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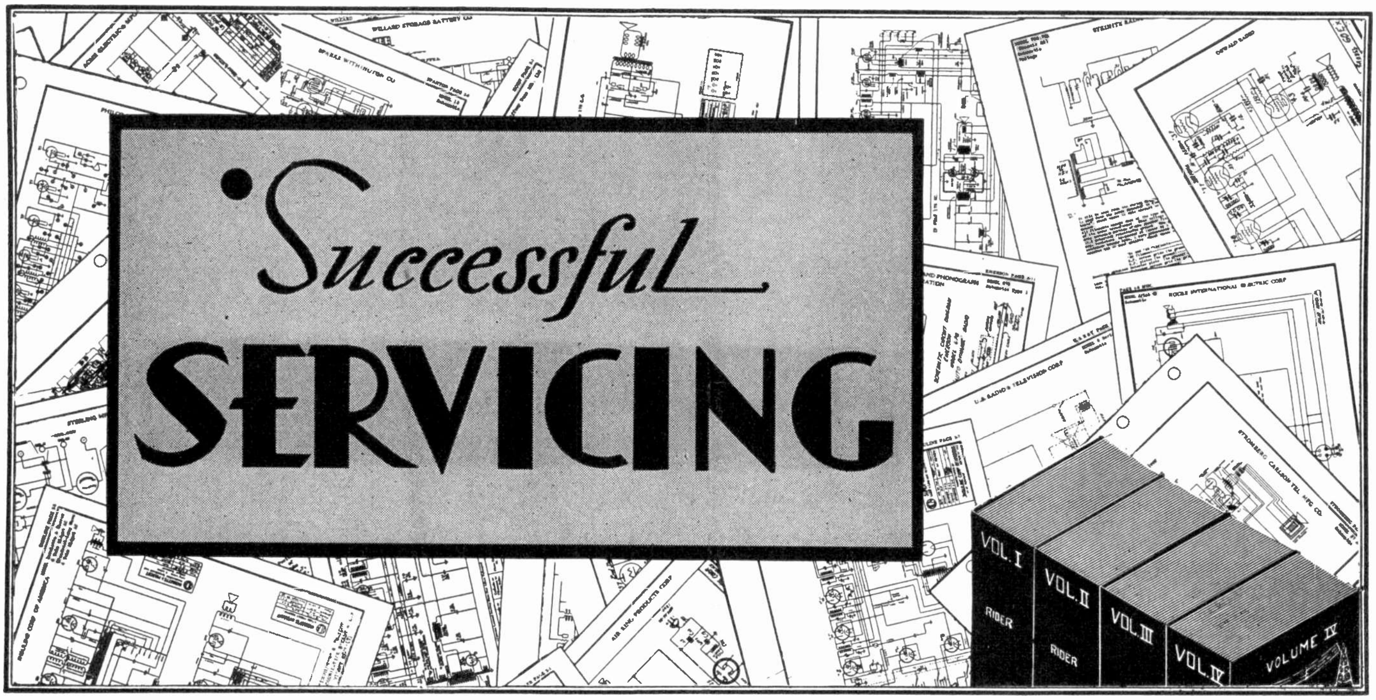


TROUBLE-SHOOTING THE OSCILLATOR

A Systematic Method for Locating Defects in the Oscillator Circuit

By JOHN F. RIDER

IT IS not an exaggeration to state that trouble in the oscillator, when it does occur, can be very annoying. For one reason or another, the service man has come to look upon the oscillator circuit in a superheterodyne as something which he cannot analyze with the same degree of ease that he can other parts of the receiver. Fundamentally, there is no reason why this condition should continue to exist.

Failure of the oscillator to function generally will result in a completely "dead" receiver. Failure of the oscillator to function *properly,* either from the standpoint of poor tracking or inadequate output, will result in a marked decrease in both the sensitivity and selectivity of the set. The reasons for this close dependence of the performance of a superheterodyne upon the oscillator performance are not hard to see. In the first place, the greater part of the sensitivity and selectivity is due to the amplification and selectivity of the i-f. amplifier. Remembering that the oscillator signal mixes with the incoming signal in the first detector to produce the beat frequency at the intermediate frequency (i-f. peak), let us see what will happen if the oscillator frequency is "off" to a certain extent. Since the greater part of the selectivity is in the i-f. amplifier, the effect will be that no signal is received when the *dial* is correctly set to the signal. However, if the set is tuned so that the dial reads incorrectly, but the oscillator frequency is such as to produce the intermediate frequency, then the i-f. amplifier will function to amplify the signal. There will still be a loss in gain, due to the fact that the r-f. and detector tuned circuits attenuate the signal, since they are not tuned to resonance with it.

In view of what has been said it should not be surprising that the adjustment of the oscillator, controlling, as it does, the resultant amplification and selectivity of the receiver, constitutes one of the most important adjustments in the receiver at the same time, one which has received little attention.

Trouble Shooting

When the i-f. amplifier and audio system are found to be functioning properly, but a signal at the dial frequency fed into the grid of the first detector produces no output, trouble with the oscillator is to be suspected. A defective tube is probably the most common cause of oscillator failure and the first step should be the substitution of another tube. If a single tube is used for frequency conversion this still holds true. If the receiver still does not function, the next step is to determine definitely whether the oscillator is oscillating. This can be done in many ways and they will now be discussed.

One of the quickest methods is to make use of another receiver in good operating condition. The exact procedure to be followed was explained on page 11 of the November issue of Successful Servicing. A still simpler method is as follows: Tune in a station with the test receiver. Then tune the oscillator being tested to a frequency which is approximately that of the station being received. This means that the dial frequency of the set being repaired will be less than the station frequency by an amount approximately equal to the i-f. peak of the set under repair. If the oscillator is very thoroughly shielded it will be necessary to place a lead from the antenna post near the oscillator to provide adequate pickup.

A more straightforward method is to use a vacuum-tube voltmeter, preferably one of the type which has a low input impedance. Whether the oscillator is working is determined by connecting the vacuum-tube voltmeter, through a small blocking condenser, across the stator of the oscillator section of the condenser gang and the chassis. A reading of at least several volts should be obtained.

A third method, which requires only a plate milliammeter, can be used, but it is not in general so convenient or conclusive as the first two. The plate supply lead is opened and the milliammeter inserted. It is advisable to by-pass the meter to ground with a .01-mf. condenser at the point where the meter is connected to the plate lead. This precaution is to avoid any possibility of stray coupling. Now, if the oscillations are suppressed by touching the stator of the oscillator condenser, then the plate current will change.

There can be no question but that the use of the vacuum-tube voltmeter is by far the best of the various methods. This, in conjunction with the test receiver method, provides an indication not only of the oscillator output, but of the frequency of oscillation as well.

Oscillator Not Operating

Now let us assume the above test shows that the oscillator is not functioning. What is the best method of procedure from this point? Naturally there are many reasons for oscillator failure. The first step should be to check the plate current and plate voltage of the oscillator. Since the introduction of capacity and coupling prevents the use of an analyzer cable, this test should be made without removing the tube. The plate current is measured by opening the plate lead, as explained in a preceding paragraph. If this check discloses nothing abnormal, a thorough resistance check of all components should be made with a good ohmmeter. In a number of cases manufacturers are, and have been for some time past, including data on the values of coil resistance. Fortunately, the tendency to include data of this type is spreading widely. To take advantage of this, it is necessary that an ohmmeter capable of measuring resistances to a fraction of an ohm be available. In this connection it may be noted that Wheatstone bridges are available or can be readily constructed for making such measurements.

An open in the grid condenser is most easily checked by shunting it with another condenser and noting on the indicator whether this restores oscillation. The other condensers in the oscillator circuit can be checked for leakage and capacity by removing the connections to one terminal of the condenser, in order to remove the effect of coils and resistances in the circut.

Other Causes

A defect which is fairly common is the stopping of oscillation as a result of excessive bias on the oscillator tube. This is most prevalent in receivers which employ a single tube to accomplish frequency conversion. The remedy is to replace the bias resistor with one of lower resistance in order to reduce the bias to the correct value. Excessive losses in the tuned circuit, as a result of moisture or other defects, are sometimes responsible for the necessity of reducing the value of the bias resistor in order to restore oscillation.

While defective switch contacts are apt to be indicated by the resistance tests, this will not always be the case. For although the direct-current resistance of the switch contact may be quite low, it is possible that the r-f. resistance may be considerably higher. This can be checked by noting the effect of a temporary short across the switch contacts in use in the band under test. If the contacts are faulty, the oscillation will be restored when the faulty contact is shunted by the bridging wire. Incidentally, this should be one of the early tests in those cases in which the oscillator functions on some bands, but not on others. Temperamental operation of the oscillator as the wave-change switch is repeatedly switched off the band and back again, should always be followed up by a check of the coil switch contacts. If the contacts prove faulty, further inspection will show whether only a cleaning is necessary or the switch must be replaced.

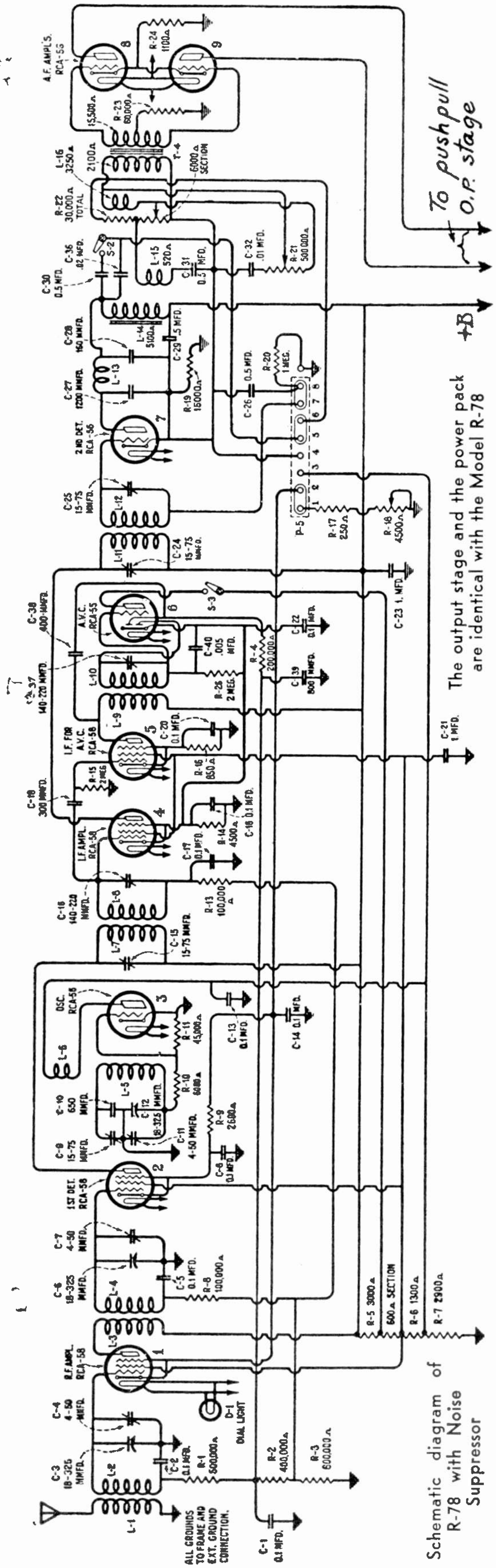
Assuming that everything up to the present point has failed to disclose the cause of the trouble, it is very likely that the defect is in the coil unit. In this case the simplest procedure is to replace the coil unit. The apparatus required for the detection of shorted turns and the actual measurement of the inductance and power factor of r-f. coils is at the present time beyond the scope of even the better equipped service shop. For this reason, it must be taken for granted that if everything else proves to be all right, then the only remaining possibility is that the defect is in the coils. Fortunately, this does not occur very often; in the great majority of cases the trouble is revealed before this step is reached.

In the case of multi-band receivers, the following point should be noted to simplify the test procedure: Certain parts of the oscillator circuit, such as the tube, voltage supply, and various resistors and condensers are common to all bands. In general, failure of the oscillator to function on any one band definitely throws suspicion on the coils and switch contacts for that band. It follows that before a systematic investigation is made, these elements should be checked.

•

FLASH ! ! !

The Rolling Reporter flashes the information that the Radio Service Shops in Jacksonville were kept open in honor of Jacksonville Night on the Major Bowes Amateur Hour, Sunday, January 12th. . . . They advertised the fact all week, and invited the public to listen in on a GOOD receiver, also providing facilities for these who wished to telephone their votes. ***Here is a RED HOT merchandising idea of which Servicers should take advantage . . . that goes for dealers, too.*** . . . When YOURS is the honor city on the Major Bowes program, contact your local Chamber of Commerce for ideas on exploitation.



The output stage and the power pack are identical with the Model R-78

Schematic diagram of R-78 with Noise Suppressor

RCA R-78 with Noise Suppressor

The schematic diagram, showing the inclusion of noise suppression to the early Model R-78, is shown in the accompanying illustration. If you will compare the schematic diagram of the R-78 that is shown on *RCA page 3-38 of Rider's Volume III and on page 1910 of the Rider-Combination Manual,* with the one given herewith, it will be seen that the 56 AVC tube in the early model has been replaced with a 55 tube and the values of several resistors have been changed. The power pack and output stage is the same in each case.

The untuned i-f. transformer used in the older model has been changed to a natural period plate coil, L-9, and a sharply tuned secondary coil, L-10. Coil L-9 supplies the voltage to operate the AVC circuit and L-10 supplies that used to operate the suppressor circuits. An examination of this circuit will show that with no signal voltage impressed on coil L-10, no current is rectified in the diode plate and hence the grid of the 55 tube operates at zero bias. The plate current is then at maximum—about 10 ma.—and since the cathodes of the 55 tube and the signal channel i-f. tube are common, the i-f. tube is biased to cutoff. This prevents signal voltage from reaching the second detector.

When the set is tuned to a signal, the signal voltage is amplified in the AVC amplifier and impressed on L-9 and L-10. On the positive half of the signal voltage, the signal is rectified in the suppressor circuit which generates a negative potential on the grid of the 55 tube. The plate current is thereby reduced to nearly zero, which releases the high bias potential on the signal channel i-f. amplifier. Signal voltage will then be impressed on the second detector.

AVC bias for the r-f., first detector, and i-f. tubes will be generated when the i-f. voltage on the AVC diode overcomes and exceeds the positive potential on the cathode of the 55. This bias is about 10 volts when the set is tuned to a signal.

The sensitivity control is in the cathode circuit of the r-f. and first detector tubes and is indicated as R-18 on the diagram. The sensitivity of the set is reduced by increasing the residual bias on these two tubes, i.e. the first two 58's in the set. One end of the sensitivity control has a switch, S-3, which is provided so that the noise suppressor circuit may be cut out; then the full sensitivity of the set is obtained.

Alignment:

Remove the oscillator tube and ground the chassis. Couple the output of the test oscillator, set to 175 kc., the i-f. peak of the set, from the control grid of the first detector to ground. With the receiver volume control at maximum, the noise suppressor control at its extreme counter-clockwise position, and the noise suppressor switch open, adjust the oscillator output until a deflection is obtained in the output indicator.

Adjust the secondary and primary of the second and then the first i-f. transformer, until a maximum deflection is obtained. Check the adjustments.

Then close the noise suppression control switch by advancing slightly clockwise, but do not advance the control beyond the snapping of the switch. The single noise suppressor circuit should then be adjusted for maximum output. Keep the input signal as low as possible so that every change can be followed in the output indicator.

For other adjustment data and notes that apply to this model see *pages 3-39 and 3-41 in Rider's Volume III and pages 1911 and 1913 in the Rider-Combination Manual.*

Voltage Data:

Below will be found the voltage data for the R-78 with noise suppression. Note that the line voltage is 120. The antenna is shorted to ground and no signal.

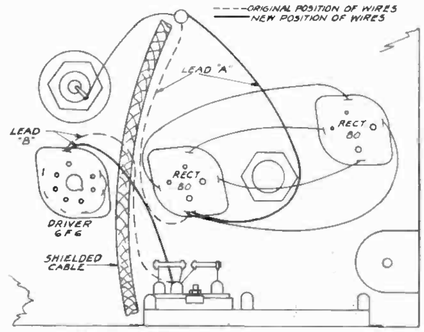
Tube	Function	Cath. to Cont. Grid	Cath. to Screen	Cath. to Plate	Diode Plate No. 1 to Cath.	Diode Plate No. 2 to Cath.	Plate MA.
58	R.F.	− 3.5	106	212	—	—	6.5
56	Osc.	—	—	65	—	—	4.5
58	1st Det.	− 9	101	206	—	—	1.8
58	I.F.	−12	98	203	—	—	2.0
58	AVC I.F.	− 5	106	210	—	—	4.0
55	AVC Sup.*	0	—	0	0	−12	0
55	AVC Sup.**	0	—	69	0	36	8.0
56	2nd Det.	−15	—	200	—	—	1.0
56	Driver	−11	—	204	—	—	5.0
46	O.P.	0	0	400	—	—	6.0
82	Rect.	462.5 volts R.M.S. each plate. 72 ma. total plate current.					

* Sensitivity control at minimum.
** Sensitivity control at maximum.

Wells-Gardner 2CM Series

If excessive a-c. hum is encountered in this model check the following:

In some of the sets the 6F6 driver control grid lead is beside the lead between the choke and the 80 socket nearest the center of the chassis. The latter carries a.c. and there is inductive pickup by the control grid lead of the 6F6 driver. In the accompanying illustration are shown the original positions of



New positions for leads in Wells-Gardner 2CM chassis

these two leads and the correct positions to which they should be moved. Change lead "A" to new position as shown. Remove lead "B" from under and beside shielded cable and re-route it so that it is at least one inch from the chassis base and away from all wires carrying a.c.

Another cause for hum has been found to be an unbalanced plate current condition in the output 6F6 tubes. The plates of these tubes should preferably balance within 5 ma. and in no case should they differ by more than 10 ma. Try several new 6F6 tubes in the output stage socket if a-c. hum is encountered.

Federal Model K

Below will be found the voltage data for this receiver, the schematic of which appears on the following pages in *Rider's Manuals: 1-21 in the revised edition; *284 in the early edition, and 987 in the Rider-Combination Manual.*

Tube	*Function*	*Plate to Frame*	*Grid to Cathode*	*Scr. Grid to Frame*
227	1st R.F.	120	7.5	—
224	2nd R.F.	110	1.5	60
227	Det.	65	0-1	—
227	1st A.F.	135	7.5	—
171A	P.P.O.P.	205	40	—

Successful
SERVICING
Reg. U. S. Pat. Off.

Dedicated to financial and technical advancement of the radio service man.

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JOBBER OR SERVICEMAN?

IT HAS come to our attention that it is becoming a common practice for parts jobbers in numerous communities to do a general servicing business. They not only work for the trade as the service men in the community, but they also solicit business from the public. The local service man who would fight such tactics finds his hands tied, because every worthwhile jobber in that town is doing the same thing, so that he cannot find any way of combating the evil.

