two other speakers some distance away. Two magnetic speakers can be connected in series directly to the output plates.

Hum Level

As in all high-gain a-c. operated amplifiers, the tendency for high hum level is strong. The sources of hum can readily be classified as below:

(1) Plate supply hum: The use of adequate reactive, resistive, and capacitive filtering reduces this to negligible value.
(2) Filament supply hum: The use of accurately center-tapped filament windings and heater type tubes reduces this to negligible value.
(3) Electrostatic pickup: Shielded transformers and short, high-potential leads minimize this. Inasmuch as a mercury-vapor rectifier is used, the power transformer windings should be fully electrostatically shielded.
(4) Magnetic pickup: This is the most difficult form of hum to cure and can generally only be controlled by placing the components and wiring carrying a-c.

* Kenyon Transformer Co., Inc.



Circuit of the Class B amplifier using two type 53 tubes, one being utilized as a driver

as far as possible from the balance of the equipment. If the amplifier is made in one unit, the chassis should preferably be made of aluminum to minimize the effect of stray fields through the chassis. The input transformer is most likely to pick up hum, and should be placed far away and at right angles to the power transformer. If possible, this transformer should not be screwed down till the amplifier is completed, at which time it can be rotated to the point where minimum output hum is found and then screwed down. The audio-frequency tubes are prone to pick up hum from the filter chokes and rectifier tube and should be spaced or shielded from them.

Two-Piece Construction

The amplifier as actually constructed is in two sections, one being the power supply and the other the audio amplifier. In this way, the absolute maximum of spacing can be obtained and stray fields need not be considered further. This two-piece construction is particularly handy where a portable case is used for P. A. work. The narrow chassis made possible by this two-piece construction can readily be set in a standard carrying case with a loudspeaker in each case. This really makes the ideal portable job. It is important when using two speakers in this manner that they be properly phased; that is, that they both push in and out at the same time. Improper phasing can be checked quickly by the "dead spots" noticeable a few feet from the speakers.

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What's This Thing Called Level?

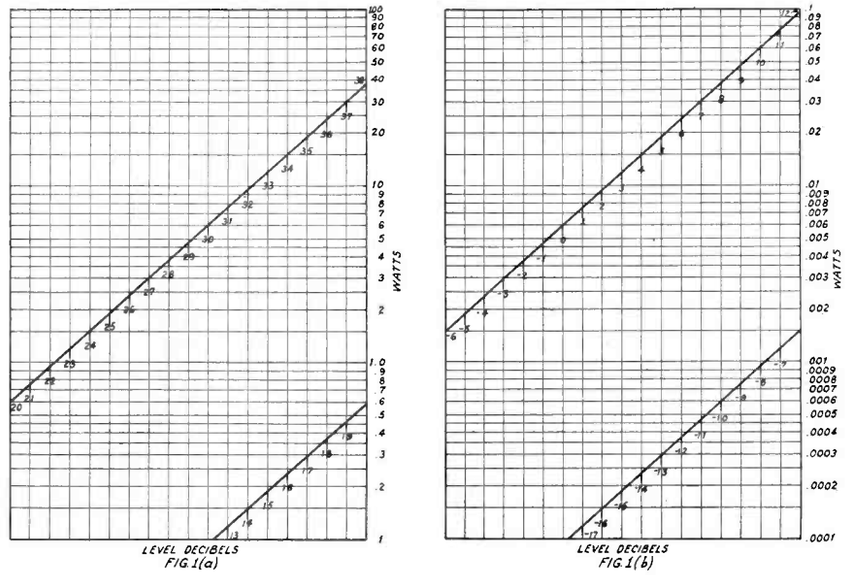
We are all used to rating the power output of amplifiers in watts. We have been doing this for years. Recently, however, manufacturers of microphones and other pieces of apparatus have started to rate the power output of their equipment in *decibels*, above or below a reference power called *zero level*.

In most of our past articles on public-address equipment we have also resorted to the decibel, mainly for the reason that stating power levels in watts or milliwatts would not have given the whole story, nor permitted you to apply the data to other apparatus where the power output is invariably stated in decibels.

We all went through the same sort of thing in connection with wavelength and frequency. But where frequency is now a common reference, and one we are all used to by this time, the decibel is still foreign to many of us. So, we thought it a good idea to cover the whole subject of power level for those who have had difficulty making the new unit of measure sit up and do the proper tricks.

The Decibel

By common agreement among manufacturers and engineers, the reference level or zero level for the decibel scale has been chosen as six milliwatts, or .006 watt, which is the same thing. This means that zero db. is 6 milliwatts.*



Here are two charts which provide values in watts for various power levels in decibels

Even so, one might ask of what earthly value such a unit of measure as the decibel might have when it is evident that we could continue to express power levels in watts and fractions of watts and still know perfectly well where we stood. Well, the reasons are many.

Now, before we start giving the reasons for the use of the decibel as a unit of measure, let's find out what it is. In the first place, it is a logarithmic unit expressing the *ratio* between two powers. Thus, when referred to power levels, it expresses the ratio between the power level at some point in the circuit and reference or zero level which we know to be six milliwatts. To put it mathematically, if the powers being compared are power-1 and power-2, then the ratio P_1/P_2 as expressed in decibels is given by the equation

$$\text{Power ratio in decibels} = 10 \log_{10} \left(\frac{P_1}{P_2} \right)$$

It is obvious that there are certain power ratios for each different value of db. Fig. 1 shows graphically the power levels corresponding to various db. levels. The graph (b) is merely a continuation of graph (a). Thus, from these graphs it will be found that +14 db. is 0.15 watt, +20 db. is 0.6 watt, +34 db. is 15 watts, and from graph (b) we see that +10 db. is .06 watt, 0 db. is .006 watt, —10 db. is .0006 watt (we are now below zero level) and —16 db. is .00015 watt, etc.

Value of Decibel

Now as to the value of the decibel. In the first place, this unit of measurement has reason and justification for existence because the effect sound has on the human ear is approximately proportional to the logarithm of the intensity. Or, to put it in another way, the human ear cannot note an increase in sound intensity if the actual increase is on the basis of 1 to 2, 2 to 3, 3 to 4, etc., but notes a change in intensity only when the sound increases in greater and greater jumps each time, such as 1 to 3, 3 to 7, etc. It is the extent or ratio of each of these jumps which we measure in decibels, the decibel itself merely representing the ratio for purposes of convenience. Thus, 1 db. represents a power ratio of about 5 to 4, while 20 db. represents a power ratio of 100 to 1. You will note from this that the ratio has increased tremendously. Now, if we state the same values in watts we see that 1 db. is equal to .007 watt and 20 db. is equal to 0.6 watt.

Thus, we see that one advantage of the decibel as a unit of measure lies in the fact that we can design, say, attenuators which provide increases and decreases by so many decibels for each position and that a change in sound intensity will be noted by the human ear for each step on the attenuator.

But the above is far from being the most important reason for the use of the decibel. The real value lies in its convenience as a unit of measure whereas if we were to express values in watts and fractions thereof we would run into very large numbers. Furthermore, the decibel permits us to express the ratio of input to output power levels of a complete amplifier unit—such as the one shown in Fig. 4—in addition or subtraction as the case may be. This will be better understood when we describe the extension of the charts of Fig. 1.

The table of Fig. 2 allows us to extend the charts of Fig. 1 as much higher or lower as we wish. This table gives the minus and plus power ratios equivalent to different values of decibels, or, in other words, the power ratios expressed in both gain and loss (above or below the zero level of 6 milliwatts). First, however, let us see how we can extend the table of Fig. 2 if necessity should arise.