An evil it is and there is no just or ethical reason why a parts jobber should be in the business of repairing radio receivers. Such is not the work of a jobber. We say this with the full knowledge that we are placing the sale of Rider Manuals in jeopardy in those communities where jobbers are operating in the manner we mentioned. However, it has always been our idea to fight for that which we thought was right and we have not changed our mind.

Some of the jobbers seem to excuse their acts by stating that they are doing service work for the trade, thereby making it possible for service men, not sufficiently well equipped, to do service work. That, to us, is a fallacy. We harbor no grievance against the service man who, realizing that he is not sufficiently well-grounded technically but is a business man, hires technical brains—but we feel that such a service man should be running his own shop and should be hiring his own technical help. If a jobber is doing his work, that service man is nothing but a delivery boy. As such, the jobber makes it possible for such a service man to operate at costs much below those normally existent and, consequently, makes competition with the few legitimate service houses so much more difficult.

Referring once more to the jobber, we cannot help but feel that it is far more important for a parts jobber to run a jobbing establishment than to make service work for the trade and the public, one of his essential activities. Furthermore, it is our belief that such mode of operation is penalizing every good service man in the community. In addition, it is limiting the sale of equipment and, in general, is making the set-up of the servicing industry just so much more complicated—by introducing another ramification. Perhaps some of the jobbers do not realize the fact, but their activities are making it so much more difficult for jobbers in other communities, who have in the past been justified in stating that they alone are entitled to the proper jobber discounts as against the efforts made by service men to act as jobbers. Now that jobbers in certain communities are taking on service activities, it is only natural that service men will attempt to take on the activities of a jobber. Of course, they may find it difficult to secure the good lines, but there always will be manufacturers who will supply their lines, irrespective of the nature of the distribution set-up. As such, competition — not necessarily really good competition—will be stimulated.

And as the last and final thought, we cannot help but comment that the jobber, who is also doing a servicing business, is a perfect example of the mouth that bites the hand that feeds it.

JOHN F. RIDER.

SEND IN YOUR QUESTIONNAIRE TODAY

Did You Know That

The **Circus Maximus** in Rome, built 2500 years ago, held 150,000 spectators. 900 years later it was enlarged to accommodate 385,000 people, more than four times the capacity of the Yale Bowl.

All **Spiders** are poisonous, but only a few will injure a human being, because some can not pierce man's skin and some do not have the inclination to attack.

It has been estimated that if all the ice in **Antarctica** were to melt, it would cause the world's oceans to rise over 100 feet and flood the shores everywhere, drowning millions of people.

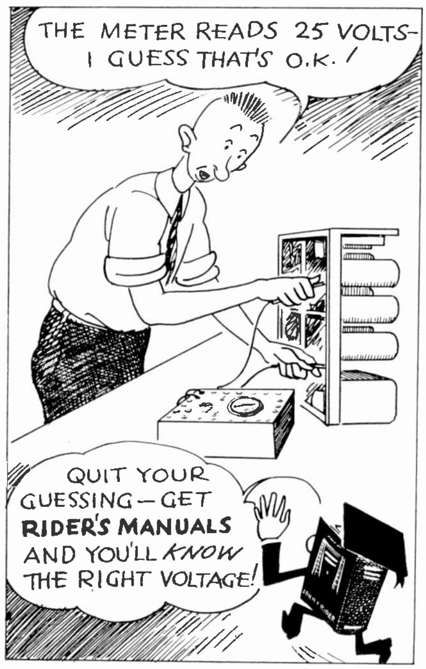
There are more people between the ages of 35 to 44 living in New York City than in any other age group.

In February, 1935, Pedro Candioti, 43 years old, swam *281 miles* in the Parana River, taking *87 hours and 19 minutes* for the trip and so establishing a world's endurance record.

It is on the average 2 degrees colder at the South Pole than at the North Pole.

The loudest noise in the world, the volcanic explosion of the **Island of Krakatoa** in 1908, was heard in Bangkok, about 1400 miles distant.

Guessing Gus



Arvin 41

The servicing data below arrived too late for publication in *Volume VI of Rider's Manuals* but the schematic diagram of this Noblitt-Sparks model will be found on *Arvin page 6-16.*

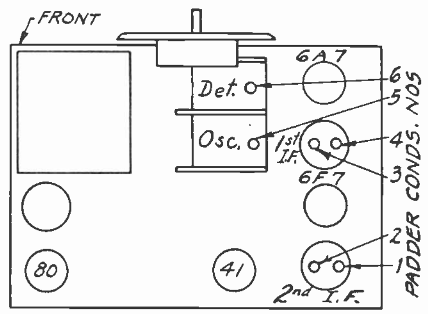
Voltage:

Tube	Plate	Screen	Cathode	Triode Plate	Anode Grid	Osc. Grid 1500 kc.
6A7	265	90	3.0*	—	155	3.5
6F7	265	90	4.0*	40	—	—
41	250	265	17.0	—	—	—
80	330 AC					

* Volume control full on.

Alignment:

Adjust the padders only in the order given. See the accompanying sketch for their location and the locations of the tube sockets.



Location of trimmers on Arvin Model 41

Adjust padders 1, 2, 3 and 4 with the test oscillator connected to the grid cap of the 6A7. Frequency of test oscillator is 456 kc.

Adjust No. 5 with the oscillator connected to the antenna wire (red) and the ground side to the set's ground wire. Set the oscillator and the dial to 1500 kc.

Adjust No. 6 with the oscillator connected as above with the same settings to 1500 kc.

Emerson 113

Please add to your Index for *Rider's Volume VI* that Model 113 uses the same chassis, No. A-11, as Model 105. The servicing data on this chassis will be found on *Emerson pages 6-11 and 6-12.*

Rolling REPORTER

The Rolling Reporter is vacationing in Florida . . . his assistant, in response to *terrific* demands, pinch-hits for him.

DEAR BOSS;

Pretty soft for you, basking in the sunshine down there in Miami, while we poor slaves freeze. . . . "Good-Times" Square habitués *(and the sons of the habitués)* miss you . . . also an assorted bunch of bill collectors . . . your tailor sent a statement with a very **nasty** note . . . seven of your readers sent in ties for Xmas . . . can I have the bright red one for my Father?—he's having his beard shaved off next month, and he'll have to wear a tie. . . . *Jean, Keeper of the Books, contributes the story of the* **"Parts Jobber vs Credit Department"** . . . *have a snicker with Jean—it seems that one of the smaller jobbers sent in an order for ten* **RIDER MANUALS,** *and the Credit Manager decided that he could not have the* **MANUALS** *until he sent in a check for a bill which was ninety days overdue . . . Jean told him of this decision, and back came a wire,* **"Cancel order—we can't wait that long"** . . . clipping in one of the papers says that the average filling station in the United States made a gross profit last year of only $60.00. . . . NOW will some of your Servicers kwit kicking ????? *I'm gonna run the mail dep't myself this month . . . you gotta lotta membership applications for the 100% RIDER EQUIPPED CLUB"* . . . among them the name of JOHN L. SULLIVAN of Syracuse, N. Y. (I thought "John L." was a FIGHTER!) P. A. BOYLE of Adah, Pa. —C. P. Miller, Charles-Town, W. Va. (he sounds like a swell guy) A. K. CORBETT, Maxwell Field, Montgomery, Ala. (another "regular guy" letter) Jimmy Randolph, Warren Plains, N.C. . . . and over 100 more 100%ers. . . . *"Chuck" Roberts, Radio Dealer-Servicer, of Fair Haven, Vt., was in to see you—said Happy New Year—he reports business better than in 1928-9* . . . **you hadda flock of cards wishing you Christmas cheer (NINE of the "cheer" cards were mailed from the BRONX, however).**

The irrepressible F. CLAUDE MOORE, of PEKIN, ILL., is in again . . . he writes the breeziest letters—this time to tell you that he took the advice you gave him in last month's col. and went out and blew in 150 bux for an Oscillograph, a VOLUME VI, and a copy of THE CATHODE-RAY TUBE AT WORK. He also complains about a fellow Servicer, RADIO DOCTORS, of PEKIN, ILL., who borrows Claude's RIDER MANUALS every time he gets stuck . . . shall I spank the RADIO DOCTORS ???? How can publishers stay in business if people keep on borrowing books ???? Consider y'self squelched, "Doc," and run right over to KLAUS RADIO & ELECTRIC in PEORIA, and do your part toward making the dollar go round and round. . . .

P. F. NEIDERHEISER of OMAHA wants to know how to join the IRSM . . . shall I tell him the address is 510 N. Dearborn St., Chicago? . . . Didja make any Noo Year Resolutions ????? Wish you'd make one to stay in N'Yawk more than you do. . . . Here are some of the Resolutions in the trade . . . RADIO TECHNICIANS GUILD, Boston, Mass.; *"We resolve to find an answer to the problems that confront the Radio Service Industry . . . and follow the RIDER recommendations that will lead us to a Utopia populated by men of high ideals."* Charlie (AEROVOX) Golenpaul; *"I'm gonna throw away my little black book of "jokes" —and get a RED one"* JOHN F. RIDER; *"To continue to serve the Servicing Industry by publishing BIGGER and BETTER MANUALS."* . . . OUR TYPESETTER; *"To make fewer and fewer mistakes in the ROLLING REPORTER'S colyum."* . . . PAUL (Sylvania) Ellison; *"To contribute to the velocity of the dollar by smoking longer and stronger cigars."* . . . OUR SHIPPING DEP'T; *"We resolve to ship out RIDER MANUALS more promptly in 1936."* . . . JOE BURSTEIN (Burstein & Applebee, Kansas City); *"To save up my thirst until I meet John Rider and Charlie Farrell at the IRSM Convention in March at the Hotel Sherman, Chicago."* . . . EVERY SET AND PARTS MANUFACTURER; *"To recognize that the Servicer is a very important part of the radio picture, and extend him every cooperation during 1936."*

Lotsa requests for inexpensive binders to hold copies of SUCCESSFUL SERVICING—will you get some prices from **Walter Wolf?** . . . *If you don't fly back, will you drop off at Camden and check on the newspaper reports that Television is coming in June 1936??* . . . our "ad" manager says that new contracts are pouring in for 1936 advertising in SUCCESSFUL SERVICING . . . **please ask all Servicers whom you contact to FILL OUT THE QUESTIONNAIRE IN THIS ISSUE . . . it's VERY important . . .** MR. RIDER addressed the Servicers of Baltimore on January 7th and addresses St. Louis on January 21st, and those of ERIE, PA., on the 23rd . . . they both requested that he talk on "ESTABLISHING PROPER SERVICE CHARGES" . . . which reminds me that RCA will announce MR. RIDER'S new book on COST ACCOUNTING FOR SERVICE MEN this month . . . tell any jobbers you see that the first printing of VOLUME VI was exhausted within three weeks . . . the second run is on the press now—should be off soon . . . *here it is Leap Year—my last chance perhaps—it's a pity you're married* . . . with which crack I'll conclude this "billet doux" . . . with best wishes for a "PERFECT '36" and with VOLUMES of love, I am,

Your Girl EVERY Day.

Stewart Warner R-136 Chassis

On *page 6-18 of Rider's Volume VI* appeared the temporary schematic of this chassis, which is used in Models 1361 to 1369 inclusive. The final diagram has now been released with the following changes:

Condenser No. 8, connected between the arm of the tone control and ground, was 0.015 mf. and is now 0.006 mf. The resistance of the tone control, No. 20, is 500,000 ohms.

Condenser No. 9, connected from the plate of the 6J7 to ground, has been changed from 0.00026 mf. to 0.00011 mf.

The left portion of tapped resistor No. 18 is 275 ohms and the right-hand part, that connected to ground, is 25 ohms.

The resistance of the volume control is 250,000 ohms. This is part No. 19A.

The notation was omitted from the diagram of voltages that the grid bias on the 6J7 tube is—1.7 volts, measured across the 25-ohm portion of resistor No. 18.

The resistance of the speaker field is 1300 ohms with the coil warm.

•

Wilcox-Gay 4G7, 4H11, 4J6, 4JA6, 4JB6, 4JC6 Alignment

The following alignment instructions apply to the above models *in toto,* with the exception of Models 4JA6 and 4JB6. When aligning either of these two models, disregard that part of the instructions pertaining to the No. 5 Long-Wave Band. Schematics and other data will be found on the following pages in *Rider's Volume VI* for the respective models: *4G7, 6-5; 4H11, 6-6; 4JA6 and 4JB6, 6-3; 4J6 and 4JC6, 6-4.*

I-F. Amplifier:

Set signal generator to 456 kc. and connect output to grid of first detector. Use minimum signal input consistent with proper indication. The first i-f. transformer is the one furthest to the left at the rear of the set. These two circuits should be tuned for maximum amplitude. After ganging the first transformer, the second one should be ganged, and then the third, which is the transformer in back of the variable condenser.

Ganging Oscillator and Preselector Circuits Broadcast Band:

Connect the output of the signal generator to the antenna and ground posts of the set through a dummy antenna. Set the signal generator at 1400 kc., the wave change switch to its fourth position and the tuning dial set so that No. 4 band reads 1400 kc. At this point the trimmer on the first section of the variable condenser should be adjusted. Then the two preselector trimmers on the second and rear sections of the variable condenser should be trimmed for maximum output. Change the signal generator and dial of the set to read 600 kc. and vary the reciprocal trimmer for the broadcast band, which is the left upper of the four trimmers on the front of the chassis, until the 600-kc. signal is indicated on the output meter. Tune the signal generator and the receiver again to 1400 kc. and retune the trimmer on the first section of the condenser for maximum amplitude at 1400 kc. Check the sensitivity at 1000 kc.

Police Band No. 3

Set wave band switch to No. 3 position, signal generator to 4 mc. Adjust upper trimming adjustment to the right of the wave change switch. Then adjust signal generator and receiver to 1.5 mc. and the left lower trimmer to the left of the wave change switch should be adjusted for maximum output. Reset to 4 mc. and recheck.

No. 2 Band:

Set wave change switch to the No. 2 position. Set signal generator to 10 mc. and the dial in the vicinity of this frequency. The center trimmer to the right of the wave change switch should be adjusted for maximum amplitude. Tune generator and set to 4 mc. and adjust the left lower trimmer on the left side of the wave change switch for maximum output.

No. 1 Band:

Set wave change switch to No. 1 position, signal generator to 20 mc. Adjust dial to vicinity of 20 mc. for maximum output and then vary the lower adjustment to the right of the wave change switch on the front of the chassis for maximum amplitude.

No. 5 Long Wave Band:

Adjust signal generator and receiver to 350 kc. and the wave change switch to No. 5 position. Adjust the left-hand trimmer of the three occurring immediately to the left of the variable condenser on the chassis top, until the signal is maximum. Afterwards the two adjustments immediately to the right of this adjustment should be trimmed for maximum amplitude. The generator and the dial should be set to 150 kc. and the adjustment furthest to the left above and to the left of the wave change switch should be adjusted for peak signal. Check again at 350 kc.

Tuning the Trap:

Set signal generator to 450 kc. and its output to antenna and ground. Its output should be a fairly high level. The trimming adjustment on the trap, which is the one immediately to the right of the first detector, should be trimmed for ***minimum*** response.

Eliminating Code Interference in Silvertone Sets

When code interference is too severe in locations near the coast to be eliminated with the code interference eliminator supplied by Sears-Roebuck, or when heterodyning is experienced because of the frequency separation of two local stations being about equal to the i-f. peak of the set, it is suggested by the manufacturer that the set be repeaked at another frequency.

For instance, suppose that the i-f. peak of the set is 480 kc. Then assume that two local stations are broadcasting on 1120 and 640 kc. respectively. The frequency difference between these stations is 480 kc., the same frequency at which the intermediate amplifier is peaked. Experience tells you that an annoying whistle will result when both these stations are on the air. In such a case, it may be necessary to repeak the set.

Follow the procedure given in *Rider's Manuals* for the alignment of the particular model in all details, except that the test oscillator should be adjusted to 455 kc. for peaking the i-f. stages instead of 480 kc. Always start with the i-f. output transformer and work toward the i-f. input transformer. It may be helpful to "kill" the set's oscillator when peaking the i-f. transformers. Do not remove the oscillator tube to do this; instead, connect a jumper from the plate of the oscillator tube to the chassis or a jumper from the stator plates of the oscillator condenser to the chassis.

After having repeaked the i-f. stages at 455 kc., it will be necessary to readjust the oscillator trimmer and padders, as well as the first detector trimmer. This should be done at the frequencies specified in the alignment instructions pertaining to the particular model.

Assume that you are confronted with this problem for some set whose i-f. peak is something other than 480 kc.—say, 175 kc. or 260 kc. How far from the original i-f. peak can you safely go? Due to the various limitations that enter into the design of transformers, the range of the trimmers, etc., it will be wise if you stay within two or three percent. of the manufacturer's rated frequency—certainly never go much be-

(*Please turn to page 12*)

Zenith ZE-12

This power pack, used with Models 39, 39-A, and 40-A, will be found on the following pages in *Rider's Manuals: 1-12 in the revised edition; *665 in the early edition, and 2698 in the Rider-Combination.* The values of some of the resistors and condensers were unavailable at the time of publication and are given below; this data was supplied by a serviceman.

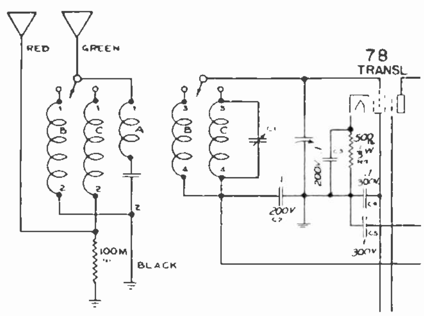
The total resistance of the voltage divider is 7,250 ohms. The resistor designated as Part No. 22-42 is now a part of the voltage divider and a change should be made in your diagram, although the resistor is still connected between the center tap of the 7.5-volt winding and ground. Starting at the top of the diagram, the first section of the divider, *i.e.* down as far as the blue lead, is 1000 ohms. The next section, between the blue and red leads, is 3500 ohms. Between the red lead and ground, 1000 ohms. The section formerly designated as 22-42, is 1750 ohms.

The condenser in the yellow lead to the left of the choke is 2 mf. The one to the right of the choke in the green lead is 4 mf., as is also the one in the blue lead. The condenser in the red lead, shunting the 1000-ohm resistor, is 1 mf.

●

Colonial 603

Changes have been made in the antenna circuit of this receiver, the schematic of which will be found on



Circuit change in Colonial 603

Colonial page 5-19 of Rider's Volume V. The new circuit is shown in the accompanying illustration. The rest of the wiring remains unchanged.

Eliminating Code Interference

(*Continued from page* 10)

yond 5%, if that far. Choose a frequency that will give quiet reception and follow the instructions given above.

While this data has been supplied by the manufacturer of Silvertone receivers, yet the same procedure can be successfully applied to any set.

●

Repairing Contact in Wave Switches

Three types of wave change switches are employed in Colonial receivers. One is the multi-section ganged type used in the all-wave sets and the other two are of the single section type, illustrated in the accompanying sketches. The latter can be distinguished by the shape of their lugs.

Multiple Section Ganged Switches

This type of switch can be repaired by turning it to such position that the double contact fingers are disengaged. Then squeeze these fingers together with a pair of long nose pliers. *Caution:* Certain of these fingers have no disengaged position. Do NOT attempt to squeeze such fingers.

Single Section Switch, Type A

Faulty operation of this type may be due either to a thin film of rosin on the surfaces of the contacts or to insufficient contact tension. To remove the rosin, brush liberal amounts of alcohol onto

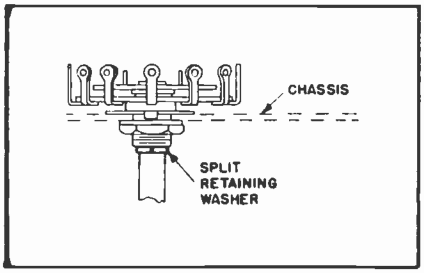


FIG. "A".

Location of retaining washer in switch Type A

the switch contacts and at the same time, work the switch back and forth. (*Caution:* Do not let the alcohol get on the surface of the cabinet.)

If this does not remedy the tro ble, increase the tension of the co. tact springs as follows: Remove the split washer that holds the switch together.

(*Please turn to page* 14)

Distortion Due to Input Overload

In some locations high-powered broadcast stations create so strong a field that the input stages of a receiver are overloaded with resulting distortion in the set's output. This condition can be remedied by connecting a small fixed mica condenser *in series with the primary of the broadcast antenna coil right at the coil.* In most cases a 0.00025-mf. condenser will be the correct size, but if this does not give the expected results, a smaller value should be tried. In Silvertone sets, it does not matter with which one of the two primary lugs the condenser is connected, but it is important that the condenser be connected *right at the coil.*

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MAIL YOUR QUESTIONNAIRE

TODAY

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RCA D7-7

In some sets bearing the above model number, the value of the resistor, R-5, is 12,000 ohms. This ordinarily is 33,000 ohms. The resistor is connected between the screen grid of the 6K7 i-f. amplifier, and the ungrounded side of the 10-mf. condenser, C-22.

The usual value of the resistor, R-19, which is connected between the grounded heater terminal of the 6A8 tube and the same tube's oscillator grid, is 100,000 ohms. In some sets the value of R-19 is 56,000 ohms.

Sometimes heterodyning may be encountered on these sets due to excessive antenna capacitance. This may be corrected by reducing the size of the antenna or by inserting a 150-mmf. condenser in series with the antenna lead. This may be done in the receiver by removing the brown lead which goes from the antenna terminal to the wave trap inductance, L-1, and inserting the condenser between these two points. In some instances, interference in the form of "beats" may be remedied by tuning the antenna wave trap to that station. The wave trap will tune up to 700 kc.

Repairing Wave Switches

(Continued from page 12)

This washer is in the groove in the shaft just forward of the threaded bushing. See Fig. A. The rotating part of the switch then can be removed. Bend the contact springs slightly and re-assemble the unit.

Single Section Switch, Type B

The same method of cleaning the rosin from the contacts can be used here as was outlined above.

If this does not help the trouble, increase the tension of the contact fingers as follows: Loosen the mounting nut of the switch to permit the switch to be turned so that all of the contacts are accessible. Notice that there are two types of contacts on this switch. These are indicated as X and Y in Fig. B. The tension of the Y type of contact can easily be increased by turning the switch to the position where the Y contact is disengaged, and then bending the contact up slightly. The tension of the X contacts can be increased by tapping lightly on a screwdriver placed as indicated in Fig. B. It may be necessary to bend the connection lugs down out of the way to make room for the screwdriver.

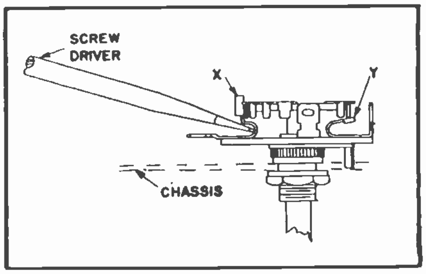


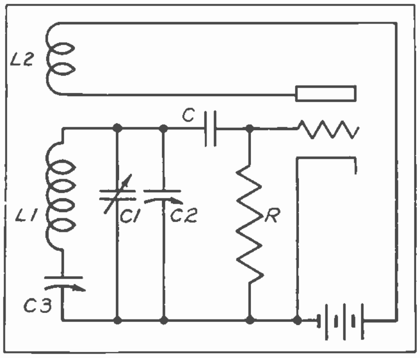
FIG. "B".
Increasing contact tension on switch Type B

TRIMMER AND PADDER

Although there are a great many varieties of oscillators used in superheterodynes, the function of the trimmer condensers is in all cases the same. Basically, every oscillator used in receivers incorporates a tuned circuit by means of which the frequency of oscillation is controlled.

Referring to the schematic, the operation of the shunt trimmer is more easily understood and we shall consider it first.

This trimmer, C2, provides the oscillator tracking adjustment over the high-frequency end of the band. At this end, the variable condenser C1, is completely unmeshed and the capacity in the tuned circuit is largely made up of the trimmer capacity C2. It is for this reason that C2 is called the high-frequency oscillator trimmer and exercizes a critical control over the oscillator frequency at this end of the band. At the low-frequency end, however, C1 is completely meshed and, its capacity being about 350 mmf., the capacity of the trimmer condenser C2



Typical oscillator circuit, showing trimmer C2 and padder C3

has relatively little effect in changing the total capacity in the circuit and hence in changing the frequency.

In the case of the oscillator padding condenser, conditions are different. At the high-frequency end of the band, the capacity of this condenser is sufficiently great so that it acts as a bypass condenser. For this reason C3 has little control over the frequency at this end; in fact, if it were removed from the circuit, the frequency would remain about the same. As the frequency is decreased, however, the capacity of the tuning condenser becomes comparable to that of the padder and therefore C3 has a greater control over the frequency of oscillation.

To summarize, C2 is the high-frequency trimmer and is adjusted near the high-frequency end of the band, while C3 is the low-frequency padder and is adjusted near the low-frequency end of the band, in accordance with standard alignment procedure.

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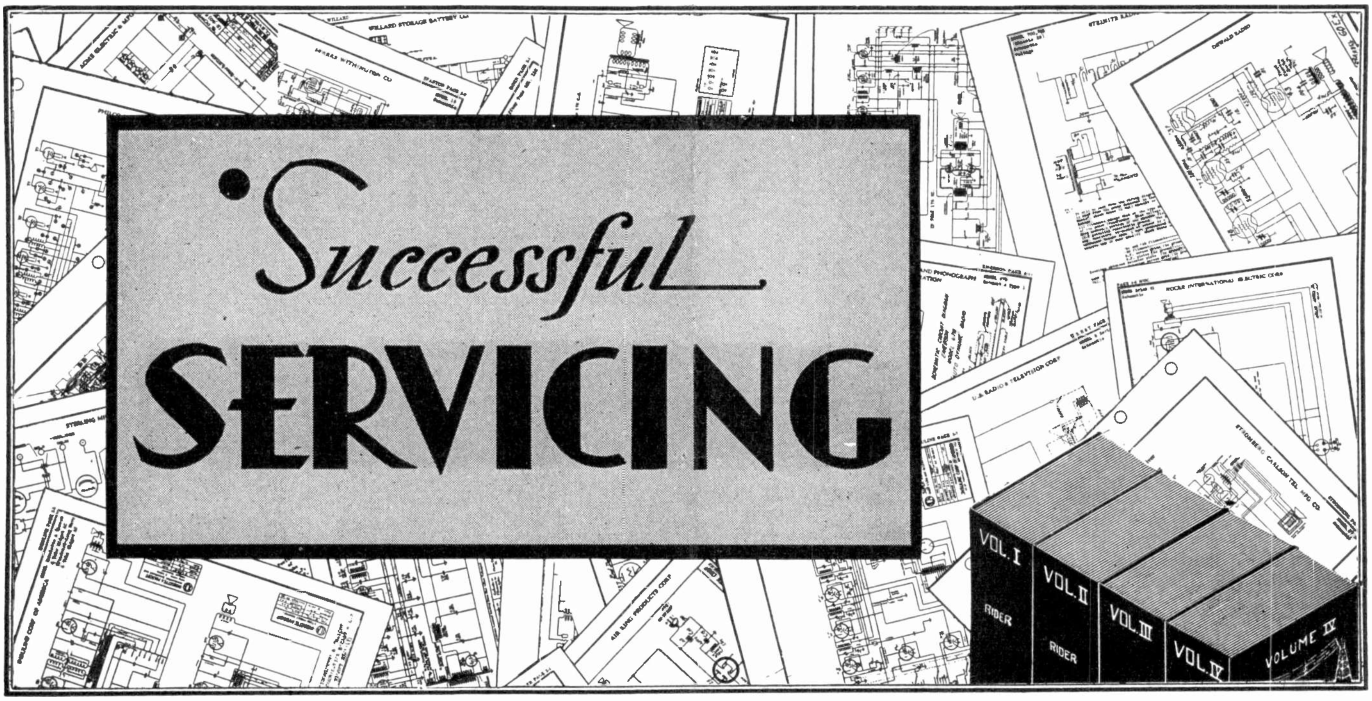


RECTIFIER ACTION

An Oscillographic Study of the Vacuum Tube Rectifier

By JOHN F. RIDER

It has always been our belief that if the basic principles underlying radio circuits are fully understood, then the apparently very complicated applications of these principles, as found in receiver and other circuits, will be much more readily grasped and understood. As a matter of fact, a thorough grounding in the basic principles is of tremendous aid in the application of the power of interpretation. While it is true that some of the modern circuit arrangements are new, nevertheless, they are founded upon basic principles and if a man is familiar with these basic principles, the analysis of the circuit is much more easily effected. This is our excuse, if one be necessary, for the presentation of the following material on the operation of rectifiers and detectors from what appears to be an elementary or basic point of view.—Editor.

THE rectifier and the detector are essentially synonymous terms. Rectification and detection, as we understand them, involve one basic principle—namely, asymmetrical conduction. (Current that flows more readily in one direction than the other.) Irrespective of the nature of the device used, when applied to radio and allied fields, the rectifier or detector is a device whereby an alternating current is changed into unidirectional current. (Current flowing in one direction.) This reference naturally means that the alternating voltage is also changed into unidirectional voltage, varying between zero and maximum. . . . If it so happens that the relation between the input and output circuits is such that input voltage and output current are involved, then the device, as a result of its unsymmetrical conduction characteristic (asymmetrical conduction), will change alternating voltage into unidirectional current, varying between zero and maximum.

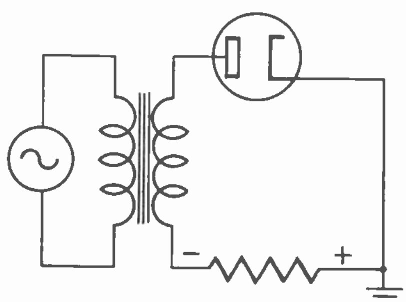


Fig. 1. The basic circuit of a half-wave rectifier tube. Note polarity of resistor.

What has been said is applicable to all types of rectifiers employed in radio systems, such as vacuum tube rectifiers, electrolytic rectifiers, gas rectifiers, oxide rectifiers, mechanical rectifiers, etc. To start this discussion, we shall concern ourselves only with vacuum tube rectifiers.

The simplest type of rectifier, which we encounter in normal practice, is the half-wave rectifier, shown in Fig. 1. As far as the rectifying element is concerned, it is assumed to be a vacuum tube containing an anode or plate and a cathode or electron emitter. If the rectifier is of the directly heated type, which employs a filament as the source of the electrons, then the filament is classified as the cathode. If, however, the rectifier is understood to be of the indirectly heated variety, and so identified, then, as a rule, a filament is employed to heat the cathode, which is a separate element, to the proper electron emitting temperature. A tube of the first type we have mentioned is the 81, wherein the filament is the source of the electrons. A tube of the second type, wherein an indirectly heated cathode is the electron emitter, is the 25Z5. There are, of course, other tubes of these two types, which bear other numbers, but specific reference other than what has been said is not necessary.

Although the terms "rectifier" and "detector" are interchangeable, as far as basic operation is concerned, it has become customary, when referring to such tubes, to employ the term "rectifier" in connection with power supply devices, and the term "detector" with the detection of modulated carriers, which is the equivalent of saying, in the simplest language, the separation of the audio component of a modulated carrier wave from the carrier wave itself. Of course, other applications exist in a radio receiver which are based upon such detector action or rectifier action, and these will be discussed at some future date.

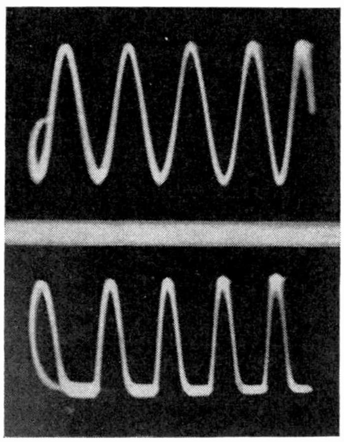


Fig. 2, above. The sine wave of a voltage applied to the transformer primary of Fig. 1. Fig. 3. With the oscillograph connected across the resistor, the rectified current wave was obtained.

Rectifiers

The simplest rectifying device, which we encounter, is the half-wave rectifier shown in Fig. 1. The tube illustrated is of the indirectly heated variety. If this tube were of the filament emitter variety, the cathode illustrated would be replaced by the filament. With an alternating voltage impressed upon the primary of the transformer, let us examine what takes place in the secondary circuit. One end of the secondary winding, as can be seen, is grounded through a resistor. The other end of the secondary winding joins the anode or plate. During a cycle of current, first one end of the secondary winding is positive with respect to the other end, and then the polarity is reversed. Consequently, the voltage at the anode is first positive and then negative during each cycle. During the interval (half cycle) when the plate or anode of the rectifier tube is positive, the rectifier passes current.

Let us analyze why this happens. Electrons are emitted or boiled off from the hot cathode. These electrons are small, negatively-charged particles. When the plate is positive, the electrons, which leave the cathode, are attracted to the plate, because the positively charged plate attracts the negatively charged particles. During the moment when the plate is positive and the electrons flow from the cathode to the anode, a complete path exists in the circuit through the tube, the transformer secondary, and the load resistor.

However, during the interval when the plate is negative, the electrons emitted from the cathode are repelled by the anode, because like charges repel. Since no electrons arrive at the plate, there is no current flow in the circuit. Hence, we can surmise that there is current flow during the positive half of the cycle and there is no current flow during the negative half of the cycle.

Now with respect to the direction of the flow of current through the circuit, the following is in order. We know that the flow of electrons, during the time when the plate is positive and during which time current flows in the circuit, is from the cathode to the plate. However, the flow of electric current, when represented in the *conventional* manner, is assumed to be from the plate to the cathode, or from minus to plus. *This is opposite to the direction of electron flow.* Thus, the right end of the load resistor, that is, the end tied to the electron emitter, is the most positive point in the circuit, and the voltage becomes more negative as we move left along the load resistor.

The current, which flows through the circuit during the positive half of the cycle, is known as the *rectified current.* Since it flows in a certain direction when the plate is positive—and no current flows when the plate is negative—current will flow in the same direction each time that the plate is positive. In other words, we have unidirectional current flow.

It is possible at this time to dismiss the subject of electron flow and to concern ourselves solely with the direction of the rectified current. In this connection it is well to remember that when the alternating voltage, which may be the signal voltage, is applied to the tube (the plate being positive and rectification occurring during that portion of the cycle) it is the cathode end of the load resistor which is positive, as far as the direction of the rectified current is concerned. This discussion of polarity and direction of current flow is extremely important because of its widespread application. There are numerous intricate arrangements used in radio receivers wherein it is important to know the polarity of the rectified current which flows through the load resistor, so that the circuit operation can be understood.

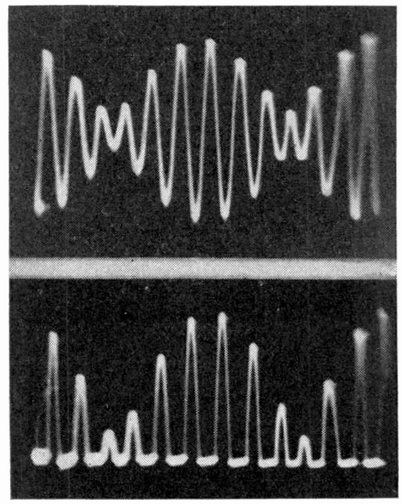


Fig. 4, above. A modulated voltage wave as applied to the rectifier of Fig. 1. Fig. 5. The modulated current wave in the load resistor, after passing through the half-wave rectifier.

Oscillograms by Successful Servicing Laboratory.

(Please turn to page 4)

Belmont 401 Series B

The schematic diagram of the Series B of this model is the same as that shown on *Belmont page 6-1 of Rider's Volume VI,* with the exception that the tube complement has been changed. The tubes now are: 6K7, R.F.; 6J7, detector; 6F6, output, and 5Z4 or 5Y3, rectifier.

The servicing data on *Belmont page 6-2* applies for the Series B, as well as to the earlier chassis.

●

Bosch 207-A Ed. 5. D.C.

The schematic diagram shown in the accompanying illustration is a t-r-f. receiver, operating from the 110-volt, d-c. line. The diagram shown has incorporated in it all the changes that were made in production runs, but in case you should have to repair an early type, we are giving below the changes as they have been made.

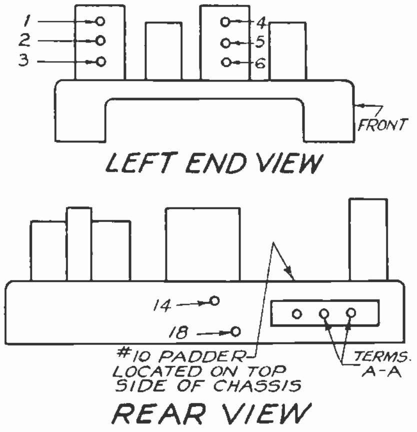
Edition 2. C-21 was changed from 8 mf., 200 volts, to 25 mf., 10 volts, Part No. SA-104487.

Edition 3. C-18 was connected to ground and changed to one end of R-11. R-3 was formerly connected to the junction of R-6 and R-8. This was changed to the junction of R-4 and R-6. C-19 was changed from 0.1 mf. to 0.08 mf.

Edition 4. R-12, Part No. 99864, and C-22, Part No. SA-100880, were added. C-7 and C-8 were also added, Part No. SA-102243.

Arvin 61, 61M, 62, 62M, 81, 81M

The following alignment data applies to all the above models. The locations of the various padders are shown in the



The locations of the trimmers of the Arvin 61 series are shown in the left end and rear views.

accompanying end and rear views. Padders numbered 7, 8, 9, 11, 12, 13, 15, 16, and 17 are accessible from the bottom of the chassis, where their locations are plainly indicated on the tuning unit cover label, through which holes must be punched in order to adjust the padders.