We see from this table that if decibels are added, power ratios must be multiplied. Likewise, if decibels are subtracted power ratios must be divided. This is because the

* Standardized by General Radio Co.

decibel is a logarithmic expression. Thus, 20 db. — 10 db. = 10 db. and the corresponding power ratio is: $\frac{.01}{.1} = .1$, or 10 db. — 2 db. = 8 db. and the corresponding power ratio is: $\frac{.1}{.631} = .158$, and 1.5 db. — 1.0 db. = 0.5 db. and the corresponding power ratio is: $\frac{.710}{.794} = .891$

Now, as stated above, and as evident from the table, the power ratio for 1 db. is .794 and for 10 db. is .1. Therefore 11 db. would be .794 x .1 = .0794, or .079 if only carried to three places. The table shows this is correct. Therefore 20 db. would have a corresponding power ratio of .1 x .1 = .01, and 30 db. a ratio of .1 x .1 x .1 = .001, etc.

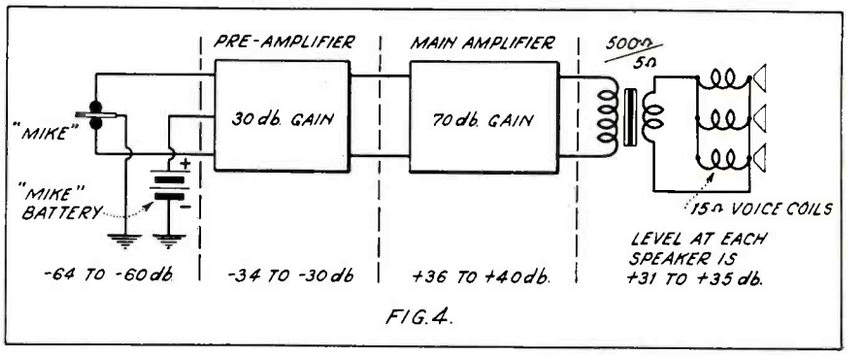
Application of Decibel

Now let us see how this can be used in public-address work. Suppose we had a double-button carbon microphone whose output was —60 db. (.006 microwatts) and we wished to supply a hall with programs. Suppose the dimensions of the hall were 40 feet high by 40 feet wide by 100 feet deep. The volume of the hall is therefore 40 x 40 x 100 = 160,000 cubic feet. From Fig. 3, which is a table worked up from experiment and research, we find that about 1 watt of acoustic power would be required to fill the hall.

If average baffle-type dynamic speakers were to be used, an average conversion efficiency (electric power to acoustic or sound power) of about 5 per cent could be expected. If the best modern baffle-type dynamic or good horn-type speakers were used an average efficiency of about 10 to 20 per cent might be obtained. However, using the 5 per cent efficiency for our case, we find that 20 watts of electrical energy must be delivered to the speaker or speakers, because 1 watt is 5 per cent of 20 watts.

Since the usual dynamic speaker is only capable of handling properly about 6 or 7 watts, three speakers would be required. From Fig. 1 we see that 20 watts corresponds to a power level of 35.25 db.—say 36 db. to be on the safe side of things.

Now, our carbon microphone has an output of —60 db. or is "60 db. down." We need a gain of 36 db. in our amplifier, so we see that the total amplification which would be required would be 60 + 36 = 96 db. If a mixer were to be used an additional 10 db. amplification would be required to overcome the minimum mixer loss which is usually about 10 db. But, such a simple system would probably not require a mixer since one of the amplifiers would probably have a gain control included which would serve the same purpose.



A power level chart for an average public-address system

Now the main amplifier will usually be found to have a gain of about 70 or 80 db. If we use the figure of 70 db., we see that a pre-amplifier of 26 db. gain would be required to make up the necessary total of 96 db. The usual pre-amplifier has a gain of about 30 db. Therefore we will have a comfortable margin of gain. This additional gain may be needed, however, since the figure for microphone output is that for a person talking 2 feet from the microphone and speaking in a normal tone. The output of the microphone will vary inversely as the square of the distance between the person speaking and the microphone. Therefore, if the speaker should be 4 feet from the microphone instead of 2 feet, the power output will be decreased to 25 per cent of its former value, or it will be 6 db. less (i.e., 54 db.). Therefore a margin of 6 db. to 10 db. will usually be necessary to take care of such conditions.

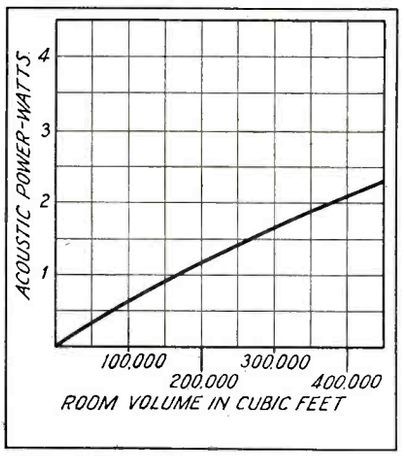


Fig. 3. A graph from which may be determined the acoustic power required for a predetermined room area

Amplifier Requirements

Now let us set up the amplifier requirements. The output of the power amplifier is 36 db. and since its gain is 70 db. the required input level will be —34 db. Now 34 db. = 10 db. + 10 db. + 10 db. + 4 db. and the corresponding input power will be .1 x .1 x .1 x .398 x .006 = .0000024 or .0024 milliwatts. Now the output of any pre-amplifier will be about 1 milliwatt so no doubts need be entertained about loading up the power amplifier. Therefore the specifications are:

POWER AMPLIFIER

Output—20 watts.
Output impedance—500 ohms.
Gain—70 db.
Gain control included.
Input impedance—200 ohms.

PRE-AMPLIFIER

Gain—30 db.
Input and output impedance—200 ohms.
Input adapted for double-button carbon microphone.

Fig. 4 shows a level chart of the system. Note that since three 15-ohm dynamic speakers are used in parallel a 5-ohm line will be required and since each speaker will take one-third of the power, the level delivered to speakers will be 5 db. less; see Fig. 2.

DECIBEL—POWER RATIO CHART

Db.	Power Ratio Loss	Power Ratio Gain	Db.	Power Ratio Loss	Power Ratio Gain	Db.	Power Ratio Loss	Power Ratio Gain
1.0	.794	1.26	4.5	.355	2.82	8.0	.158	6.31
1.5	.710	1.41	5.0	.316	3.16	8.5	.141	7.08
2.0	.631	1.59	5.5	.282	3.55	9.0	.126	7.94
2.5	.562	1.78	6.0	.251	3.98	9.5	.112	8.91
3.0	.500	2.00	6.5	.224	4.47	10.0	.100	10.00
3.5	.447	2.24	7.0	.200	5.00	10.5	.089	11.22
4.0	.398	2.51	7.5	.178	5.62	11.0	.079	12.59

Figure 2

(*Continued from page* 168)

We have no intention of employing Service to further the ends of any one or a group of service organizations if for no other reason than the unfairness and shortsightedness of such a move. The good that Service can do and has done lies elsewhere. Should it become the central organ for an association or group of associations, it would only weaken itself as a medium for the communication of technical data for which it was originally instituted. It is for this reason that we must take an impartial attitude toward any form of service organization and be as impartial in presenting plans which we consider worth accepting.

Auto-Radio . . .

RCA Victor M-34

This receiver is a superheterodyne and employs some of the latest tubes, such as the 6A7 and 6B7, as shown in Fig. 1.

The total battery current drawn is 5.5 amperes. The undistorted output of the receiver is 2 watts. The loudspeaker field current is 1.35 amperes and the total plate current for the receiver is 53 milliamperes.

A vibrator type transformer-rectifier is employed as the B power unit, which is contained in the receiver, and this provides a maximum d-c. voltage of 250.

Servicing Data

The three r-f. line-up condensers and two i-f. tuning condensers are accessible and may require adjustments. The r-f. adjustments are made at 1,400 kc. and the i-f. adjustments at 175 kc. The r-f. adjustments are made with the receiver in its case, access to the adjusting screws being obtained through a slot in the bottom of the case. For the i-f. adjustments, however, it is necessary to remove the rear cover in order to couple the oscillator to the first detector. The following procedure should be used for either adjustments:

The three r-f. line-up condensers are adjusted at 1,400 kc. Proceed as follows:

(a) A fairly accurate adjustment can be made by using the ear for an indicating device, thus eliminating the need of an output meter and the necessity of removing the rear cover to connect it.