I-f. Alignment:

I-f. peak is 456 kc. for all models. For Models 61, 62, and 81 connect the signal generator to the 6A7 tube and for Models 61M, 62M and 81M connect to the 6A8 tube. Adjust padders in their numerical order, *i.e.* 1, 2, 3, 4, 5, and 6.

R-f. Alignment:

Connect signal generator to terminals A-A on rear of chassis. Adjust padders in the following order only:

Padder Number	Signal Gen. Frequency	Adjust Radio Dial to	Set Wave Switch to Standard Broadcast
7	1500 kc.	1.5	.55—1.7
8	"	"	"
9	"	"	"
10	600 kc.	.60	"
			Aviation-Police
11	4.7 mc.	4.7	1.8—5.5
12	"	"	"
13	"	"	"
14	1.9 mc.	1.9	"
			S-W. Foreign
15	15.0 mc.	15.	6.0—18.0
16	"	"	"
17	"	"	"
18	6.0 mc.	6.0	"

Note: To adjust oscillator padder on 6-18 mc. band, unscrew wide open, then tighten until first signal is reached and tuned to resonance.

Models 61 and 62 will be found on page 6-19 of Rider's Volume VI; 61M and 62M on page 6-20; 81 on page 6-1 and 81M on page 6-22.

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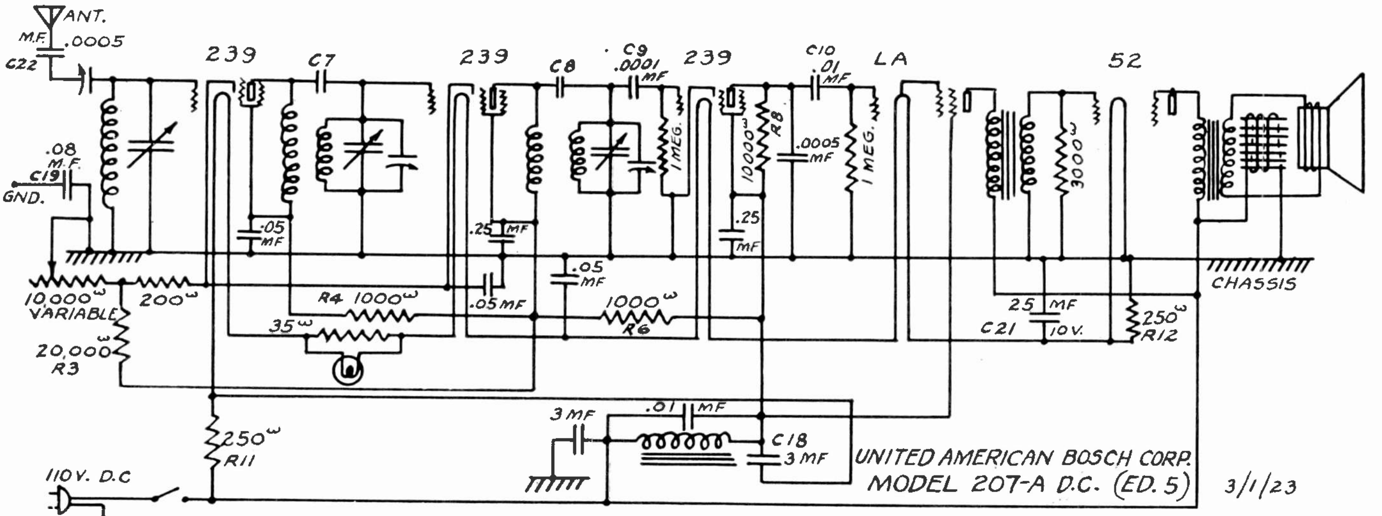
Garod I-F. Peaks

The i-f. peak of the receivers of this manufacturer, that are shown in *Volume VI of Rider's Manuals,* is 456 kc. Kindly mark this on the schematics.



See text above for other changes in earlier models.

Rectifier Action

(Continued from page 2)

When this is known, the polarity of the voltages distributed from this source becomes a simple, rather than a complicated matter, as, for example, in AVC circuits.

To get back to the subject of rectification, Fig. 2 illustrates a sine wave of a voltage applied to the transformer. Fig. 3 shows the resultant rectified current in the half-wave rectifier system, shown in Fig. 1. Note that the horizontal lines are heavier than the others, which is because these intervals represent the time when the anode is negative and so no voltage is developed across the load resistor. This results in no vertical deflection of the oscillograph beam. It is evident that rectification is taking place during one-half of the input voltage cycle, i.e., the positive half of the cycle, the negative half being cut off. It might be well, at this time, to mention that the frequencies of the voltage fed into the transformer are of little consequence with respect to the operation. The operation, as described, is just as readily applicable to a 40-cycle voltage as to a 1,000,000- or 5,000,000-cycle voltage. As it happens, the oscillograms shown in Figs. 2 and 3 are for 10,000-cycle waves.

The operation of such a diode rectifier remains substantially unchanged when the input voltage is modulated. For example, Fig. 4 illustrates a modulated wave. By using a comparatively low frequency carrier, as carrier frequencies go, an abnormally high modulating frequency with respect to the carrier, and a high sweep in the oscillograph, this representation of a modulated wave shows the carrier cycles spread. The normal representation of a modulated carrier wave shows a solid pattern, because the sweep frequency of an oscillograph timed with the modulating frequency is not high enough to spread the individual cycles of the carrier. When this wave is rectified in a half-wave diode rectifier, it appears as shown in Fig. 5. Note the similarity between Figs. 3 and 5. So much for the half-wave rectifier for the present. More extensive discussion will follow later.

(Please turn to page 10)

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Vol. 2 February, 1936 No. 6

THANKS A MILLION

THANKS a million to the men who responded to the questionnaire which we enclosed in the January issue of SUCCESSFUL SERVICING. We expected a good response, but the number of questionnaires, which were filled out in great detail and returned to us, was beyond our fondest hopes. We were apprehensive when we prepared this material, because of the large number of questions which had to be answered. Actually fifty-five questions required answers, some of them in greater detail than others, and we were afraid that the majority of men who received these questionnaires would feel that too much time was required to fill in the answers. . . .We were wrong and we are delighted to admit it. It is impossible for us to reply individually to each and every man who responded to these questionnaires, but we want you to know that we appreciate sincerely your whole-hearted and enthusiastic cooperation. Special thanks are tendered to those men, who not only replied to the questionnaire, but accompanied it with separate, lengthy, typewritten letters and explanations of matters, which they felt required further elaboration.

Thousands of these questionnaires have already been received by us, and while we know that many more will arrive at this office during the next thirty days, a sufficient number have been received to justify starting the tabulations. We have taken on additional men for this purpose, and it is our belief that the normal staff required to complete this tabulation will be between eight and ten persons. We estimate that this questionnaire will cost us at least $2,000.00, but we feel that every dollar will be well spent, if it is going to help improve the status of the servicing industry. . . .We are positive that such will be accomplished.

A most casual analysis of the answers, which have been received by us, corroborates certain beliefs we have entertained. We are certain that, when the full facts are released, definite improvements will be instituted.

Again we say, thanks a million for your kindness.

JOHN F. RIDER.

Signal Generator or Test Oscillator?

Which is the more appropriate term—"test oscillator" or "signal generator"? . . . At the present time, the terms "test oscillator" and "signal generator" are employed interchangeably. They are used in connection with single-band or multi-band calibrated oscillators, which are equipped with a means of adjusting the output voltage. However, some people employ the term "signal generator" only in connection with the more expensive type of equipment, such as is used in the design and laboratory testing of receivers. The term "test oscillator," on the other hand, has been the designation normally used in connection with oscillators employed for radio servicing operations.

There are several reasons why we would like to see the term "signal generator" in general use, when referring to all instruments which generate a standard r-f., or i-f., or a-f. signal. In the first place, servicing instruments are becoming more complex and the time is not far distant, when, in general, the design of such service instruments will closely approach the more expensive units. To attempt to distinguish between such units by employing one term, or the other, on the basis of price, seems somewhat unusual, and if it is done, confusion is inevitable. The term "signal generator" can very well be used today to describe all such equipment, because ultimately it will be the generally used term. . . . If ultimately, why not now?

There is another practical reason why we feel the term "signal generator" should be in general use. When describing the alignment of a superheterodyne receiver or, for that matter, a number of different tests upon such a receiver, it is often necessary to refer to the oscillator in the receiver. It is also necessary to mention the source of the signal fed into the receiver. At the present time, when the term "test oscillator" is used, it is necessary to distinguish between the test oscillator and the receiver oscillator. Not only is it confusing to the man who reads the description of the operation, but it makes matters more difficult for the person who writes the description. It cannot help but be confusing when one speaks of a test oscillator in one breath, and a moment later refers to the receiver oscillator. Confusion would be eliminated if the oscillator within the receiver were referred to as the oscillator and the source of the test signal were referred to as the "signal generator." . . . What say you?

National Radio Servicemen's Week

We have received notice from the National Radio Service Association that a movement is afoot to set aside the fourth week of May each year as "Radio Servicemen's Week." The idea is to acquaint John Public with the work of servicemen and the important part they play in people's everyday life.

The Sextet from Rider

Packard-Bell 25

The alignment data, just received for this automobile receiver, is given below. The schematic will be found on *page 6-1 of Rider's Volume VI.*

Set the test oscillator at 460 kc., the i-f. peak of the set. Connect a 0.006-mf. condenser in series with the test oscillator output and the 6A7 control grid. Volume control should be fully advanced and the plates of the variable condenser entirely unmeshed. Place a metal plate beneath the chassis. Keep the output of the test oscillator low, so that there will be no AVC action. Adjust the i-f. trimmers for maximum output, as shown on the indicator connected across the voice coil of the loud speaker.

The test oscillator should be reset to 1600 kc. and the oscillator trimmer adjusted for maximum output. Variations in car antennas will make it necessary to adjust the antenna trimmer after the set is connected to the antenna in the car.

●

RCA BT7-8, BC7-9 Correction

A printer's error caused an incomplete paragraph on *RCA page 6-97 of Rider's Manual, Volume VI.* This paragraph is just to the right of the Replacement Parts List and is headed "I-F. Tuning Adjustments." Kindly insert the following paragraph on the above-mentioned page:

I-F Tuning Adjustments

The i-f. amplifier comprises two stages including three transformers. The third transformer is untuned so that only a total of four circuits are to be adjusted. Refer to Figure 4 and proceed as follows:

(a) Short circuit the antenna and ground terminals and tune the receiver so that no signal is heard. Set the volume control at maximum and connect a ground to the ground terminal.

(b) Connect the test oscillator output between the first detector control grid and chassis ground. Connect the output indicator across the voice coil of the loudspeaker and adjust the oscillator.

●

Philco 116X and 116B

Remove rubber bumper, Part No. 27-4150, to prevent microphonics. Remove bezel light guard, No. 27-8001 on Codes 121 and 122. Add bezel frame gasket No. 27-7973.

See Philco pages 6-10 to 6-14 in Rider's Manuals for data.

Rolling REPORTER

TIP

The coming Presidential election campaign will probably be one of the most hectic in the history of the country . . . that means radio listeners . . . why don't you cash in on the fact that the **Dems** and the **Gops** will be blasting away at each other via the air lanes ? ? ? ? The Conventions in June will find many a broken down receiver pining for a new condenser or a coupla new tubes—**invest some shoe leather and a bit of printer's ink and gather in the shekels** . . . and you lads who have been "thinking" about getting into the P.A. business better get started NOW —you'll get yours when the local spellbinders need to have their oratory amplified.

100%*ers* ATTENTION!

A very large number of the fellers who sent in questionnaires own SIX Rider Manuals . . . THAT makes them eligible for the **RIDER 100% CLUB**. . . . We are going to make an interesting announcement to those of you who are 100% Rider Manual owners . . . so tell us who you are, lads . . . *you'll be glad you joined up* . . . no dues or assessments or initiation fees—nothing but BENEFITS. Howaboutcha?

BINDERS

Gosh, we were overwhelmed at the response to our query regarding binders for keeping **SUCCESSFUL SERVICING** neatly bound . . . we couldn't get one to sell for less than fifty cents, so we pass along to you the suggestion of **EVERETT R. BOLANDER** of Richmond, Ind., who informs us that he went to Kresge's and got himself a *"Collegiate No. 2090" flexible binder for twenty-five cents, lettered, in white ink, the contents of the binder and now* has his file copies of **SUCCESSFUL SERVICING** in a handy, neat form. . . . Thanks, "Bo," for your smart tip . . . hope your fellow Servicers follow your example.

SQUELCH

The Pilot of this Pillar of Perspicuity is a good natured fella most of the time, but he has been getting a bit peeved at the number of caustic cracks from "jealous colleagues," who seem to take exception to the fact that he walks around Times Square with a coat of *Florida tan*. . . . Most of the criticism is based on the premise that no writer is entitled to a vacation in Miami . . . ***well, whoinell ever said I was a writer????***

U.S.S. OKLAHOMA

One of the most interesting letters to ever come over your Reporter's desk is the one from **H. L. Dawes, Radio Electrician,** *U.S.S. Oklahoma,* at San Pedro, Cal. . . . he tells us that there are more than 200 broadcast receivers aboard his battle wagon, and we presume that this figure holds good on most of the other war vessels . . . OF COURSE, the RIDER MANUALS *are well nigh indispensable in keeping these receivers in repair* . . . radio helps keep up the morale of our boys in blue—the first line of defense of the U.S.—and to be able to contribute, no matter how remotely, is a source of pride to the RIDER organization. . . . When your ship comes to New York again, drop in on us, willya, Sailor? You'll be interested in the **SUCCESSFUL SERVICING LABORATORY,** and the gang around here will be glad to have you tell them some more about the radio installation on a modern battleship. . . . GOBS OF LUCK TO YOU. (*P.S. You're elected to the HUNDRED PERCENTERS.*)

THANK YOU, KIND SIRS

The little gal who puts your name on the mailing list for SUCCESSFUL SERVICING tells us that the response to our request for back copies has exceeded her fondest expectations . . . and, in her kewt way she says "Thank you, kind Sirs" to all of you, who sent in your extra copies. **You have enabled many a Servicer to complete his files.**

DISA AND DATA

What "hard-to-get" radio manufacturer is, according to gossip, gonna middle-aisle it with Miss M. Etal Tube in June? ***O. K. McCoy*** operates the *SARATOGA RADIO SERVICE CO., SARATOGA, CAL.* . . . he must be the **REAL McCoy** they talk about. . . . ***Harvey Flood of Davenport, Iowa,*** has just discovered that RIDER publishes the finest MANUALS in existence—we knew that all along, Harvey. . . . THE RESPONSE OF YOUSE GUYS TO OUR QUESTIONNAIRE IN THE JANUARY ISSUE WAS **ENORMOUS** . . . WE ESPECIALLY APPRECIATED THE NOTES WHICH ACCOMPANIED MANY OF THEM. . . IT IS PHYSICALLY IMPOSSIBLE TO ACKNOWLEDGE THEM ALL . . . SO CONSIDER Y'SELVES THANKED, FELLOW SERVICERS. . . AND IF YOU HAVEN'T SENT IN YOURS YET, DO SO **TODAY,** WILLYA?????? . . . "Ad-man" Charlie Farrell addressed the Registered Service Men of Erie, Pa., on the subject of ESTABLISHING PROPER SERVICE CHARGES . . . despite the terrific blizzard, *forty keen Servicers were present* . . . ***Arthur Risley of Richfield Springs, N. Y.,* now has a perfectly clear idea of the theory of the padding condenser—he found a concise explanation in the *January issue of SUCCESSFUL SERVICING.*** . . . Parts Manufacturers are producing finer literature than ever before . . . these catalogues all contain valuable information—every Servicer should avail himself of the helpful efforts of the Manufacturers. . . . ***Joe Napora, of Uniontown, Pa.,*** aspires to be a poet, and sends in a sample. . . . **STICK TO YOUR SERVICING, JOE!!!**

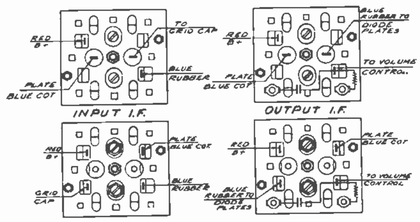
The Rolling Reporter

Belmont 777 Series C

Several changes have been incorporated in this new series C receiver. Series A and B schematics are shown on *Belmont page 6-29 of Rider's Volume VI,* with other data on the two pages following.

The tube complement of the Series C is different, several metal tubes being used. The following tubes have been changed: R.F., 6K7; oscillator, 6C5; and I.F., 6K7. The rest of the tubes are the same as shown on the Series B schematic.

The resistor, R-5, has been changed from 19,000 ohms to 12,000 ohms and condenser C-9 has been changed from 0.0014 mf. to 0.0012 mf. A trimmer condenser has been shunted across the oscillator coil, having a resistance of 0.72 ohm, as it was in the Series A model, but not in the Series B. The frequencies covered by the three bands have been revised; they are now: Broadcast, 535 to 1725 kc.; Middle Wave, 1720 kc. to 5.5 mc., and Short Wave, 5.5 to 18.0 mc.



The two upper sketches show connections for the General Mfg. Co. transformers and the lower pair are those of the Meissner Mfg. Co., both types being used in Series A, B, and C.

The chassis layout for the Series C is the same as that shown on *Belmont page 6-30* for the Series B, with the following exceptions: 6K7 tubes are used instead of the 6D6 tubes and the 76 is replaced by a 6C5.

The alignment data is the same as that given on *page 6-31 of Rider's Volume VI.*

Two types of i-f. transformers are used in the production of Model 777 Series A, B, and C. The operation and performance of these coils are identical, the only difference being in the way they are connected. The accompanying drawing shows the way each transformer is connected. The i-f. peak is 465 kc.

General Motors 251

The condenser, C-9, in the antenna circuit of the schematic diagram shown in *Rider's Volume II on page 2-9 in the revised edition and page 346-G in the early edition, and in the Rider-Combination page 1099,* should be marked C-7. This condenser has a value of 0.01 mf. Please make this change on the diagram in your Manual.

●

Zenith 50 and 60 Series

According to Zenith, if a complaint in these series is fading or cutting out, and all the connections are properly soldered, then it may be attributed to two conditions:

The original condenser used (Part No. 22-64), in the plate circuit of the first a-f. 227 tube, had a tendency to open internally. When this occurs the volume will drop considerably and the reproduction will be distorted. Replace with another 0.03-mf. condenser.

The other reason can be traced to the volume control. The graphite lubricating material seems to dry between the roller and the roller arm, resulting in very high resistance, which causes the circuit to open and close intermittently. A simple remedy is to remove the volume control and clean the movable parts with alcohol.

The resistance strip should be wiped with a clean dry cloth to remove grease and loose carbon particles. *Do not use alcohol on this strip,* as it may remove the carbon. When reassembling, the pressure washer must be set tightly between the inner face and the roller arm.

Complaints of noisy volume control operation may be attributed to loose carbon particles between the roller and the resistance strip. Wipe with a dry cloth.

Where the case is obstinate and cannot be corrected with the methods given above, you should check the bypass condensers.

The schematic diagrams of these series will be found in *Rider's Volume I. The 50 Series on Zenith page 1-14 in the revised edition; *667 in the early, and 2700 in the Rider-Combination Manual; the 60 series on page 1-16 in the revised edition; *670 in the early and 2702 in the Rider-Combination.*

Rectifier Action

(*Continued from page* 4)

Full-Wave Rectifier

You know that there is such a circuit as a full-wave rectifier. The difference between full-wave rectifiers and half-wave rectifiers is that in a full-wave rectifying system, rectification of both halves of the input alternating-current voltage takes place. This is accomplished by utilizing two separate rectifier elements in individual containers, or two such separate rectifier elements in a single container. An example of such a unit is the type 80 power rectifier, wherein two rectifying elements are contained in a single bulb, or the use of two half-wave rectifier tubes, such as the 81. Another example of two separate rectifying elements contained in a single envelope is the 55, the 6B7, the 6H6, etc. The circuit arrangement of such a full-wave rectifier is shown in Fig. 6. Two separate rectifier tubes, or pairs of elements are shown similarly for the sake of clarity, although there is one other reason, which will become apparent later. However, what will be said is just as applicable to a system wherein these two pairs of elements are located in a single bulb. It might be well at this time to add that it is commonplace to employ a single cathode as the emitter for two anodes, as in the type 80 tube.

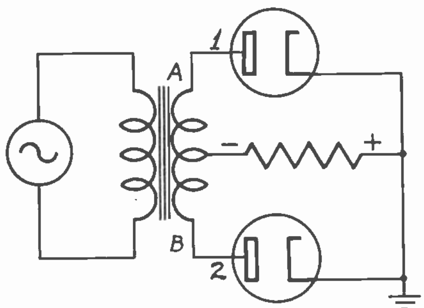


Fig. 6. Basic circuit of a full-wave rectifier.

Operation of such a full-wave rectifier system is predicated upon the fact that, because of the circuit arrangement, the anodes within these two tubes alternately become positive. In other words, during one half of the input voltage cycle, one anode is positive and current

(*Please turn to page* 12)

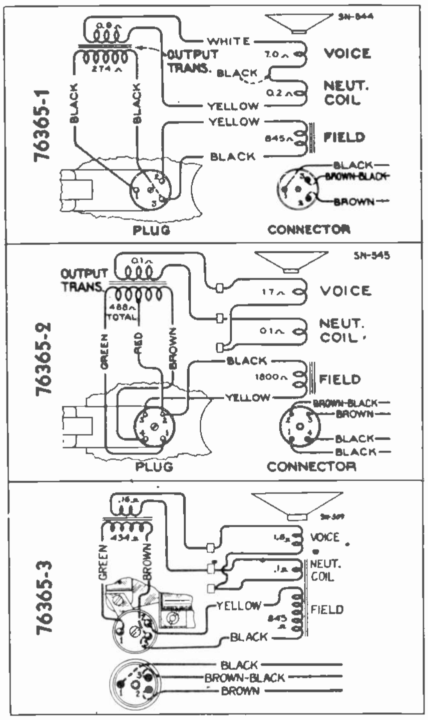
RCA Speaker Data

On receiver Models T 7-5 and T 8-14, three different speakers are used. They can be readily identified by the numbers stamped on them: (1) RL 63-4, (2) 76365-1, and (3) 76365-3.

On receiver Models T 10-1 and T 10-3, two different speakers are used: (1) RL 63-5 and (2) 76365-3.

On Model T 8-16, two different speakers are used: (1) RL 63-4 and (2) 76365-3.

The schematic diagrams appearing herewith indicate the wiring and the color coding of the plug and connector of the speakers, which are not described in the servicing data already published. Please make the proper notes in your *Rider's Volume VI.*



Color coding and connections of plugs and connectors for three RCA speakers.

●

Silvertone 1564

Please make a notation in your Index to Rider's Manuals that Sears-Roebuck model 1564 is the same as Colonial model 56, which is found on *Colonial page 3-8 of Rider's Volume III and page 604 of the Rider-Combination Manual.*

Rectifier Action

(Continued from page 10)

flows through that tube to the related portion of the transformer winding and the load resistor. During the other half of the cycle, the anode of the other tube becomes positive and current flows through that tube to the related portion of the secondary winding and its load resistor. In other words, during one half of the input cycle, point A becomes positive and tube No. 1 rectifies. During that time, point B is negative; consequently, there is no rectification through tube No. 2. During the next half of the cycle, point B is positive and point A is negative; consequently, rectification takes place in tube No. 2 and current flows as previously described. Since the anode in tube No. 1 is negative, there is no current flow through this tube.

Since these two rectifier tubes operate alternately, they can be viewed as two separate systems. If you examine the circuit, you will find that the relation between the load resistor and the remainder of the circuit is the same in both cases, so *that the direction of the rectified current flow through the resistor remains the same during the entire operation,* irrespective of which tube may be performing the role of the rectifier. Whichever tube is functioning, its cathode is still positive as far as the direction of the rectified current is concerned. Whereas in the half-wave system, one half of each cycle of the input voltage is wasted, in the full-wave system it is put to use. In a power supply system, full-wave rectification results in a current output equal to approximately twice that available in a half-wave system.

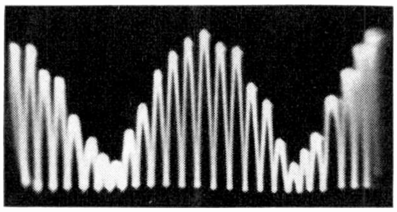


Fig. 7. A rectified modulated current wave flowing in resistor of Fig. 6.

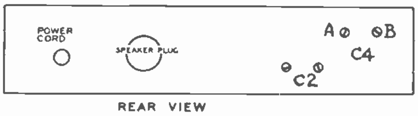
(Please turn to page 14)

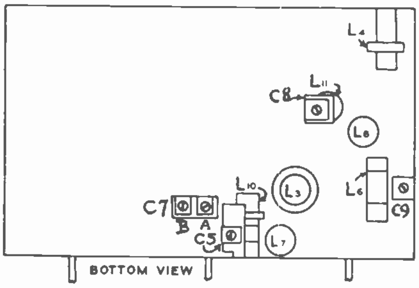
Sparton 616, 616-M, 666, 666-M, 616-X, 616-MX

The alignment data on the above Sparton models will be found herewith. The schematic is shown on *page 6-9 of Rider's Volume VI* and the top view of the chassis, showing the locations of condensers, C-3 and C-6, may be found on the page following, i.e. *6-10.* The locations of other trimmers are shown in the illustrations below.

I-F. Alignment:

Set band switch to broadcast position and the condenser so that the plates are meshed. Set test oscillator to 345 kc. and connect between grid cap of 78 i-f.





Trimmer locations of the Sparton Model 616.

tube (Type 6K7 in the "M" models) and chassis. Volume control on full. Adjust condensers C-3, which are reached from top of chassis.

Change test oscillator lead from the 78 tube to grid cap of the 6A7 and adjust condensers C-2, which are reached from the chassis' back.

Broadcast Band Alignment:

Connect test oscillator to antenna terminal of set. Set both test oscillator and receiver's dial pointer to 1350 kc. Adjust condensers C4A, C7A, and C9 in the order given.

Tune test oscillator and set to 600 kc. and adjust condenser C4B, at the same time moving tuning knob back and forth to obtain maximum deflection of the tuning indicator.

Retune test oscillator and receiver to 1350 kc. and check adjustments of the condensers mentioned.

(Please turn to page 15)

Rectifier Action

(*Continued from page* 12)

If you will refer to Fig. 5, you will see that the base of the pattern consists of lines which are much heavier than the remainder of the pattern. This is so because these intervals represent the time when the anode is negative and, consequently, no voltage is developed across the load resistor, hence the oscillograph beam is not deflected vertically. If the signal, shown in Fig. 4, is fed into a full-wave rectifier, the pattern appears as in Fig. 7. If you compare Figs. 5 and 7, you will note that in the latter a vertical deflection, indicating current flow and voltage, is obtained during those time intervals which represent no rectification in Fig. 5.

●

Wincharger Service Notes

There are several causes for a low charging rate in the Wincharger battery charging equipment. These are:

Oil on Commutator. This results from tipping the equipment when mounting. It is preferable to use oil after the equipment is mounted. This can be remedied by sanding the commutator with No. 00 sandpaper.

Brush Setting. The brushes are set at the factory for maximum output at low speeds, but this setting sometimes becomes disturbed in transit or through ill advised adjustment. The proper setting is for the third brush to be one commutator segment away from the left-hand brush, when viewed from the rear.

Grounded Armature. The most common cause is the practice of letting the Wincharger operate without the battery connected to the line. The armature can also be grounded by permitting the plant to revolve enough to twist off the generator wires. This will not occur if the large spring, which stands vertically along the mounting shaft, is properly connected.

Low Generator Speed. After checking the above causes, the trouble may be that the armature revolves too slowly. In this case, the installation should be looked over to determine what can be done to subject the Wincharger to greater wind velocities.

Sparton 616, 616-M, etc.

(*Continued from page* 13)

Calibration of this band should also be checked at 900 kc. and 600 kc.

Blue S-W. Band Alignment (*6.6-20 mc.*):

Turn band switch to this position. Connect output of test oscillator to grid cap of the 78 r-f. tube and chassis. Tune test oscillator and receiver to 18 mc. and adjust condensers C8 and C7A. (Observe the usual caution when making these adjustments in respect to image frequency response.)

Change test oscillator from grid cap of 78 r-f. tube to the antenna terminal. Adjust condenser C6A. Retune both oscillator and receiver to 9 mc. and check sensitivity and calibration.

Red S-W. Band Alignment (*3.2-8.0 mc.*):

Turn band switch to this position. Tune test oscillator and receiver to 7.2 mc. and adjust condensers C5 and C6B.

Tune test oscillator and set to 3.6 mc. and check calibration and sensitivity.

Green S-W. Band Alignment (*1.3-3.8 mc.*):

There are no adjustable condensers for this band, but it is advisable to check the calibration of the dial at 1.7 mc. and 3.0 mc.

●

Colonial 656

In the schematic diagram of this circuit, appearing on *page 5-37 of Rider's Volume V*, the third section of the gang condenser was omitted in the antenna circuit, only the trimmer being shown. Please draw in on the above-mentioned schematic a variable condenser shunted across the trimmer, appearing in the extreme upper left-hand corner of the diagram.

The fixed condenser shunted across the 3000-ohm resistor in the cathode circuit of the 75 tube has a value of 0.1 mf. Please mark this in opposite this condenser.

The value of the resistor connected between the 500,000-ohm receiver in the grid circuit of the 42 tube and the junction of the speaker field and the 350-ohm resistor, has been changed from 4000 to 5000 ohms.

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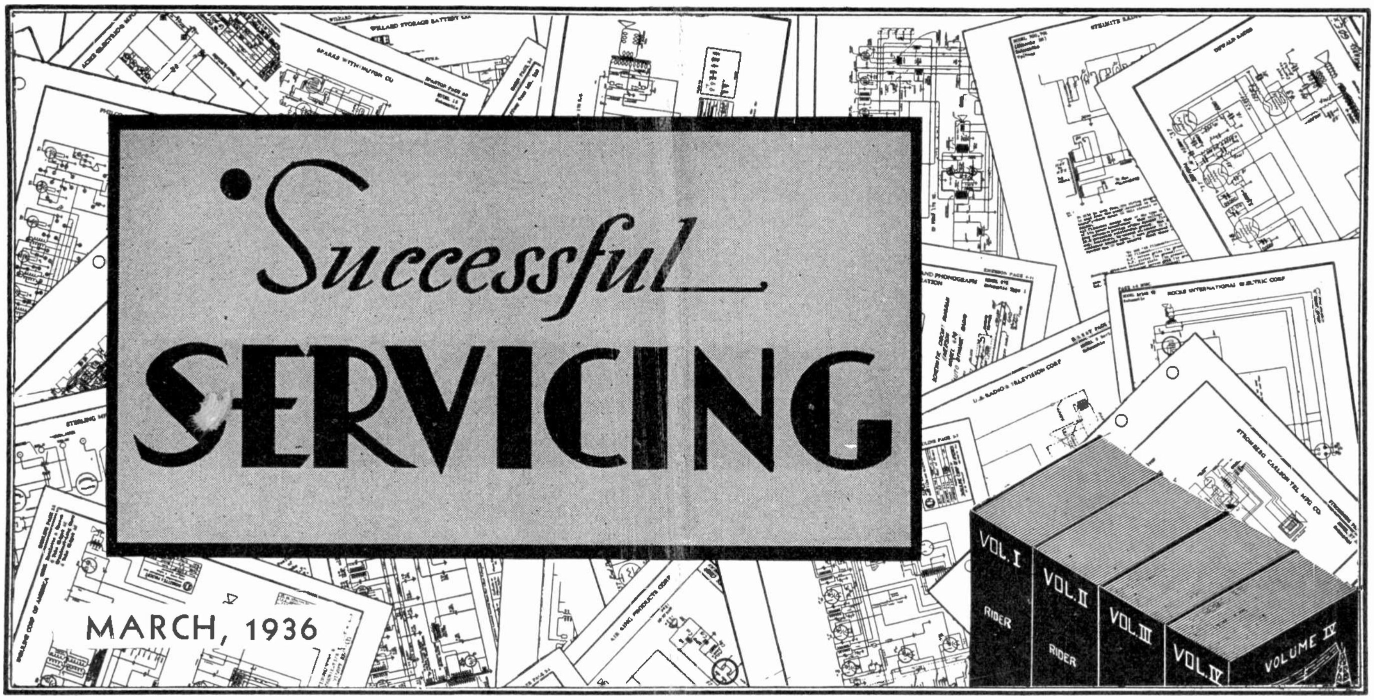


R-F. and I-F. AMPLIFIERS IN SUPERHETERODYNES

An Explanation of the Relative Functions of These Components

By JOHN F. RIDER

HAVE you ever given any thought to the relative functions of the radio-frequency and intermediate-frequency amplifiers of a superheterodyne receiver other than that both portions tend to amplify the signals fed into the system? In contrast to the tuned-radio-frequency receiver, wherein the radio-frequency amplifying portion serves as a means of separating stations in addition to its amplifying property, the two portions of the superheterodyne receiver, previously mentioned, have independent yet related functions in the effort to produce what would normally be accepted as a satisfactorily operating receiver.

Adjacent Channel Selectivity

At the present time we are not concerned with the number of stages used in the radio-frequency section or in the intermediate-frequency section, but we are primarily interested in the manner in which these systems contribute to the operation of the receiver. Based upon conclusions generally reached after consideration of TRF receivers, one cannot help but wonder how it is possible to secure the required amount of adjacent channel selectivity with the few stages of tuned-radio-frequency amplification normally used in a receiver. As a matter of fact, in many superheterodyne receivers, there is only one tuned circuit which precedes the mixer stage, or possibly two tuned circuits, if a stage of radio-frequency amplification is employed. If we look back upon what transpired in the days of tuned radio receivers, we recall that as many as three and four stages of tuned-radio-frequency amplification were considered as essential in order to provide the ability to select stations which were operating on adjacent channels. By adjacent channel selectivity is meant the ability to choose between broadcasting stations which operate upon frequencies 10 kc. apart—the usual mode of frequency allocation in the United States.

In the TRF receiver, the function of the radio-frequency amplifier was to select one of two such stations. If two broadcasting stations are operating upon 1000 kc. and 1010 kc., respectively, the frequency difference at the antenna is 10 kc. or about 1.0%. This frequency difference is maintained throughout the entire r-f. amplification system, because the frequency relation between the two carriers remains the same. In order to secure the required amount of selective powers, a cascaded series of tuned-radio-frequency amplifiers were used with the hope that the cumulative resonance curve for the entire radio-frequency system would be so sharp as to reject the station 1.0% away in frequency; or, at least, to reduce the intensity of the undesired station to such a level that it would not create discernible interference with respect to the desired station. The same requirement exists in a superheterodyne receiver, but in contrast to the TRF system, the radio-frequency amplifier of the superheterodyne receiver plays a very unimportant role in connection with such adjacent channel selectivity. The ability to select stations operating on adjacent channels or nearby channels, in a superheterodyne receiver *depends upon the intermediate-frequency amplifier rather*

(Please turn to page 3)

Zenith A, B, C, D, Zenette

Several changes have been made in the improved chassis 2004, which is used in these models. These changes are shown in the accompanying schematic; only a portion of which is shown, as the remainder is the same as the early model.

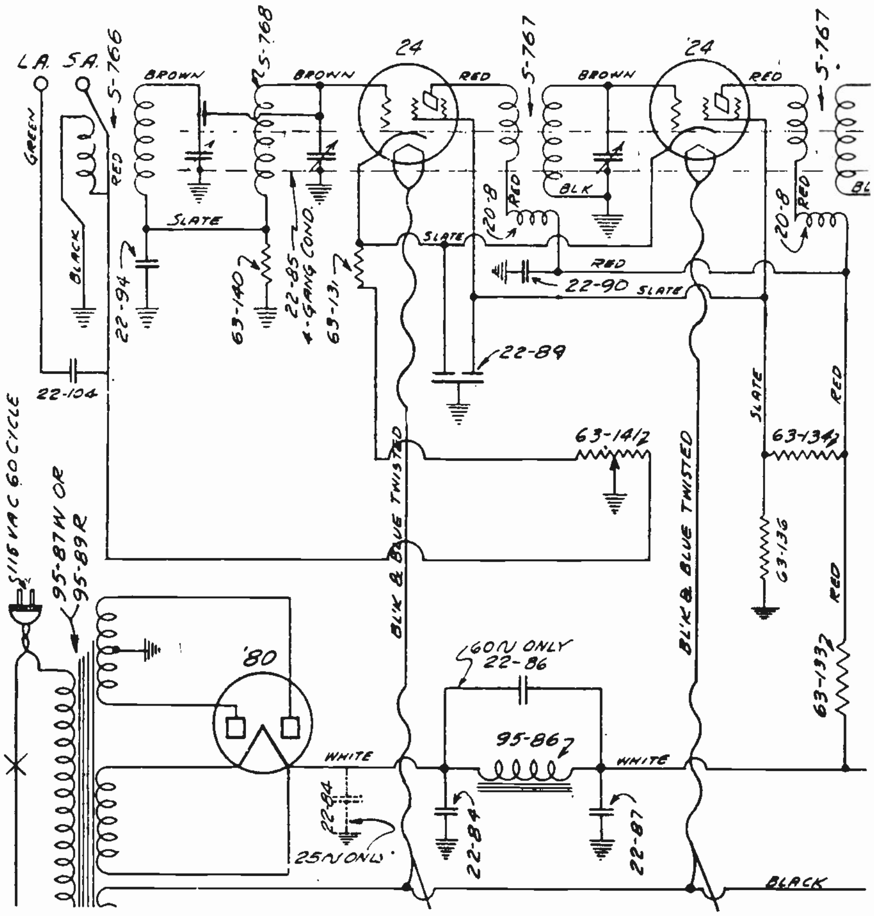
If you will compare this with the original schematic (see *Zenith page 1-26 in the revised edition; *674-C in the early edition, and page* 2722 *in the Rider-Combination*), it will be seen that the green wire connecting the long antenna terminal to the center tap on the antenna coil, now goes to a condenser, Part No. 22-104, having a value of 0.0001 mf. The other side of this condenser is connected now to one side of the volume control, Part No. 63-141. The other side of the volume control is now connected to the 400-ohm resistor (Part No. 63-131) in the cathode circuit of the first 24, instead of to ground.