(b) Couple the output of a modulated oscillator from antenna to ground, set the tuning dial at 140 and the oscillator at 1,400 kc.

(c) Place the oscillator and receiver in operation and adjust the oscillator output so that a weak signal is obtained in the loud speaker when the volume control is full on.

(d) Then adjust the three line-up condensers until maximum sound in the speaker is obtained. Readjust these condensers a second time as there is a slight interlocking of adjustments.

For a more accurate adjustment, the use of an output meter is recommended. However, this will require the removal of the rear cover in order to connect the output meter across the speaker voice coil. Also the bottom and Radiotron side of the chassis must be shielded together with the transformer so that vibrator noise will not be obtained, due to removal of the case shielding.

In order to make the i-f. adjustments, it is necessary to remove the rear cover, due to the fact that the external oscillator must be connected between the control grid of the first detector and ground. Proceed as follows:

(a) Use a modulated oscillator set at 175 kc. and use it in connection with an output meter.

(b) Remove the receiver from its case, shield the transformer and Radiotrons as previously described, place the receiver in operation and connect the oscillator output between the first detector grid and ground. Connect the output meter across the voice coil of the loudspeaker. Then connect the antenna lead to ground and adjust the tuning condenser so that no signal except that of the i-f. oscillator is heard at maximum volume. With the volume control at maximum, reduce the external oscillator output until a small deflection is obtained on the output meter. Unless this is done, the action of the AVC will make it impossible to obtain correct adjustments.

(c) Each i-f. transformer has but one winding that is tuned by means of an adjustable condenser, the other windings being untuned. The condensers should be adjusted for maximum output.

At the time i-f. adjustments are made it is good practice to follow this adjustment with the r-f. adjustments, due to the interlocking that always occurs. The reverse of this, however, is not always true.

The voltage data for this receiver is given in the accompanying table. The values given are based on a battery voltage of 6.3.

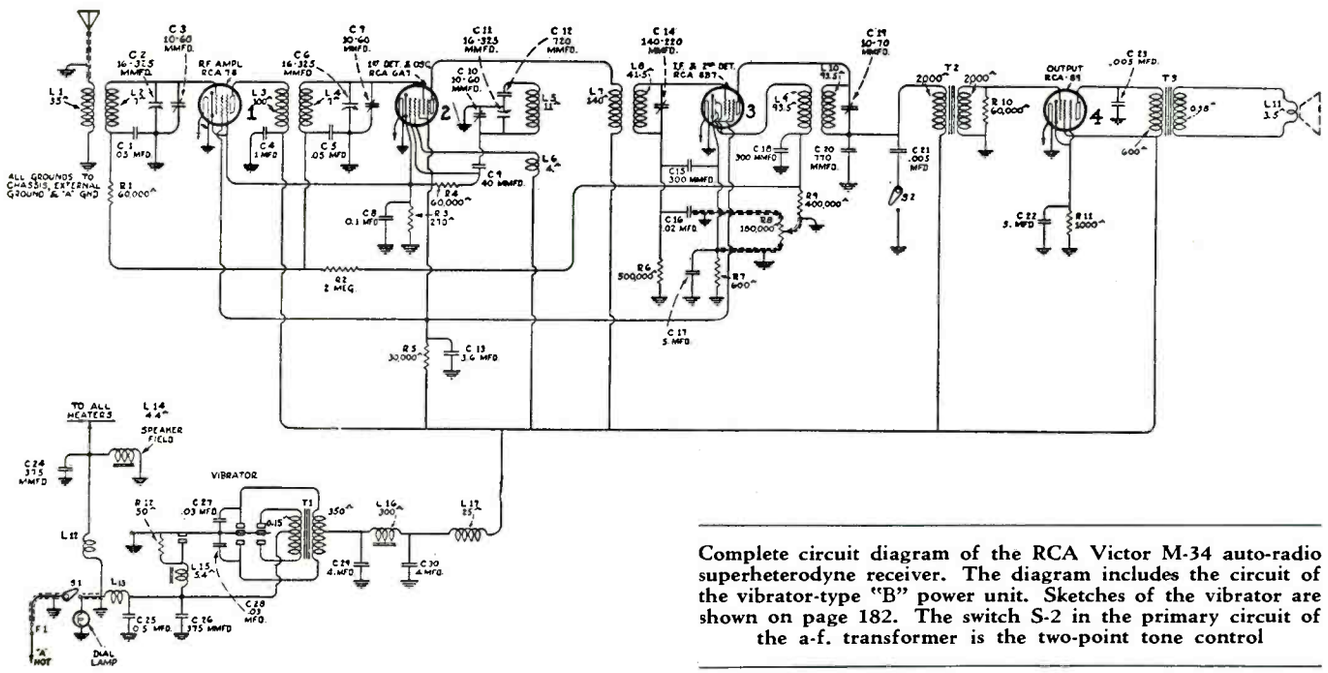
Vibrator Unit Servicing

Referring to the circuit diagram, it will be noted that the primary and secondary of the vibrator transformer are center tapped. By connecting the outside of each winding to the contacts of the vibrator and using the arms and center taps of the windings as sources of input and output voltage, a combined generating and rectifying action is obtained.

When the switch is turned on one portion of the vibrator makes and breaks contact. This constitutes the driving action of the unit, and is in no way connected with

RCA VICTOR M-34 VOLTAGE DATA

Tube	*Cathode to Ground*	*Cathode to Screen*	*Cathode to Plate*	*Plate MA.*	*Heater*
R-F	3.7	92	253	7.0	6.06
1st Det.	3.7	92	253	(12.0 Total)	6.06
Osc.	0.0	—	253		
2nd Det.	3.2	92	236	6.0	6.06
Power	26.5	230	217	27.5	6.06



Complete circuit diagram of the RCA Victor M-34 auto-radio superheterodyne receiver. The diagram includes the circuit of the vibrator-type "B" power unit. Sketches of the vibrator are shown on page 182. The switch S-2 in the primary circuit of the a-f. transformer is the two-point tone control

the other circuits. The primary vibrator functions to connect the input low voltage current first across one half and then across the other half of the primary of the transformer. This results in a pulsating direct current applied to the primary in an alternating direction. The result is an a-c. voltage emanating from the secondary of the transformer; as the transformer has a step-up ratio the a-c. secondary voltage is considerably greater than the primary. The secondary vibrator functions in a similar manner as that on the primary side, so that by reversing the alternations applied to the load, a pulsating d-c. is obtained. After filtering, this is used as plate and grid supply in the receiver.

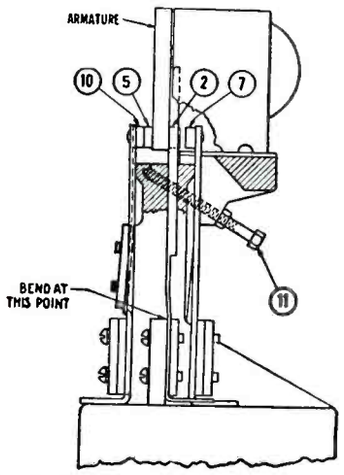


Fig. 2 (a) Showing the vibrator and adjustments. The top view is shown below

Proper adjustments of the various contacts are made in the following order and manner:

1. With 8 and 10 (see (a) and (b) Fig. 2) firmly held against their respective stops and with 3 and 5 in contact with 8 and 10 respectively, the air gap between 1, 6 and 2, 7 shall be 0.015" plus or minus 0.005." On no particular unit, however, shall the differences between the two air gaps exceed 0.005."

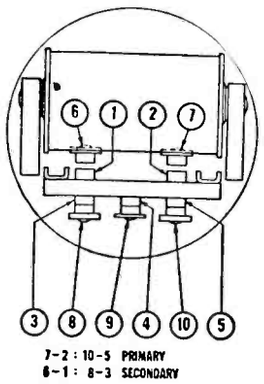


Fig. 2 (b) Top view of the vibrator unit of the "B" power transformer. The proper adjustments to be made are described in the accompanying text

2. Adjust the buzzer screw, 11, so that when the position of the armature is such that 1 and 2 are just making contact with 6 and 7 respectively, the contact between 4 and 9 shall just be breaking.

If any pair of contacts show excessive sparking, the following procedure will in general reduce the sparking to a minimum.

For example, consider the case where excessive sparking is occurring between 6 and 1. Sparking will be reduced to a minimum by bending the armature spring on that side (secondary side) away from 6 and toward 8. If the bend is too small, only a small change will be noted. However, if an excessive bend is made, the sparking will be transferred from 6,1 to 8,3.

The same method may be applied to any pair of contacts. Usually only a slight bend will be necessary. Although after bending, no change in the position of the armature contacts may be noted, a sufficient change in the initial force requirements will have been made to reduce sparking.

When connected to a 6-volt primary source, the output voltage across a 5,000-ohm resistor (connected in place of the receiver load at the output of the filter), must be 240 volts or greater.

INSTALLATION

The remote tuning control is designed to be mounted on the steering column. This connects to the receiver through a flexible shaft. The receiver may be mounted back of the instrument panel. It should be so mounted that the under-surface of the receiver case is in a horizontal position.

It is important that if the negative side of the storage battery is grounded that the two leads equipped with spade terminals and located beneath the radio chassis be reversed. If the positive side of the battery is grounded, no change is necessary.

The usual interference suppression units come with the receiver and these should be put to use in the usual manner.

The following suggestions may prove useful when making installations on the particular cars mentioned.

Chevrolet 1933—Mount chassis on the left side, end against car bulkhead and use short flexible shaft between receiver and tuning control. Use both suppressor condensers, one on the ammeter and one on the generator. Use all suppressors. Place a copper screen under the toe board on right side, 10" x 10" to prevent the body from radiating ignition interference which may be picked up by the antenna. This screen must be grounded.

Plymouth 1933—Mount chassis on left side, back against car bulkhead and use 33⅞" flexible shaft. Use both suppressor condensers, one on ammeter and one on generator. Use all suppressors.

Ford V-8, 1932—Mount chassis on left side, end against car frame and use short flexible shaft. Use one condenser, connected to the generator. Install eight spark plug type suppressors only, no distributor suppressor being necessary.

The majority of cars will be found to be entirely free from ignition noise when the standard equipment is used. Usually mounting the chassis on the right side of the bulkhead will be found most desirable, although if a heater is used, the left side will be preferable.

Auto Antennas

Philco states that Auburn is equipping all closed models with a top antenna. The Reo Royale N-2 for 1933 is equipped with an antenna, while the Flying Cloud Model 52 is equipped with an antenna on special order only.

The open and convertible models, both Auburn and Reo, will be supplied with antennas on order.

●

Philco EF Vibrator

The Model EF full-wave vibrator takes the place of the EB dynamotor in the Philco Model 6F receiver. The cable connection between the vibrator and the Model 6F completes the installation of the vibrator. Terminal 1 is connected directly to the main battery lead. Terminal 2 is the cable shield. Terminal 3 is connected to the radio switch. Terminal 4 is the B+ high-voltage lead and is connected directly to the plate circuits.

●

Philco 12-122

The original Model 12 was similar to the Model 8 and was properly known as Model 12—Code 121. The present Model 12 is the Model 12—Code 122, and is similar to the Model 9 except that it is for 12-volt operation. The tubes, the circuit and the base arrangement are the same. Fig. 1 shows the wiring of the tube heater circuits. Since 6.3-volt tubes are used, a series-multiple connection must be used to operate from a 12-volt battery.

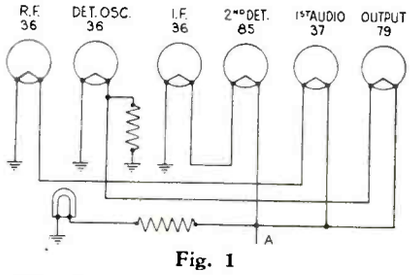


Fig. 1

The shunt resistor on the oscillator tube has a value of 21 ohms. The pilot light resistor is 30 ohms. The speaker is the A-9 and is equipped with a 12-volt field. The Model EE dynamotor is used, supplying 40 ma. at 220 volts.

The Model 12 has been designed especially for bus and boat installations where 12-volt battery systems are used.

●

Selling Auto-Radios

Recently I took on a line of auto-radio receivers. I was stumped as to selling them until I thought of this idea: I approached a number of car salesmen. Whenever they sold a car they gave me the customer's status, then I followed this lead.

If I sold this customer, then I gave the car salesman a commission. This has sold quite a number of car and house radios for me whereas, without the above I wouldn't have even met these prospects. Both the car salesmen and myself are very well pleased.

S. Rider

ON THE JOB . . .

Test For Noisy Tubes

At the present time noisy tubes seem to be about as prevalent as weak ones and the problem of tube testing is complicated by the fact that short indicators are very seldom helpful in detecting tubes defective in this respect. The conditions that cause noise are not limited to intermittent shorting of tube elements and the problem of giving a noise test looms large and baffling. Many tube replacement sales are lost because the dealer is unable to demonstrate that a tube is noisy. The method here described has been used with great success and is passed on for what it may be worth.

Design

With the aid of the accompanying diagram it should not be difficult to construct the apparatus required and perhaps some will be able to make variations and improvements. Briefly, a regenerative detector is used with an audio amplifier and a loudspeaker. The grid coil is any convenient size and has four turns between taps. The number of taps is determined according to the maximum number of elements in tubes which are to be tested. At the present time, I think that seven are sufficient since only one connection is made to the filament. No tuning condenser is used. Several sockets to accommodate the various tubes are arranged for use and a connection from each element (one for the filament) is made to a separate tap on the grid coil. The plate circuit tickler coil is wound with sufficient turns to produce oscillation. Some method of oscillation control should be included, such as variation of the tickler coil position or otherwise.

Operation

The operation of the apparatus is very simple. The tube to be tested is inserted in the proper test socket and the detector is adjusted to oscillate weakly. Tap the tube under test and observe any noise produced. If it is noisy, it will produce the same noise as it would in a receiver. If it is normal, it will emit a ringing sound the same as when a detector tube is tapped. The method is so sensitive that some noise conditions are heard that do not give any noticeable trouble when the tube is actually used in a receiver.

Some noise conditions do not show up until the filament has been heated and the tube elements expanded to their operating size. To check this condition pre-heat the tube and insert it quickly in the noise tester. It will be necessary to advance the regeneration to compensate for the loading effect produced as the elements will draw emission on the positive cycles.

The principle of operation is that any small fluctuation of capacity or intermittent short in the tube under test will vary the amplitude of oscillation and the resultant audio component is amplified and made audible. Even the vibration of the elements is heard and is denoted by the familiar "bong" when the tube under test is tapped. Care must be exercised in the construction of the apparatus such that the detector and the associated grid circuit are not affected by mechanical vibration as these also will produce a sound.

Alfred E. Teachman.