The 50,000-ohm resistor (Part No. 63-136) has been added in the screen grid circuits of the first two tubes. Also the 0.1-mf. condenser, across the choke in the power supply circuit, has been added in those receivers using 60-cycle supply. This condenser is omitted in 25-cycle sets and the condenser shown dotted is used instead; the value is 2 mf. (Part No. 22-84).

Westinghouse-RCA Equivalent Models

Please add the following equivalent model numbers to the Westinghouse International listing in your Index to *Volume VI of Rider's Manuals*.

Westinghouse Model	RCA Model
WR-45-A	143 (Revised)
WR-46-A	128 (Revised)
WR-48-A	118 (Revised)
WR-93	R-93



Partial schematic diagram of Zenith A, B, C. D Zenette showing changes in improved chassis 2004

G.E.-RCA Equivalent Models

Below will be found a list of G.E. model numbers with the equivalent RCA models. Please add these to your latest *Index of Rider's Manuals*.

G.E. Model	RCA Model
B-1	Radiola 21
B-2	Radiola 22
S-22-D	R-7 DC
K-40 (Revised)	R-27 (Revised)
K-41	R-17-M
M-41	101
M-42	103
S-42-D	R-9 DC
SZ-42-P	R-7 AC, Radiola 86
D-50	M-101
M-50	117
D-51	M-104
H-51, H-51-R	Radiola 82, 82-R
M-51-A	118 (Revised)
D-52	M-108
K-52	110
L-52	112
M-52	119
K-53	111
K-54	RE-40
M-55	214
M-61 (Revised)	128 (Revised)
C-62	126-B
K-62 (Revised)	R-11 (Revised)
KZ-62-P	RE-18, RE-18-A
M-62	125
K-64-D	127
M-66	226
M-67	224
M-69	322
H-71, H-71-R	Radiola 86, 86-R
D-72	M-109
C-75	235
K-80	140, 140-E
K-80-X	141, 141-E
M-81 (Revised)	143 (Revised)
J-83-A	R-73
J-85	R-12
M-85	243
J-87-A	R-75
K-88	340
K-88-X	340-E
K-106-P	R-90-P
M-106 (Revised)	262 (1935 Production)
M-107	263
J-125-A	R-78
M-655	225
JZ-822	R-24
JZ-822-A	R-24-A
JZ-835	RO-23

R-F. and I-F. Amplifiers

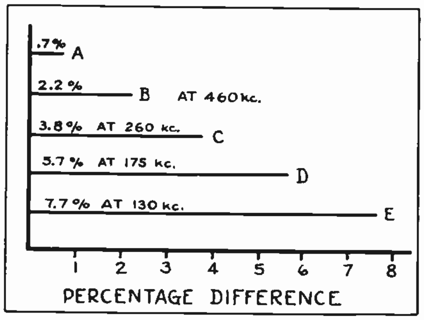
(*Continued from page* 1)

than upon the radio-frequency amplifier portion. Of course, the r-f. end contributes, but the greatest portion of this selection takes place in the i-f. system. Let us see how this is accomplished.

In the superheterodyne receiver, the received carrier is converted into a carrier of lower frequency, but which retains the same modulation characteristics as the originally received signal. This is the function of the mixer tube and is the result of the heterodyning of the received signal with the frequency set up by the receiver oscillator. The newly created carrier is the intermediate frequency signal. The increase in adjacent channel selectivity is the result of such conversion, because during the process of the conversion of two signals on adjacent channels, the frequency separation in the intermediate frequency, while the same in numerical value, is much greater in percentage value.

No doubt a numerical example will tend to clarify any points which are not perfectly clear. Let us assume two carriers in the r-f. portion of the receiver. One of them is at 1000 kc., and the other one is 1010 kc. The numerical difference in frequency is 10 kc. and the percentage difference in frequency is about 1.0%. The intermediate-frequency amplifier of the receiver is peaked at 460 kc. If the desired signal is the 1000-kc. carrier and the 1010-kc. carrier gets through, the two signals present in the input of the i-f. system are at 460 kc. and 450 kc., respectively. As is evident, the frequency separation is still 10 kc., but the percentage difference now is slightly more than 2%. If this i-f. amplifier is peaked at 260 kc., the two signals which appear across the input to the i-f. system are of 260 kc. and 250 kc.—a frequency separation of 10 kc., but a percentage separation of approximately 4%. With the i-f. amplifier peaked at 175 kc., the two signals would be 175 kc. and 165 kc., a frequency separation of 10 kc., but a percentage separation of approximately 5.7%. Thus, as a result of the frequency conversion and the use of properly designed i-f. transformers of high-fidelity powers or high "Q", the two signals, which may have been difficult to separate in the r-f.. system, are easily separated in the i-f. system. As a result of the conversion there is an increase in adjacent channel selectivity.

The higher the frequency of the original two carriers, the less the percentage difference between them for any certain frequency separation. For example, if the two carriers are of 1450 and 1460 kc., respectively, the frequency separation is 10 kc., but the percentage is only about 0.7%. However, after conversion, when the i-f. amplifier is rated at 260 kc., the percentage separation is approximately 4%. As you no doubt recall, the greatest amount of trouble, due to adjacent channel selectivity in the old TRF receivers, occurred at the high frequencies, so that the role played by the i-f. amplifier is of greatest importance over that portion of the broadcast band which required aid most greatly. A graphic picture of the apparent increase in the adjacent channel selectivity due to frequency conversion is shown above. The line A represents the percentage difference between the desired and undesired carriers at frequencies within the broadcast band which have so often proved annoying—for example, 1450 kc. and 1460 kc., respectively. Line B represents the percentage difference between the two same carriers after frequency conversion to an intermediate frequency of 460 kc. Line C represents the percentage difference between the two same carriers after frequency conversion to an intermediate frequency of 260 kc. Line D represents the same condition, except that the intermediate frequency is 175 kc. and line E represents the same condition for an intermediate frequency of 130 kc.



The apparent increase in adjacent channel selectivity due to frequency conversion.

It is obvious from this graph that the lower the intermediate frequency, the greater is the increase in adjacent channel selectivity, or the ability of the receiver to separate stations operating on adjacent channels.

Image Frequency

It would appear then that modern superheterodyne receiver design, which employs intermediate frequencies higher than 300 kc., is contrary to what would represent the means of securing the greatest amount of selectivity in accordance with what has been said. Such, however, is not the case, because of two factors: One of these is that by employing well-designed, high "Q", intermediate-frequency transformers, the separation at frequencies around 460 kc. is sufficient to reject the undesired signal: The second factor is that which relates to another type of interference which, while not governed solely by the i-f. amplifier, is related to the numerical value of the intermediate frequency. This interfering signal is known as the *image signal* or the *image frequency.*

In the operation of a superheterodyne receiver, the intermediate-frequency signal is the difference frequency between the received carrier and the locally generated oscillator signal. As a rule, the oscillator frequency is *higher* than the received carrier by the numerical value of the intermediate frequency. However, since the intermediate frequency is the difference frequency between received carrier and the locally generated signal, it is perfectly possible that two signals will find their way into the i-f. amplifier despite the fact that they may be widely separated carriers. These two signals are 1, the carrier which is lower in frequency than the locally generated oscillator signal by the numerical value of the intermediate frequency, and 2, the carrier which is higher than the locally generated heterodyning signal by a value equivalent to the intermediate frequency.

For example, in a receiver which employs a 460-kc. intermediate, a 700-kc. signal will get through when the oscillator is tuned to 1160 kc. At the same time, it is also possible for 1620 kc. to find its way simultaneously into the i-f. amplifier, because the difference frequency of the 1620 and 1160 kc. signals is 460 kc., the intermediate fre-

(*Please turn to page* 16)

AN HOUR A DAY WITH RIDER

THE Radio industry as a whole is progressive. . . . It refuses to stand still . . . . Always the conversation of radio men is about something NEW. . . . some progress that has been made. Being an integral part of this whole, *the Serviceman MUST PROGRESS* too, if he is to maintain his position in the industry.

This train of thought has resulted in John F. Rider authoring a series of books for the busy Serviceman. . . . *AN HOUR A DAY WITH RIDER.*

Altogether too many men in the servicing industry have adopted the I-know-enough-to-get-by attitude and they think that the future will take care of itself. Well and good, but things do not work out that way. The Serviceman around the corner may not have that attitude and when the 1936 sets start to come into the shop for repair, he will be all set to do a good job on them and then the other fellow will be trying frantically to get some of that business—and failing, for he will not know what it's all about.

AN HOUR A DAY WITH RIDER is a series of books, primarily designed to prevent just such things from happening, as were mentioned above. The information they contain has been reduced to essentials—all the frills eliminated—one subject is treated in each book and that subject is covered thoroughly from its fundamentals to its latest refinements. Theory is necessary for a complete understanding of practice and their combination is fully explained in every one of these books.

You are familiar with the adage "One picture is worth ten thousand words"? With that in mind, so that clarity will be assured, hundreds of oscillograms have been made in the *Successful Servicing Laboratory* and draughtsmen have been busy for a long time, preparing the sketches for these books. All these will illustrate the descriptive material, so that the readers will not have to guess—everything will be as clear and complete as is humanly possible.

The first four books of the *AN HOUR A DAY WITH RIDER* series—and there will be forty or fifty subjects covered eventually in the series—will be ready in April. The books will be a handy pocket size . . . they will have a hard cover, that has been designed to stand up under lots of use . . . they will be type set . . . profusely illustrated . . . and their cost is within the reach of all—sixty cents each book.

Book No. 1 of the series is entitled *"AN HOUR A DAY WITH RIDER ON ALTERNATING CURRENTS IN RADIO RECEIVERS"*. Briefly, this is a comprehensive book covering the basic functions of the various components of a radio receiver . . . what each unit does and how it works. Various types of parallel and series resonant circuits . . . different kinds of coupling . . . inductance, reactance, impedance and how these phenomena are employed in radio practice. And with this goes

Book No. 2. *"AN HOUR A DAY WITH RIDER ON RESONANCE AND ALIGNMENT"*. What happens when a circuit is tuned to resonance. All types of circuits—single, double, and triple tuned systems—are described and how and why they function. How these circuits are aligned so that maximum efficiency is obtained. The latest high-fidelity i-f. amplifiers are thoroughly explained.

Book No. 3. *"AN HOUR A DAY WITH RIDER ON D.C. VOLTAGE DISTRIBUTION"*. All receivers contain some type of d-c. voltage distribution system supplying the d-c. voltages from the power unit to the elements of the tubes. The many different forms these circuits take are described in this new Rider book, which explains networks from the simplest to the most complicated, and among the latter are those included in

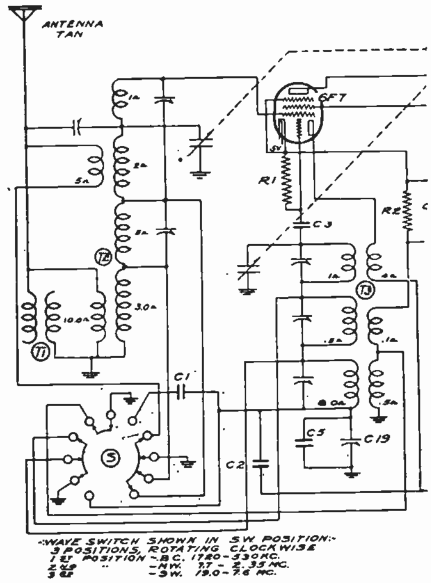
Book No. 4, which covers a subject that is becoming more and more important as time goes on. *"AN HOUR A DAY WITH RIDER ON A.V.C."* describes automatic volume control and all the systems that come under that general heading. Noise suppression systems, time delay circuits, a-f. volume expander circuits and other such networks are all explained.

If you want to learn new radio facts or brush up on some that have been forgotten—Spend AN HOUR A DAY WITH RIDER.

Belmont 585 Series D

Series A, B, and C of this model are described in detail on *Belmont pages 6-19, 6-20, and 6-21 in Rider's Volume VI.* The values of three condensers have been changed in this latest series: C-10 and C-11 are now 0.000125 mf. instead of 0.0001 mf. and C-15 has been changed from 0.015 mf. to 0.006 mf.

A change has been made in the antenna circuit, the new coil being shown in the accompanying illustration. The



New antenna circuit of Belmont 585, Series D.

rest of the circuit remains the same as is shown for the Series B and C schematic, with the exception of a 6K7 being used instead of a 6D6 as an i-f. amplifier and a 6F6 in place of the 42 output tube.

The alignment data for the Series D is the same as is given for Series B and C on page 6-21 with the exception that under "Aligning I-F. Transformers," the output of the signal generator is connected to the grid cap of the 6K7 instead of the 6D6.

●

Airline 62-167

Please add to your index for *Rider's Volume VI* that the servicing data for the above model is the same as that for Models 62-134 and 62-139 found on *Mont.-Ward pages 6-5, 6-6. and 6-7 in Rider's Volume VI.*

Emerson 107, 111

The schematic diagram of the receiver bearing these model numbers, shown on *Emerson page 6-15 of Rider's Volume VI,* is for Chassis U6A. A note on that page makes reference to chassis U6F that carries the same model numbers, 107 and 111. This chassis is different and its schematic is shown in the accompanying illustration.

The filament dropping resistor (Part No. 2LR-212) is of the cylindrical plug-in type and is located on top of the chassis between the 6H6 and 25Z5 tubes. The output transformer (Part No. 2LT-221 and T-9 on the diagram) and the filter choke (Part No. 2CT-207A and L-2 on the diagram) are located in the square can on top of the chassis to the left of the speaker.

Voltage Data:

Tube	Plate	Screen	Cath.	Osc. Plate
6A7	99	43	1.1	80
6K7	99	80	1.8	..
6H6	..	..	0	..
6F5	50	..	0	..
43	87	99	0	..

The above voltages are from the points indicated to the cathode of the 43 tube (B minus). Line voltage for these readings—117.5, 60 cycles.

The voltage across the speaker field (black and yellow leads)—120, and the voltage across the filter choke—9.5. Voltage across two outside terminals of the 250-ohm bias resistor (R-16 and R-17, located underneath the chassis deck near the volume control)—11.5 and the voltage from the cathode of the 43 tube to central terminal of resistor—1.0.

The various paragraphs under the heading "Adjustments" on Emerson page 6-16 applies to this chassis also, with the exception of the locations of the trimmers for the antenna coils. These are as follows: Short-wave coil, upper trimmer; police band, central trimmer, and that for the broadcast band is the lower trimmer. While adjusting the short-wave antenna trimmer (the upper one) for maximum response, rock the variable condenser.

●

Philco 60

In Run No. 11, the tube shield and tube shield base Nos. 28-2726 and 28-2725 for the 6A7 tube are unnecessary.

The following resistors have been changed from 0.5 watt to 0.25 watt: Nos. 21, 31, 32, 34, and 36.

The servicing data on this model will be found in *Rider's Manuals on Philco pages 4-30 to 4-32 and 5-40.*

Stewart Warner Ferrodyne

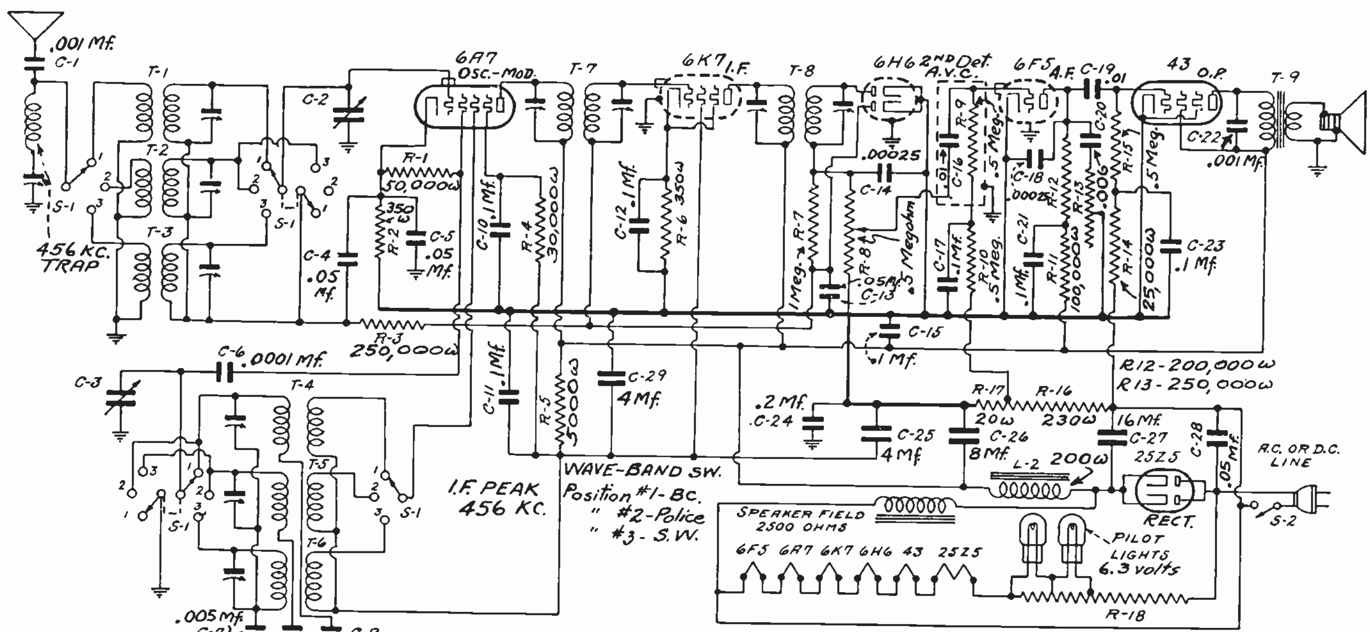
Should you get for repair one of the Ferrodyne Model R-136, R-137 or R-138 chassis which has the following symptoms:

1. Poor sensitivity at the low-frequency end of the broadcast band.
2. Inability to align or calibrate at 600 KC.,
3. Oscillation at the low-frequency end of the broadcast band,

Stewart-Warner suggest the following: The trouble is almost certain to be due to a large change in capacity of the small bakelite fixed condenser which is connected across the oscillator shunt padding trimmer. This condenser, part No. 85454, is color coded: brown, brown, black.

Since the capacity of this condenser is only 11 micro-microfarads (.000011 mmfd.) its value cannot be tested with the equipment usually available in a service department. Replacing this condenser will almost invariably remedy the trouble described above.