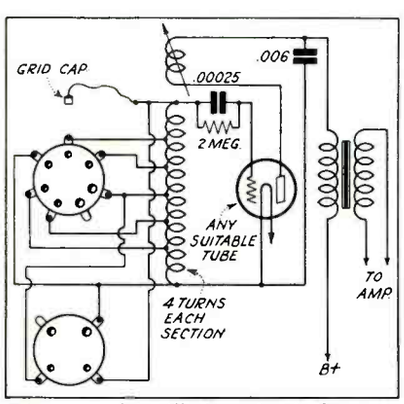


Diagram of oscillating circuit for testing noisy tubes. The unit may be used with headphones or an amplifier and loudspeaker

ANNOUNCEMENT

Though the "On The Job" department has no doubt been of value to many of our readers, we feel that its value can be greatly increased by adding technical items which apply to both the shop and the field. Therefore, starting with this issue, we will run not only merchandising suggestions but also kinks and testing systems which appear to have special merit.

The information published on this page must, of course, come from you. Therefore, we hope that you will co-operate with us and send in the merchandising and technical ideas which have been of value to you. All such material accepted for publication will be paid for.

We are discontinuing the awarding of prizes each month, as this system does not permit us to expand the department. Instead, we shall publish a greater number of items each month, and of a greater variety and value.

Come on, fellows; kick in!

Summer Business

During the Summer months I make weekend trips to Tourist Camps and small villages and find lots of work replacing worn-out "B" batteries, charging storage batteries and changing tubes.

I have also made good profit on the rentals of battery-operated receivers to people on vacations.

I have been doing this for six years and it certainly has paid me.

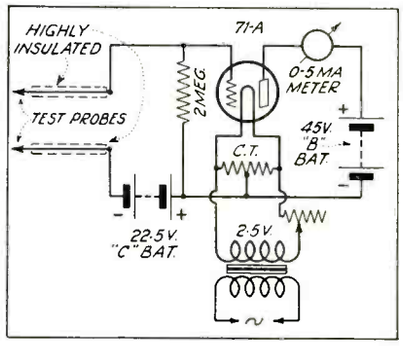
John J. Birkel

Condenser Tester

I have been using a simple testing device which I think would be of special value to the Service Man. This device can readily be constructed from parts which are always available in the repair shop. Its principle is based on the blocking of plate current. The diagram is shown herewith.

I have found this device to be superior to any instrument that I have been able to compare it with, in testing condensers of values as low as .0001 mfd. or lower, for opens, shorts and leaks, which the ordinary meters cannot test.

The device may be made as sensitive as desired. It may be calibrated for resistance readings when dealing with values from 500,000 ohms up to several megohms. Heretofore high resistance leaks, especially in small coupling condensers, have been my special problem, but now they are no more worry than a shorted condenser.



Arrangement for testing condensers with values as low as .0001 mfd. The sensitivity of the circuit is controllable

In my test set I am using a type 71-A tube with 2.5 volts a-c. on the filament with a rheostat in this circuit, as shown, for adjusting plate current for full-scale meter reading. The meter reads full scale with test prods open. The high resistance of the body across the test prods is sufficient to block the plate current flow.

Carl Keppler, Jr.

Boosting Old A-K's

Many of the older Atwater-Kent receivers using an aperiodic transformer in the first r-f. stage (such as the Model 44) can be increased in their sensitivity at low-frequency settings by replacing the aperiodic transformer with one designed for the low-frequency end of the broadcast band.

I wind mine with No. 30 enameled wire on large size flashlight battery containers, using 50 to 75 turns for the primary and 150 turns for the secondary. (I never figured this out—I tried it out.)

This transformer is connected in place of the old one. I have reason to believe that it increases selectivity and sensitivity all over the band, but shows up best from 800 to 540 kc.

R. H. Koch.

SUPER GIANT B

MASTER B

BABY B

50 WATTS A.F.

Into every Racon type B unit is built a diaphragm structure that will withstand 50 watts of audio frequency power, without distortion, without voice coil failure, without rattle. The frequency range is from 50 to 9000 cycles. Actual field tests have proven that.

You'll *hear* those good points.

When you examine the internal construction of Racon units, you'll *see* a mechanically perfect diaphragm, without acute bends to cause metal fatigue, and an integral voice-coil mounting.

The Racon line is complete, to meet every price level. The manufacturer is one of the oldest, financially able to back up every guarantee. Service is excellent—shipments immediate from stock. Try the type B units. You'll find them 100%.

Racon products are covered by U. S. Patents Nos. 1,507,711; 1,501,032; 1,577,270; 73,217; 73,218; 1,722,448; 1,711,514; 1,781,489; 1,832,608; 1,834,327; 1,835,739; 1,845,210; 1,878,360; 1,888,442.

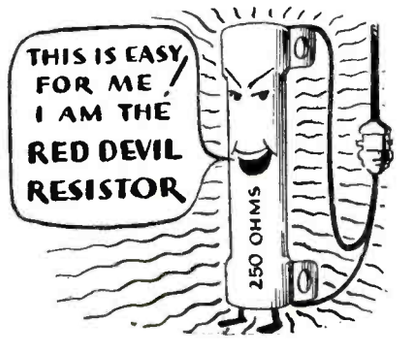
WRITE FOR BULLETIN S5

RACON ELECTRIC CO. INC.

52 East 19th St., New York, N. Y.

London, Eng. Toronto, Can.

OF COURSE, RADIO SETS SHOULD NOT GET RED HOT, BUT...



When overloads occur due to shorts, surges, or condenser breakdowns, it's comforting to know that the resistors you have installed will stand more than a 500% overload. Because of their exclusive cement coating, RED DEVIL resistors will not fail even though they become *red hot!*

Use RED DEVILS to replace low wattage units and sections of voltage dividers which have burned out; this insures against further trouble and eliminates return calls at *your expense.*

Use RED DEVILS and know that your guaranteed repair jobs will stay put.

The coupon will bring your copy of the new eight-page OHMITE RESISTOR BULLETIN No. 9. Get your copy now.

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Ohmite Mfg. Company, 633 N. Albany Ave., Chicago, Illinois

Please send my copy of the new Ohmite Resistor Bulletin No. 9.

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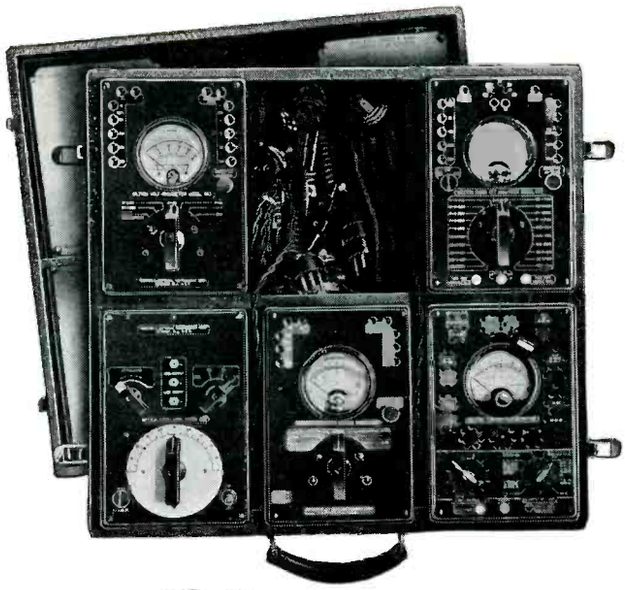


Now—

all 5 in one set

. . . to satisfy every service requirement

COMPACTLY housed in a single carrying kit, Weston now offers the complete set of 5 Standardized Service Units: Analyzer, Volt-Ohmmeter, Test Oscillator, Tube Checker and Capacity Meter. The combination is a portable laboratory that makes intelligent servicing of any set easy and certain. It contains every instrument for making both Point-To-Point and Tube Checker-Analyzer tests as desired.

With the addition of this 5 unit set Weston has rounded out its line of Standardized Service Unit combinations. Those who prefer the Tube Checker-Analyzer method will want the set containing the Test Oscillator, Tube Checker and Analyzer. For those who prefer the Point-To-Point method Weston offers the kit containing a Test Oscillator, Capacity Meter and Volt-Ohmmeter.

Bear in mind that each unit is entirely independent and can be bought and used separately. It can then be combined in the multiple unit case at some later date. We will be glad to furnish detailed description. Write to ..... Weston Electrical Instrument Corporation, 604 Frelinghuysen Ave., Newark, N. J.

WESTON-JEWELL *Radio Instruments*

Weston Electrical Instrument Corporation
604 Frelinghuysen Ave.
Newark, N. J.

Name .....

Address .....

Please send me further information on Weston-Jewell Service Equipment. .....

HIGHLIGHTS . . .

Spring

The gentle zephyrs of the South are upon us. Buds are growing on trees faster than new vacuum tubes. Static is just around the corner.

Little men, looking very concerned, and old ladies who can't be told anything, are taking up the subject of lightning arresters. Dealers will soon go stark mad trying to explain why it is that these new interference-eliminating aerials will choke the noise of the vacuum cleaner and the dentist's drill, but pass natural static like a politician passes favors.

People are going to be merry for a change and spill beer on the power transformers. Humidity is going to warp a lot of speaker cones and many a set will get rain-soaked for being near an open window.

Some of the broadcast stations are going to go "plop" during an electrical storm and an odd thousand people are going to complain by phone, wire and letter to the FRC and the Public Service Commission.

Many auto-radio sets are going to play to trees along a dark road of an evening.

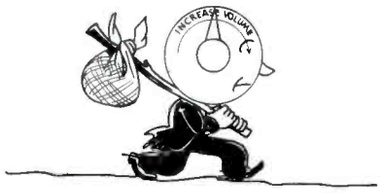
Good old Spring.

•

Radio Cycles

It is interesting to watch the changes that take place in radio receiver design. Take volume controls for example. These gadgets have in their time wandered all over the whole circuit. Some years back it was home in the first audio circuit. Later it moved into the antenna circuit. Some time after, with the same spirit of intrepidness it has shown right along, it took an excursion into the r-f. amplifier circuit, in some cases leaving a part of its family in the antenna circuit as a sort of rear guard.

Recently, it has again been bitten by the wanderlust and has visited its old haunts in the audio circuit. There is no telling where it will finally settle down. Maybe it never will. Maybe it has gypsy blood.



We have also had no end of fun following the growth and decline of audio systems. There was the time when we had one or two intermediate audio stages between the detector and power tube. Then these intermdeiate stages sort of dwindled away and there was nothing between detector and power tube but resistors or a transformer.

Then came AVC and diodes and back came the intermediate audio stages to do a bit of boosting along the line. Then Class B and Class A Prime, both of which required drivers. Now, with duo-diodes, high-mu triodes and pentodes, the intermediate audios will probably wither away again. But maybe when the leaves turn red and the wind starts biting, they will be back again.

•

Service Girls?

One "Sparks, the Radio Man," from Minot, North Dakota, writes in and asks have we ever heard of a Service Girl. He says girls do everything else and was just wondering if there were any of 'em fixin' radios.

Well, we never heard of one—but if there is one we would like to make her honorary member of something or other.

•

W. E. Ham Tubes

The Western Electric Company have brought out a special catalogue of vacuum tubes for use with amateur transmitting and receiving equipment which is the berries. There are in all 26 tubes described and the characteristics, base connections, classification, etc., given in each case.

Copies of the catalogue may be obtained by licensed amateurs at the offices of the Graybar Electric Company which are located in 75 principal cities of the United States.

•

A Rose By Any Other Name . . . .

We have been consistently amused by the outlandish names given to some of these small receivers you build at home. Most of the names seemed to have been selected from that old phrase, "Hears all, sees all, knows all."

But there is a bit of impatience mixed in with our amusement. We feel that it is about time for a new deal. These professional namers might well turn to the Pullman Co. for both ideas and system. We await the day when a tender two-tube morsel is described under the name, "The Two-Tube Planet Snatcher." Or, "All-Wave Grabber-Oner."

•

Pacent Carries On

To safeguard and perpetuate one of the best known names in radio, Louis G. Pacent has personally purchased the principal assets of the Pacent Electric Co., Inc., and its subsidiary, the Pacent Reproducer Corporation. He now heads the Pacent Engineering Corporation with headquarters at 79 Madison Avenue, New York City. The new organization will not only manufacture and market the lines of the former companies, but in addition will introduce novel devices and accessories for many purposes.

Associated with Mr. Pacent are R. L. Lewis, former Sales Manager of both Pacent companies and now General Sales Manager of the new company, and Harry L. Likel, former research engineer of both Pacent companies and now in charge of the research and engineering activities.

The company is maintaining a research and engineering laboratory at Little Neck, Long Island, and a production plant at Seymour, Conn. The parts and equipment for movie theatres will be manufactured in their plant at Ampere, N. J.

A radically new merchandising plan based on a long study of retailing and servicing problems in many localities, and definitely aimed at producing greater profits for merchandisers and for the public will be announced shortly.

•

Humanity and Radio

It has always seemed that as soon as the world's microbe hunters bash a disease on the button, another crops up to take its place. There may be a lot to the idea.

At any rate, as humanity progresses (?) new microbes appear to crop up, and darned if radio receivers don't follow in close order.

Each year we get a new crop of receivers that make old man current do some new tricks. And just as sure as fate, a new bunch of receiver ailments crop up; things you never would have expected.

It will always be so, we fear. Any day now we expect to hear of new receiver grumblings—due possibly to such things as 3.2 fluid in the electrolytic condensers or pretzels in the loudspeaker.

•

Beer and Radio

Mr. R. M. Klien, General Manager of Fada, thinks the return of beer will increase interest in radio reception. He bases his conclusions upon certain natural reactions and probabilities.

He thinks that, in the first place, it is likely that the drinking of beer is going to become to a large extent an established home institution. Among average people there will be a return of the old home gatherings on a large scale. Families and friends will get together for an evening snack. On such occasions it is only natural that radio will play an important role.

Mr. Klien also sees a return to the pleasantries of yesteryear. Beer does not induce the ha-cha complex, but rather demands the quieting and the restful. It may therefore have a direct influence on the sort of music we may hear over the radio.

Beer and old tunes go well together. Add rye bread, pretzels and radishes and you're all set for some of Victor Herbert's melodies —or a Strauss waltz or two. But ha-cha jazz. Nein!

Pacent
Carries On!

To safeguard and perpetuate one of the best known names in radio, Louis Gerard Pacent has personally purchased the principal assets of the Pacent Electric Company and Pacent Reproducer Corporation. His new organization, the Pacent Engineering Corporation, will manufacture and market the Pacent Essentials, as well as new products being developed by its research laboratory. A radically new merchandising policy insures real profits to service men and better values to their public.

Write for details of the new and enlarged line of Pacent Essentials, as well as our "New Deal" Merchandising Plan.

Just a few

ESSENTIALS

Radioformers
Line Filters
Phonovoxes
Recordovox
Compensating Phonovox
Phantom Antenna
Talking Picture Sound Equipment
Duo Lateral Coils
Phono Motors

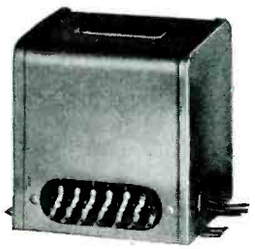
PACENT ENGINEERING CORPORATION

LOUIS GERARD PACENT, *President*

79 Madison Avenue :: New York City

PACENT

New Kenyon Amplifier Components for 53 Tubes



As leaders in the development of class B audio components the Kenyon Transformer Co., Inc., is pleased to announce the release of specially designed audio and power units for class B 19, 46, 49, 59, 79, 210 and 203 class B power amplifiers. Audio components for the Kenyon 53 class B amplifier kit may be purchased at net wholesale prices only from authorized Kenyon distributors.