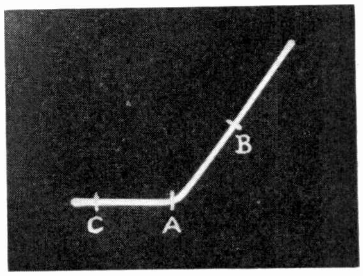
The schematic diagrams for chassis R-136, R-137, and R-138 will be found in *Rider's Volume VI on S.-Warner pages 6-18, 6-19, and 6-20 respectively.*

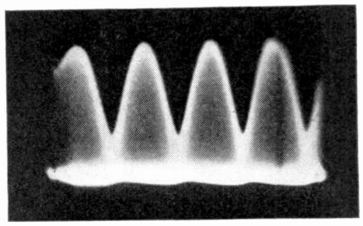


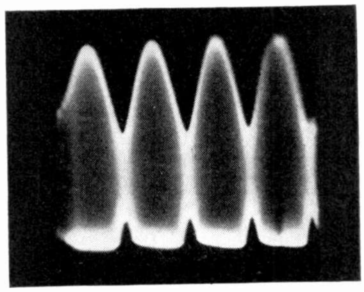
Schematic of Emerson chassis U6F used in Models 107, 111.

Detection of Modulated Waves

The most frequent reference to the cathode-ray oscillograph in the service field is in connection with visual alignment of tuned circuits. However, the function of that unit is by no means limited to such operations. One of the most valuable uses of the device, as has been stated upon numerous occasions is the







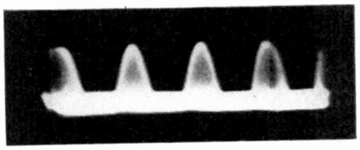


Fig. 1. The plate current—grid voltage characteristic of a detector with a sharp cutoff. A denotes the correct operating point; B and C indicate under- and over-bias respectively.

Fig. 2. This oscillogram indicates normal detection as a result of correct operation at the point A.

Fig. 3. Operation at the point B produces partial detection. Note that part of the lower peaks is present.

Fig. 4. The excessive distortion and decreased efficiency of detection is evident. This is due to overbias, corresponding to operation at point C.

Oscillograms by Successful Serving Laboratory

observation of various types of electrical phenomena. No other devices of equal value provide a means of securing a bet-

(*Please turn to page* 12)

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TIME OR PARTS PROFITS

UP to this writing we have received about 3300 questionnaires from the people to whom we mailed them during January and February of this year. An analysis of this Rider Survey bears out one particular belief, which we have expressed during the past two years in connection with profitable service operation. We maintained in the past—and for that matter we still do—that the average service station operator placed too much importance upon the profit on the sale of parts in connection with any one service job—and too little importance upon the profit on the sale of his time or labor. This fact is borne out by answers to some questions asked in this questionnaire.

According to the analysis of the Rider Survey, approximately 42% of the total service charge made to the customer represents parts which are charged to him at list. The remaining 58% is the charge for labor. In other words, for every dollar charged, about 42 cents represents parts and 58 cents represents labor. In view of the fact that the operations of the average service station are such that the net profit on parts is only about 15 to 20%—less than 10 cents of the aforementioned 42 cents remains in the pocket of the service station operator. This cannot be changed very much, in that the discount which the service man receives from his supplier, that is, the jobber, is definitely set and his maximum profit is limited by the list price. Hence the net profit is determined by the expense of operating the station. However, the significant item is that the balance between parts and time charges is not in correct proportion with what would represent proper profitable operation. It is our belief that under normal circumstances, the portion of the total service charge to the customer, which represents parts charged at list, should not exceed 25%.

We appreciate, of course, that this proportion cannot be maintained when the dollar value of the parts is very high, but we most certainly do believe that it should be maintained when the dollar value of the parts is less than $1.00.

It is, of course, possible that even when the dollar value of the parts is several dollars, it is possible to maintain the same balance if the nature of the service job is such as to justify the sale of a sufficient number of hours of time, so as to result in the proper balance. Of course, it is true that when the value of the replacement parts is quite high and represents a reasonable amount of profit in dollars that it is possible to juggle the charge for time and the charge for labor in such manner that the proper price is charged to the customer and a reasonable profit results.

It is of utmost importance to remember that a minimum charge for labor is imperative. It matters not how low the dollar value of the parts used. . . . It is impossible for any service station to operate profitably without setting a minimum of one hour as representative of the lowest charge for labor for any service rendered, which involves the sale of time or labor.

We still believe, as we have stated in times past, that the major profit in the operation of a service station should come from the sale of time and that supplementary profit should come from the sale of parts. We further believe that it would be a good thing if the average service station operator checked his operations and arranged so that the aforementioned balance between time and parts was maintained whenever possible.

JOHN F. RIDER.

Did You Know That

The **Ginkgo** or **Maidenhair Tree** existed on the earth before flowering plants, according to scientists, and has not changed in 10,000,000 years.

An African plant is called the **Sausage Tree**, because of what appear to be huge weinies hanging from its branches. Another tree of Africa is the **Poached Egg Tree,** which was so named because of the resemblance of its flowers to the breakfast dish.

The largest flower in the vegetable world is the East Indian **Rafflesia,** which is sometimes 36 inches in diameter and weighs over twelve pounds.

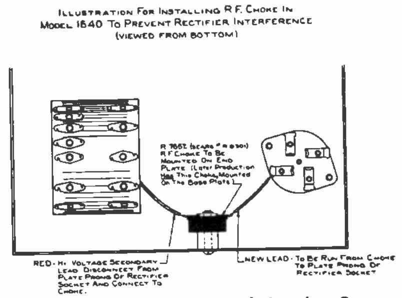
The **Umbrella Bush** of Australia smells like *raspberry jam* and a plant that grows in the rocks of Teneriffe smells like *mice*.

If cattle, sheep or horses eat the **Locoweed,** native to the western part of this country, they lose all sense and proportion, jumping high in the air to clear a stick lying on the ground, as though it were a high fence.

After eating the **Miraculous Fruit,** everything eaten tastes sweet. This is caused by the paralysis of those parts of the tongue that register sour tastes.

Silvertone 1640

Reception can be often improved by the insertion of a choke (Part No. R-8301) in the *red* plate lead of the 283 rectifier. This will reduce the hiss or feedback. In some instances this tube may cause interference within the set, as well as other sets in the vicinity. If the use of one choke does not eliminate the trouble, a similar choke can be inserted



How the choke is inserted in the Sears-Roebuck 1640 for reducing hiss.

in the other plate lead of the 283. See accompanying illustration for installation of this choke. For schematic diagram, see *Rider's Volume III, Sears page 3-12 and page 2098 in Rider-Combination Manual.*

The undesirable effect of time lag (weak programs interrupted during bursts of static) can be greatly reduced by replacing the 0.1-mf. condenser, connected between the plate and cathode leads in the type 57 AVC tube, with one having a value of 0.01 mf. Making this change minimizes the time lag difficulty when tuning in distant stations in some localities without affecting the AVC action. The reduction of capacity lessens the charging time of the condenser and therefore the AVC recovery is practically instantaneous.

•

Check Before Aligning

In general, receivers are carefully aligned before leaving the factory and so before you decide that a set has to be aligned, the tubes and the various voltages should be checked to make sure that these are correct, according to the data in *Rider's Manuals.* After it has been found that these are satisfactory and the set still continues to be weak in sensitivity, then the alignment may be checked.

A reader wants to know how to go about writing a colyum such as this is alleged to be . . . . we hasten to reply. Well . . firstly—you don't HAVE to be crazy, but it helps (as my Mother-in-law would say); secondly, parkyacarcass in front of a typewriter—reach for a Lucky (free ad for George Hill, who doesn't need it)—then you push the first key down—the words go down and around, ho ho whoa ho . . . .

TREK

About the time you read this squib, the *trek to Chicago* will begin—that noise you fellows in Indiana and Ohio will be hearing, as the 20th Century whizzes by your home towns, will be the parts and tube mfrs. on their way to the **IRSM Show in Chicago on March 27-28-29** . . . they'll be keeping in training by trying out their speeches on each other . . . and the resultant clamor will be loud enough to wake up all the Servicers from here to there . . . this Rider organization will be represented by JOHN RIDER—CHARLIE FARRELL—AND, *OF COURSE,* THE ROLLING REPORTER . . . when y'all get to the Show, **stop by Booth No. 3**—just at the entrance . . . . MR. RIDER will address the gathering during the Show . . . his subject will be **"The Service Man is STILL King."**

HUMORIST

One of our Servicers who sent in his questionnaire neatly and painstakingly filled out pulled a funny one on us . . . at least **WE** thought it was funny and we pass it along . . . in addition to answering the 55 questions (and it was **SOME** job), this humorist wrote a separate letter in which he informed us that as long as we knew *SO* much about him, we might as well have the complete story of his life . . . he told us his birthdate and place—the coolr of his eyes—the loudness of his wife's snores (figured in decibels)—said he voted the straight Democratic Ticket—his secret passion is Shirley Temple—his pet peeve is the tinkerer who ruins radio receivers and then expects the Serviceman to put them in their original condition—and he LOVES LEMON MERINGUE PIE FOR BREAKFAST!! **WOTTA MAN!!**

BLAST

A reader of this more or less enlightening conglomeration of goo writes from Calif. and puts the blast on your Reporter for going to Fla. for his vacation, when the salubrious climate of Sunny Cal. offers so much . . . he signs himself **"Native Son, but from Kansas,"** and insinuates that almost ANY day now I might expect a visit from a Committee of Servicers who will put me in a straight jacket and park my carcass in the *State Insane Asylum* at Napa, Cal. . . . well, well, well! I promise to spend ALL of my future vacations in Southern California—**IF YOU FIX IT SO I CAN MEET MYRNA LOY!**

NUMBERS AND BONUS

Seems like every reformer in the world takes an occasional crack at the "Numbers" racket . . . many thousand words have been written anent the evils that follow upon its heels . . . but it must be an ill wind that blows nobody good—witness the Servicer in Boston who played the "Numbers" and ***won something like $80.00.*** Wanna know what he did with it??? Well, this is what he did with it *. . . he went out and bought hisself SIX RIDER MANUALS*—and from now on, we're gonna give the elevator boy in our house a nickel a day to play for us . . . not that WE will buy MANUALS—oh! no—but y'know, Bartenders have to be supported. . . . then there's the tale of the lad who has ordered SIX MANUALS from his Jobber—**to be delivered when he collects his BONUS** . . . we hope that many, many ex-service service men (*stet!*) get their RIDER MANUALS before they go on that "binge."

SPEAKING OF

RIDER . . . seems like that man *never* sleeps . . . he no sooner gets ONE book written and published then he dashes on the road to talk to his gang of fellow-Servicers in every part of the country . . . then back to the grind here in N'Yawk . . . right now he's up to his neck in a new Series of short subjects . . . *there will be a complete collection of sixty-cent tomes on every conceivable subject* . . . mebbe as many as **FORTY** different books . . . ask your favorite jobber to give you the details . . . we're already swamped with advance orders . . . the Series is to be known as AN HOUR A DAY WITH RIDER . . . **and you couldn't spend AN HOUR A DAY with a more helpful guy.**

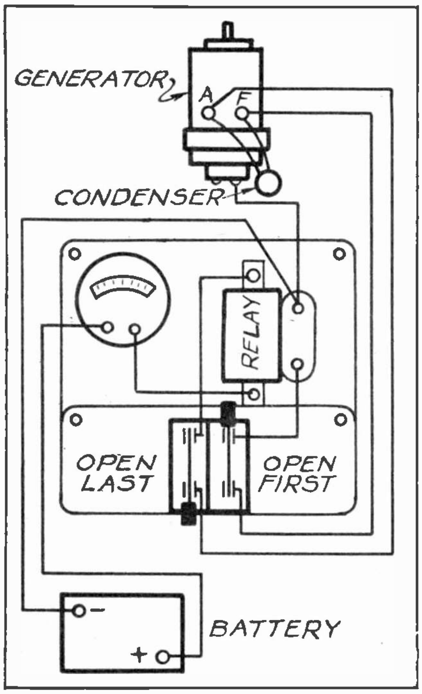
MR. FARLEY'S DEP'T: . . . **J. P. Graham,** *Columbus, Ohio*; I only NOMINATED Joe Napora as Prez. of the **RIDER 100% CLUB** . . . on accounta he was the lad who first gave us the idea of THE HUNDRED PERCENTERS . . . you sure have an impressive collection of RIDER PUBLICATIONS—just to keep you happy we'll *soon* have some more helpful publications for you . . . **W. W. Cheney,** *President, Association of Registered Servicemen, Erie, Pa.* . . . Thanx for conferring honorary membership upon us . . . we feel like Major Bowes must feel when he's appointed Honorary Mayor of this or that city. ***PHILLIPS ELLIOTT, Clarksville, Tenn.;*** We HOPE that all Servicers feel that their **RIDER MANUALS** would be valued at $500.00 if it were not possible to replace them . . . thnx for your cordial sentiments. **ROYPERKIN, PORTELIZABETH, SOUTH AFRICA;** Hands across the sea, O.M . . . hope to hear your CQ some night when I'm playing around with some friend's dials . . . what kind of a rig have you???? 73 . . . ***PAUL V. ZEYN, West Milton, Pa.;*** Have answered your swell letter personally . . . you're elected to the 100%ers . . . **over 300 members to date**—we're readying an announcement for early publication . . . . . *Auf Wieder*-ZEYN.

. . . . ho ho—and it comes out here!

The Rolling Reporter

S-W. Interference in Wincharger Installation

It sometimes happens that excessive interference is experienced on short-wave reception on a battery-operated receiver, the battery of which is charged by a Wincharger. The accompanying schematic diagram shows how two single pole-single throw switches can be connected in the circuit so that the plant can function without any danger of burning out the armature. These switches disconnect the generator from the battery and must be included in the circuit, otherwise the armature is liable to become grounded, if permitted to operate without a load.



How switches are connected in the Wincharger circuit to prevent burnout.

If too small wire is used to connect the generator to the battery, the resistance is excessive and the result may be a burned-out armature. In any case, the charging rate will be too low. It is recommended that the following wire sizes be used:

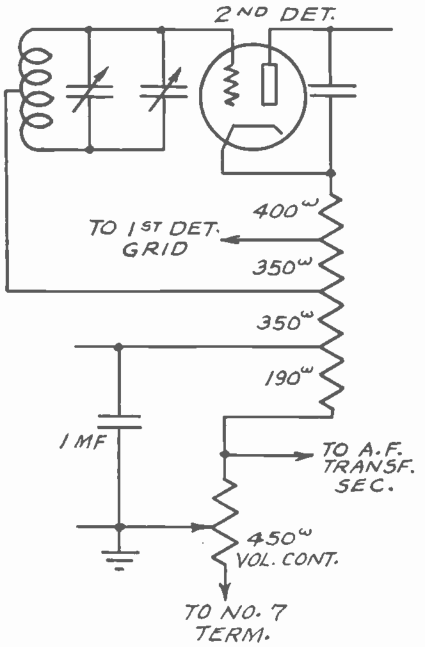
Up to 50 feet, use No. 8 Weatherproof Solid Copper Wire.

50 to 100 feet, use No. 6 Weatherproof Solid Copper Wire.

100 to 200 feet, use No. 4 Weatherproof Solid Copper Wire.

Radiola 62

The values of the tapped resistor strip and the volume control of the Radiola 62 were omitted from the manufacturer's schematic. These values are shown in the accompanying illustration. The part



Valves of resistor strip and volume control of Radiola 62

number of the tapped resistor is 5810 and that of the volume control is 5811.

The schematic for this receiver will be found on *RCA page 1-40 in the revised edition; page *497 in the early edition, and on page 1878 of the Rider-Combination Manual.*

●

Graybar-RCA Equivalent Models

The following list of Graybar-RCA equivalent model numbers should be added to your latest *Rider Manual Index*:

Graybar Model	RCA Model
GC-13	R-6
GB-300	Radiola 16
GB-310	Radiola 18
GB-311	Radiola 33
GB-330	Radiola 60
GB-340	Radiola 62
GB-500	Radiola 44
GB-550	Radiola 46
GB-600	Radiola 66
GB-900	Radiola 86

Philco 116, Codes 121 and 122

The adjustment of the high-frequency end of the broadcast band should be made at 1500 kc. instead of 1600 kc.

Run No. 5. The resistors, Nos. 22 and 39 in both Code models, of 1000 ohms and 8000 ohms respectively, are removed. The 0.00125-mf. and 0.003-mf. condensers, Nos. 40 and 71 in Code 121, and 40 and 74 in Code 122, are replaced with Parts Nos. 38-6978 and 7301 respectively.

Run No. 9. The 2nd i-f. transformer, Part No. 32-1734, was replaced with Part No. 32-1865 to eliminate frequency drift.

In Code 122 only. The grid lead from the 6A3 power tube near the front of the chassis was changed to run over to and parallel with the end of the chassis down as far as condenser No. 85, then over to the input transformer. This was done to prevent audio oscillation.

Run No. 9, Code 121 and Run No. 11, Code 122. The 2000-ohm resistor, No. 75 (Code 121) and 80 (Code 122), was removed.

See Philco pages 6-10 to 6-14 in Rider's Manuals for data.

Detection of Modulated Waves

(*Continued from page* 6)

ter understanding of the action and operation of radio circuits. The oscillograms shown in connection with these notes on the detection of modulated waves illustrate such an application.

The story of detector operation begins with the detector operating characteristic. Normally, such characteristics are drawn wherein the grid voltage and plate current are plotted step by step, thus entailing a great number of individual observations. In Fig. 1 is shown the plate current—grid voltage characteristic of a detector stage in the form of an oscillogram, which was developed with the cathode-ray oscillograph in a single operation. The illustration closely approaches an ideal condition, as indicated by the sharp cut-off. The displacement along the horizontal direction represents values of grid voltage, while the vertical displacement represents the plate current for the corresponding value of grid voltage. This type of detector characteristic is representative of those possessed by tubes of the 6C6 type which have an unusually sharp cut-off as opposed to the

(*Please turn to page* 14)

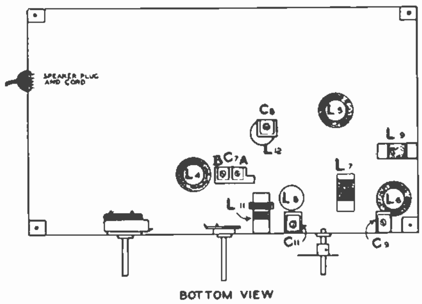
Sparton 766, 966, 716-X, 766-XP, 766-XS

The alignment for the above models will be found herewith. The schematic diagram is shown on *page 6-13 of Rider's Volume VI* and the chassis layout, showing the locations of condensers C2, C3, C4, C5, and C6, is on *page 6-14*. The bottom view of the chassis with the locations of the other trimmers is given herewith.

I-F. Alignment:

Band switch to broadcast position. Have rotor plates completely meshed with stator of tuning condenser. Connect test oscillator across grid cap of 6A7 and ground. Connect output indicator across voice coil of speaker. Tune test oscillator to 456 kc., the i-f. peak of the set. Volume control on full.

Adjust condensers C4, C3, and C2, which are reached from the top of the chassis.