1—BPR or BLG	Universal input to grid.	$5.50
1—BC-3000	High impedance reactor	4.50
1—B-531	53 driver to 53 grids....	6.00
1—B-530	Push-push 53 output...	6.00
2—BC-210	Input and output filter chokes @ $4.00.....	8.00
1—B-53 P.T.	53 plate and filament supply	8.00

List Price of Transformer Kit **$38.00**

Net wholesale dealers price $22.80

KENYON UNIVERSAL REPLACEMENT TRANSFORMERS with the exclusive slip cover feature are designed to supply plate and filament voltages to more than 2,000 standard radio receivers. There are five types available for use with 171, 245, 247, 210 and 250 tubes.

Write for bulletin ABTRM showing transformer replacement chart for standard radio sets.

KENYON TRANSFORMER CO., INC.
122-124 Cypress Ave., New York City

Keep Your Radio Business Going this Summer with
OHIOHM
Spark Suppressor Sets

A HOT seller for hot weather. New installations by the thousands call for radio technicians with Ohiohm Spark Suppressor Sets.

FOR ELIMINATING IGNITION INTERFERENCE ON RADIOS INSTALLED IN AUTOMOBILES.

Furnished for 4, 6 and 8 cylinder cars. Condensers designed to withstand unusual conditions of temperature and vibration. Spark suppressors enclosed in glazed porcelain tube eliminating accumulation of dirt. Porcelain made of special non-moisture absorbing material to prevent shorting.

WRITE TODAY!

This is the time to get under way. The fastest growing market in radio today.

Also ask us about CLEANAIRE, the ideal companion item for spring.

THE OHIO CARBON CO., 12508 Berea Rd. Cleveland, Ohio

Ohiohms are made in Canada by C. C. Meredith & Co., Ltd., Bay St., Toronto.

THE FORUM . . .

"Mobilize"

Editor, SERVICE:

In all probability the radio industry in general and the service profession in particular have been the most abused of all businesses. Mr. Rider, in his article, "Organize for Profit" has indeed sounded the call to arms for all engaged in the service field.

Are we, the Service Men, not (as a prophet of old might say) the Chosen People? Are we not living in a radio age when the marvels of the electronic sciences reign supreme? Try to imagine the voices of the ether quieted for 48 hours, the animate sounds of the movie screens stilled, the voice of the public speaker carried back to his own lips ere a hundred people had heard his message. The man in the sky would falter as the pilot signals ceased; thieves and murderers would need have no fear of the "radio arm of the law."

It is not so difficult to see the paramount importance of that group of tireless men who have made their life work the study of radio equipment and its maintenance.

And just how do we—the men to whom the country turns when its equipment fails—just how do we behave? We sneak about like hunted criminals, fearing that our charge is unjust, thinking a paper hanger, garage man or plumber may steal our trade.

To say we should organize is putting it mildly. We should MOBILIZE—then fight!

In what has gone before and what is to follow it is not the wish of the writer to criticize the statements of Mr. Rider. He is to be commended for his timely message to the Service Men and it is up to us to act for relief.

Mr. Rider has rightly pronounced a dictatorship undesirable. An organization must be representative of those who are its members. However, in the opinion of the writer, *it is impossible for an organization composed of an unrestricted body of men to, per se, limit its own membership.* It is suggested that the unworthy man would eventually eliminate himself. Even granting this to be the absolute truth, untold damage to the trade would result before this end would be accomplished. In service as in all things people demand both *quality* and *low price.* Would you, however, accept the verdict of "Mr. Average Set Owner" as to whether the i-f. stages in his set were correctly tuned? As he is incompetent to judge *quality* he is influenced largely by price. Hence the prosperous condition of the "gyp" and his continued growth and happiness under a system that provides for his elimination only by the public at large.

It is true that the principle of "natural selection," survival of the fittest, if you please, presents the least complicated cure of our troubles. But when there are factors in force that make this principle ineffective, then we must turn to a more stringent plan. Organization would be just a cloak for the same old body. Remember, the public is averse to buying in a basket that which it can gather under a tree. To be effective, organization must embody two acts; first, the selection of participants and, second, a uniting of purpose. Without the first the second cannot exist.

What to do about it? For the sake of all that we hold dear, let's don't turn out the lights and go to bed! Mr. Rider has loosened the stone; why not put our shoulders thereto and help?

To hope that we can bring about legislation for the mutual protection of the public and our profession is not beyond the realm of reason. Mark you, we do not come before the country with a demand for better cages for blonde canaries. We represent the most technical and vital interest of the nation. The broadcast stations from coast to coast are our natural allies.

We have lawyers of the bar, doctors with degrees, licensed plumbers and steeplejacks, and registered pharmacists. Why not CERTIFIED SERVICE MEN?

WILLIAM F. BLOOM,
Eaton, Ohio.

(Again the question arises: if the public is to be protected, who will do the certifying? The Government? The States? Or who? Possibly Mr. Bloom has ideas on this and will let us have them. We think his letter is fine.—The Editors.)

•

Government Licensing

Editor, SERVICE:

There seems to be some agitation about government licenses for radio Service Men. For myself I would favor the following plan:

(1) The government would require every radio Service Man to obtain a license by written examination. The licenses would be issued immediately to those qualifying, but would not be required until the end of the first year.

(2) All Service Men would be required to register within the first month, otherwise they would not be permitted to service receivers until they passed the examination.

(3) All dealers would be required to register and furnish a complete list of the Service Men in their employ, state whether or not these men were licensed, and to report immediately the addition of any new men to their list.

The first ruling would be very liberal in allowing one a full year to obtain the license and would be fair to all. The second would furnish the government with a complete list of Service Men and would keep all newcomers out of the field until they could pass the examination. The third ruling would prevent dealers from employing unlicensed men. At the end of the year every qualified man would be licensed and the incompetent cut-price men would be out.

RICHARD CUSTER,
Detroit, Mich.

•

Still Favors Control

Editor, SERVICE:

It has been a pet idea of mine for the past five years that the service end of the radio industry needed a background which would create confidence in servicing. My idea of government licensing was put forth with the thought in mind that such a condition would establish a favorable reaction on the part of the customer toward the Service Man so licensed.

I am for any solution which will create a receptive attitude on the part of the customer. If and when such organization is effected, I believe it will accomplish this purpose. But I am not very optimistic as to the possibility of voluntary cooperative effort. Therefore, I still think that some compulsory method will be necessary in order to create this confidence in servicing.

In the absence of specific information as to how such organization is to be started, I will withhold judgment until further details appear.

Any practical plan which will accomplish benefits for the service profession will have my complete support.

RICHARD P. ROBERTS,
Philadelphia, Pa.

•

Stresses Education

Editor, SERVICE:

I have read with great interest the letter in the February issue by Mr. Richard P. Roberts in regards to Government control of Service Men; also the editorial remarks.

The subject is one of great importance and requires careful study. Radio servicing in my opinion should not be Government controlled. The Service Man should find the means of eliminating the back-number members of the fraternity by higher educational methods.

The radio service fraternity is divided today into two groups: first, the Professional Radio Technician, and second, the Radio Mechanic. The latter, through his lack of proper training in the fundamental principles of radio, cannot keep pace with radio development and eventually will be pushed out. On the other hand, the Professional Radio Technician is always in demand because of his technical knowledge and all that is necessary is for this group to band themselves together and instruct the public through propaganda and advertisements.

JAMES G. HORSFORD,
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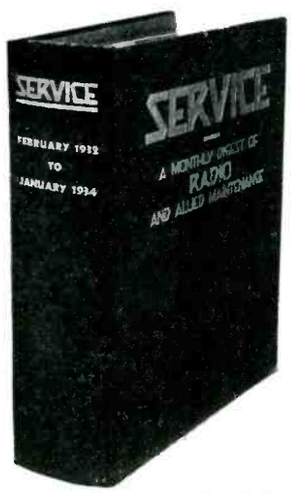

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THIRD . . . .

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FOURTH . . . .

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It would have been a fairly simple matter to realize a handsome profit at a list price of $5.00--by reducing the high quality of workmanship --by making the Manuals less detailed--accurate--complete. But of what use is a manual which is not detailed--accurate--complete? We could have saved money by purchasing cheaper binders--but this would have interfered with the utility of the Manuals.

We could have saved money by making no effort to secure the diagrams and other service data covering the products of manufacturers who are out of business--but whose sets are still in the field...We could have saved money by furnishing wiring diagrams only--without additional valuable information...However, if the Manuals were to have been the finest possible--as was our aim and always will be--they had to be the best in every respect...We spared no expense to produce what you wanted and needed.

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In this respect we are asking for nothing to which we are not entitled. We back this statement by guaranteeing satisfaction. If you do not think that Volume III is worth what we ask--send it back and your money will be refunded.

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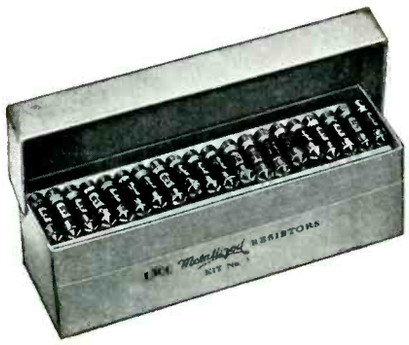
THE MANUFACTURERS . . .

IRC "Midget" Resistors

In line with the growing popularity of midget sets, the International Resistance Company, of Philadelphia, Pa., is featuring a kit of midget, space-saving resistors. This is known as Handy Certified Kit No. 3 and contains twenty IRC Metalized 1/3-watt re-



sistors. Resistance values have been chosen to meet the replacement demands of the most popular and commonly used small sets. Of course, other values are possible by connecting the resistors in series or parallel.

•

Hickok Multiplex Socket "A"

The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio, have completed the design of a special multiple adapter to bring up to date the Hickok Tube Testers Nos. A.C. 47, 4300, 4301, 4302, 4303 as well as all Display, Jobbers' Models and Stati-K-Testers.

The Multiplex Socket "A" replaces fifteen adapters and will accommodate 42 new type tubes. It is made to plug into the present tube sockets on the Hickok equipment and cannot be installed wrong.

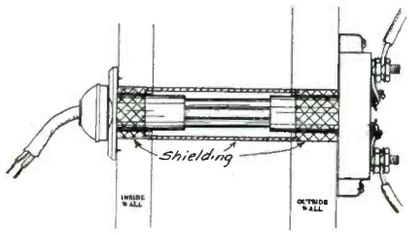
•

Woodruff Shielded "Super-Thru"

Woodruff & Company, of Meridian, Mississippi, have introduced a new model of the "Super-Thru" antenna and ground lead-in unit which permits its use with practically any of the many forms of noise-reducing antenna systems now on the market. This is made possible by the incorporation of a flexible, braided sleeve of wire, similar to the usual form of shielding, which fits over nearly the entire unit. This is shown in the accompanying sketch.

A stranded copper wire is woven into the braided sleeve so that the shielding may be grounded or connected to the shielding on the antenna lead-in wire which in some systems is not grounded.

It is interesting to note that both the new type and the standard type of "Super-Thru" fit in perfectly with an antenna system using a transposed lead-in. In such a case the two lead wires which are a part of the "Super-



Thru" are merely twisted so that these leads are also transposed, like telephone wire. Since these particular leads are short in any event, the idea may also be applied to doublet antennas with leads employing transposition blocks for short-wave use.

•

Oak Vibrator-Transformer

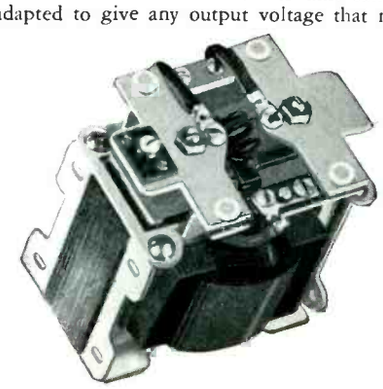
The Oak Manufacturing Company, of 711 West Lake Street, Chicago, is introducing a new vibrator-transformer assembly especially designed for use in auto-radio receivers.

This unit can be built directly into the chassis and used to furnish plate current to the tubes so that no B-batteries are required in the installation.

A push-pull primary circuit giving a true alternating current input keeps the excitation losses in the transformer at a minimum and divides the load between two sets of contacts, thus allowing a useful life of 4,000 hours or more. Full-wave rectification on the secondary side allows the use of a smaller filter and assures a smooth output.

The efficiency of the vibrator-transformer unit alone is high, being of the order of 60 to 65 per cent. This is possible because the energy required to actuate the vibrator is taken from the leakage flux of the transformer.

The Oak vibrator-transformer unit can be adapted to give any output voltage that may



be required up to 350 volts at 40 milliamperes, or, if desired, the unit can be made to operate with input voltages of 6, 12, or 32 volts.

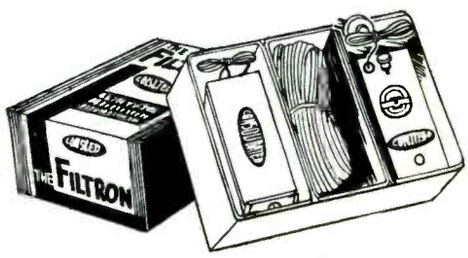
Radio-frequency radiation has been kept down to a minimum and it is said that no difficulty is experienced in the elimination of this interference with the unit mounted directly on the receiver chassis.

•

Consolidated "Filtron"

Consolidated Corporations, Peoria and Harrison Streets, Chicago, have introduced a double unit noise eliminator called the "Filtron." The complete kit is illustrated on this page.

The "Filtron" consists of an antenna impedance-matching transformer used in conjunction with a shielded lead-in wire for eliminating the pickup of man-made interference in the antenna system. The shielding is grounded at the receiver. There is also a second unit, consisting of a heavy filter of condensers and chokes, which is connected between the wall outlet and the power plug of the receiver. This filter is used to prevent similar forms of interference from entering the receiver via the light lines.



Each kit is provided with a sufficient length of shielded lead-in wire for an average installation.

•

Acrocycle Oscillator

The J-M-P Manufacturing Company, Milwaukee, Wis., have announced a new service oscillator known as the Acrocycle Oscillator, Model B. It is a self-contained, fully shielded instrument. The two dial scales are calibrated in kilocycles, the upper one for

intermediate and the lower for broadcast frequencies. The total coverage is from 100 to 1,500 kc. The calibration from 100 to 200 kc. is given as 1 kc. per division, from 200 to 400, 2-kc. per division and from 400 to 1,500, 10 kc. per division. All frequencies higher than 200 kc. are harmonics and are so marked in the scales.

The oscillator is battery operated and uses a single type 30 tube.

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

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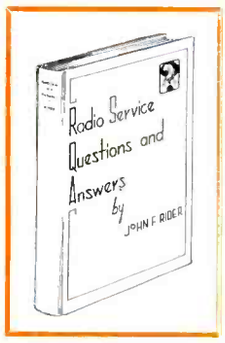

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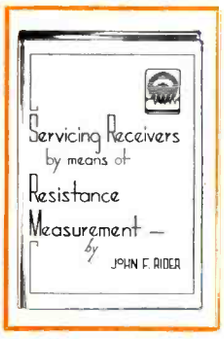

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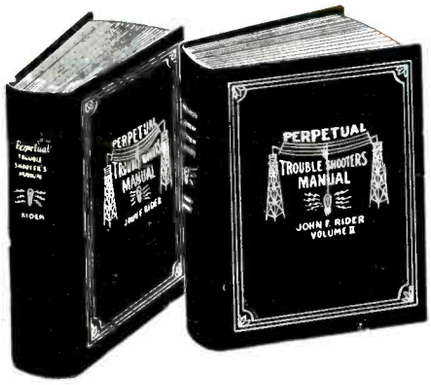

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