Locations of trimmers of Sparton 766, 966, 716-X, 766-XP, 766-XS.

Broadcast Band Alignment:

Connect test oscillator to antenna terminal of chassis through a 150-mmf. condenser dummy antenna. Tune both test oscillator and set to 1350 kc. Adjust condensers C5A, C7B and C9 in the order given.

Tune test oscillator and receiver to 600 kc. and adjust condenser C5B, at the same time moving tuning knob of set back and forth to obtain maximum deflection of the output indicator.

Retune test oscillator and receiver to 1350 kc. and check adjustments of C5A, C7B and C9. Calibration of the broadcast band should also be checked at 900 kc. and 600 kc.

Blue S-W. Band Alignment (6.5-20 mc.):

Turn band switch to this position. Replace the 150-mmf. condenser in the lead

(*Please turn to page 17*)

Detection of Modulated Waves

(*Continued from page* 12)

variable-mu tubes of the 6D6 type, which have a long, gradual cut-off.

Improper operation of a detector circuit results in distorted output and one of the conditions representative of improper operation is the selection of a wrong point of operation upon the characteristic. As a rule, this point is determined by means of the bias voltage applied. Let us take as a first example the application of a grid bias which results in cut-off. This point is indicated as A in Fig. 1. Under this condition, current will flow in a load only during the positive course of applied grid voltage and, consequently, only the upper half of the modulated wave will be reproduced in the plate circuit. The resulting rectified wave, representative of operation at point A, is shown in Fig. 2. Such operation represents normal detection and this oscillogram can be used as the basis for comparison with what follows.

Suppose that an incorrect value of bias is used—that is, one that is too small. Such a point of operation would be B in Fig. 1. What happens now? Evidently detection will not be as complete as before, since the tube acts partially to amplify the signal rather than to detect or rectify the signal completely. The absence of proper rectification and the presence of a certain amount of amplification is shown in Fig. 3, wherein will be seen that the greater part of the modulated wave is reproduced. You will note that a part of the negative peaks, which normally should be eliminated as a result of proper rectification, appear in the oscillogram.

Let us now assume the application of a bias greater than normal, in other words, operation at point C in Fig. 1. This is the equivalent of operating below cut-off and means that detector efficiency is decreased and more than normal rectification occurs. The effect of over-bias is shown in the oscillogram of Fig. 4. The reason for the shape of the resultant wave is at once apparent. Because of the excessive bias, only the peaks of the input modulated wave can cause current to flow in the load circuit and, consequently, the fluctuations of current in the load will correspond only to the peaks of the modulated wave. A com-

(*Please turn to page* 18)

Stewart-Warner R-136, R-137, R-138

You may occasionally come across a Model R-136, R-137 or R-138 Ferrodyne chassis which is relatively insensitive in the high frequency range above 12 megacycles, although the set is in good alignment and seems to be perfect in every respect. An invariable symptom of this trouble with the Models R-137 and R-138 is that the shadow of the station register meter contracts as though a station is coming in, when the set is tuned in this range, although no signals come in.

We have found that when this loss of sensitivity in the high-frequency range occurs, it is because of stray coupling in the wiring of the set. This stray coupling sets up spurious oscillation of the 6A8, causing the control grid to draw current. Since this control grid is tied into the A.V.C. system, the grid current sets up an A.V.C. voltage and reduces sensitivity, just as though a signal were going through. In the Models R-137 and R-138 this also causes the shadow of the station register to narrow, since the A.V.C. voltage applied to the grid bias reduces plate current.

To eliminate this condition in any set in which it occurs it is necessary only to isolate the grid return of the short-wave coil of the 6A8 tube from the A.V.C. system, by returning it direct to ground. By referring to the pages covering these three models in *Rider's Volume VI*, you will see that in the chassis illustrations, the coil in question is tuned by trimmer condenser No. 11 in the Model R-136, by trimmer No. 15 in the model R-137 and trimmer No. 16 in the model R-138. If you look at the coil itself, you will see that the short-wave section is the one wound with heavy bare copper wire, and the grid return side is at the *top* of the coil, the lead wire running down the full length of the coil before it is soldered to its terminal lug.

The simplest way of isolating the grid return circuit is to cut the heavy coil wire as close to the lug as possible. *In doing so, be careful you do not cut the fine wire from another winding that is soldered to this same terminal. This fine wire may be wound around the heavy one to prevent breakage.* After the heavy wire is cut, merely re-solder it to the grounded threaded support lug of the coil.

When this change has been made the set should be re-aligned.

●

Silvertone 1326

Please note in your Index to Rider's Manuals that Sears-Roebuck Model 1326 is the same as Models 1320, 1322, 1324, 1386 and 1450. The schematic will be found on *page 2-11 of the Revised Manual; 524-19 of the early edition of Volume II, and on page 2077 of the Rider-Combination Manual.*

R-F. and I-F. Amplifiers

(*Continued from page* 3)

quency. In the example cited, the 1620-kc. signal is the image for the 700-kc. signal, assuming that the latter is the desired signal. On the other hand, the 700-kc. signal is the image for the 1620-kc. signal. So much for that. Let us now take another example at a lower intermediate frequency. Suppose that the intermediate-frequency amplifier is rated at 260 kc. and the desired signal is of 700 kc. In order that this intermediate frequency be produced, the local oscillator is tuned to 960 kc. In addition to the 700-kc. signal, which can find its way into the i-f. amplifier as a result of conversion, it is also possible for another signal to find its way in as a result of conversion. This is the signal which is 260 kc. higher than the oscillator signal. This is a signal of 1220 kc. If the intermediate-frequency peak is 175 kc., then two signals separated by 350 kc., one of which is lower than the local oscillator signal by 175 kc., and the other which is higher than the local oscillator signal by 175 kc. can find their way into the i-f. system.

If you now analyze the relation between the i-f. peak and the possible image interference, you can see that the lower the i-f. peak, the closer is the image signal to the desired signal, hence the possibility of such interference. It is, therefore, obvious that from this viewpoint it is most advantageous to employ a high intermediate frequency. By so doing, it is possible to place the image signal actually beyond the tuning band of any one range. This is shown in the first example, where the intermediate frequency is 460 kc. and where the desired signal is 700 kc., the image signal of 1620 kc. is actually beyond the normal broadcast band which includes the 700 kc. signal.

If you now compare the relation between the intermediate frequency and adjacent channel selectivity, and the intermediate frequency and image interference, it is quite evident that the selection of any one intermediate frequency, because of its value with respect to adjacent channel selectivity or image frequency elimination, is offset by the other.

(*Please turn to page* 18)

Sparton 766, 966, 716-X, 766-XP, 766-XS

(*Continued from page* 13)

from the test oscillator with a 400-ohm non-inductive resistor dummy antenna and connect to grid cap of 78 r-f. tube. (This is a type 6K7 in model 966).

Tune test oscillator and receiver to 18 mc. and adjust condensers C8 and C7A. (*Caution:* Be sure to adjust the various condensers to the fundamental of the signal and not to the image.)

Change the lead from the test oscillator, with the resistor still in series, to the antenna terminal of the set. Adjust condenser C6A. Due to interaction between the circuits, it is necessary to move the tuning knob while making these adjustments to get the maximum gain.

Retune the test oscillator and receiver to 9 mc. and check sensitivity and calibration.

Red S-W. Band Alignment (*3.2-8.0 mc.*):

Turn band switch to the proper position. Tune test oscillator and receiver to 7.2 mc. Adjust condensers C11 and C6B.

Tune test oscillator and receiver to 3.6 mc. and check calibration and sensitivity.

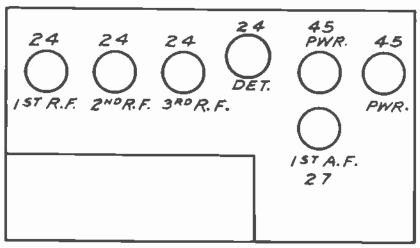
Green S-W. Band Alignment (*1.3-3.8 mc.*):

There are no adjustable condensers for this band. However, the calibration should be checked at 1.7 and 3 mc.

●

Zenith 10, 11, 12, 102, 112, 122

The accompanying illustration shows the tube socket layout of the chassis employed in these a-c. receivers. The



Socket layout for Zenith Models 10, 11, 12, 102, 112, 122

schematic will be found on the following pages in Rider's Manuals: *Zenith page 2-9 in the revised edition; 674-Q in the early edition, and page 2715 in the Rider-Combination.*

R-F. and I-F. Amplifiers

(*Continued from page* 16)

Thus a low intermediate frequency will provide greatest adjacent channel selectivity, but it will provide minimum freedom from image frequency interference. On the other hand, the selection of a high intermediate frequency will provide greatest freedom from image interference by minimum adjacent channel selectivity. As it happens, however, it has been found that it is possible to use a high intermediate frequency so as to avoid image interference and still retain sufficient adjacent channel selectivity by employing highly efficient intermediate-frequency amplifiers and, at the same time, highly efficient tuning circuits in the r-f. system. Supplementing this, it has been found that adjacent channel selectivity is not as great a problem as image-frequency interference.

Another limiting factor with respect to a high intermediate frequency, but which has been solved by the use of additional circuits, is the fact that when the intermediate frequency is within the 300 to 500-kc. range, it is within the band used for marine and aviation radio beacons. However, the use of a wave trap in the antenna circuit, tuned to the intermediate frequency, has helped minimize this type of interference.

It is hoped that this discussion will clarify some of the problems which service men have had concerning the function of certain units used in superheterodyne receivers, and has explained the function of the r-f. and i-f. amplifiers in a superheterodyne.

•

Detection of Modulated Waves

(*Continued from page* 14)

parison of Figs. 2 and 4 shows the greatly reduced efficiency of detection in the latter case, and the large amount of distortion resulting from such over-bias operation. The distortion takes place, because the modulation contained in the valleys is completely lost and is replaced by a flat bottom, instead of the sharply peaked wave shown in Fig. 2 and representative of a normal condition.

The subject of detection is by no means complete in this discussion and it is the lack of space at this time which is responsible for this meager description.

Zenith 430, 440

Below will be found the voltage readings for these models, the schematic of which appears in *Rider's Volume III on Zenith page 3-7 and in the Rider-Combination Manual on page 2737.*

Tube	Position	Plate	Cath.	Screen	Suppr.	Plate Current
Z-58	1st R.F.	175	2.2	75	2.2	5.7
Z-58	1st Det.	190	4.5	75	4.5	2.3
Z-56	Osc.	100	0	—	—	3.5
Z-58	1st I.F.	200	2.2	75	2.2	5.5
Z-56	2nd Det.	110	10	—	—	0.3
Z-56	1st A.F.	170	80	—	—	0.8
Z-57	A.V.C.	—	-85	—	-85	—
Z-57	Q.A.V.C.	30	13	75	13	—
Z-59	Driver	190	20	190	190	13
Z-59	Power	195	-70	195	195	22
Z-80	Rect.	360	—	—	—	65

The filament voltage for all tubes, except the rectifier, is 2.5; that of the 80 is 5.0 volts.

Balance the i-f. stage at 175 kc. Condenser gang at 1500 kc. and oscillator padder at 600 kc.

Silvertone 1855

The schematic diagram of this Sears-Roebuck receiver, appearing on *page 5-45 of Rider's Volume V,* should be changed according to the manufacturer.

There should be no choke coil across the upper 0.5-mf. condenser in the vibrator circuit.

The on-off switch should be in the other 32-volt line—not in the same line with the 2.5-amp. fuse.

The tap in the primary winding of the power transformer should go to the 32-volt line to the right of the on-off switch. In other words, the 0.5-mf. condenser should be across the 32-volt main.

The secondary of the power transformer should be tapped and connected to the junction of the two 0.3-mf. condensers that are shunted by the Globar resistor.

JOHN F. RIDER, Publisher 1440 Broadway, New York • Tel. CHickering 4-4542-4543

Mr. F. Claude Moore
Pekin, Ill.

Dear Claude;-

Sometime ago the Rolling Reporter suggested that you jar y'self loose from the price of an oscillograph and you DID. You wrote and told him that it was one SWELL investment. So you won't mind if I sound off with a suggestion, willya?

In these hectic days of radio refinements and advancements, a radio Serviceman has to be "on his toes" every minute. As a matter of fact, the average Servicer has a pretty tough time keeping up with the technical advancements. (You and I know that YOU'RE not, Claude, but you and I know that a helluva lotta the boys are.) And now in good old 1936 A.D. (After Depression) most of the boys are so busy fixing up old Majestics and Brunswicks that they never get to see a high-fidelity circuit, therefore they don't know much about them....but those old Majestics and Brunswicks can't last forever, and THEN COMES THE DAWN OF REALIZATION THAT IT WOULD HAVE BEEN A GOOD IDEA TO GET SOME "SKULL PRACTICE".

My Boss, John Rider, is working on a new series of books for busy Servicers.... the lads can't quit working and go back to school -- they gotta eat . . . . so John figured that a series of short, snappy books covering a wide range of subjects, which are vital to his fellow Servicers, would be just the thing.

The Series is entitled AN HOUR A DAY WITH RIDER and the hope that springs eternal in John's human breast is that a flock of the boys will put aside an hour a day and get themselves up to date on what's what.

Here's a friendly suggestion --- spend AN HOUR A DAY WITH RIDER and keep in touch with what's doing - - - incidentally, keep that Wolf away from your front porch.

Always understandable, John reaches a new high in his role of helpful adviser to the Serviceman in this series.

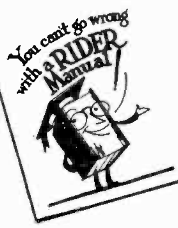
And to lads like yourself, Claude, AN HOUR A DAY WITH RIDER will brush up your mind on a lotta things you've learned, but forgotten. The BEST of us forget sometimes. (Even I forgot the Wife's last birthday -- and did I catch Hell!!)

Yours for successful servicing,

Charlie

Charles H. Farrell
Promotion Department.

See page 4



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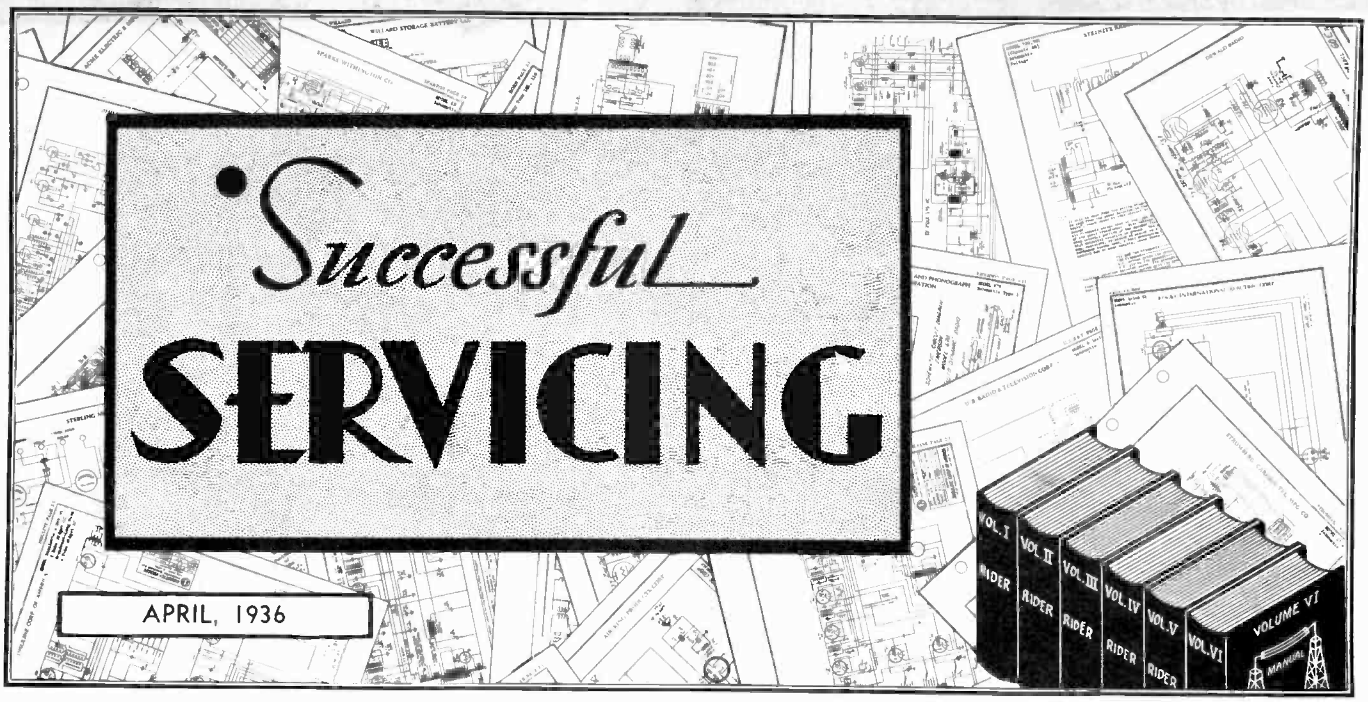


WAVEFORM AND HARMONICS

What Part They Play in Amplifier Distortion

BY JOHN F. RIDER

IN the course of your work you have, no doubt, come across references, in one connection or another, to waveform, sine waves, complex waves, distorted waves, and harmonics. This is to be expected, because theoretical discussions often refer to waveform, and since the advent of the cathode-ray oscillograph, observation of waveform is fast becoming a definite method of analysis.

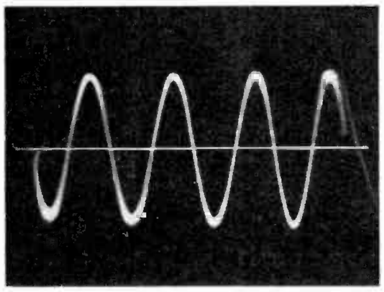


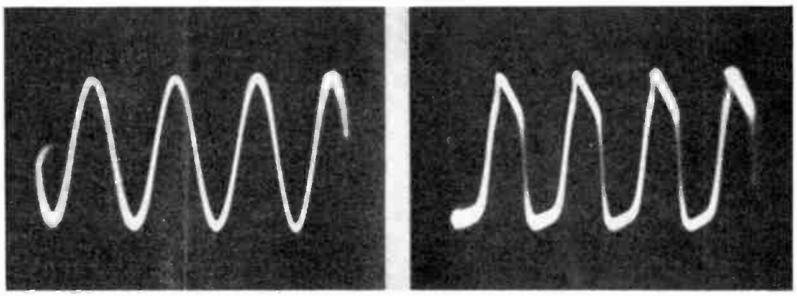
Fig. 1. An example of a pure sine wave. The horizontal reference line was added after the oscillogram was made

Furthermore, equipment of a certain specific character, for example, the sine wave oscillator, has been developed for the purpose of checking and it is to your advantage to understand the significant reasons why a sine wave oscillator is to be preferred for certain applications. At the same time, it is also important to understand how oscillators, which produce so-called distorted waves that are rich in harmonics, find a definite application—as the use of harmonics in r-f. and i-f. oscillators as testing signals. Then again, reference is frequently made to distortion of various kinds in audio amplifiers, which manifests its presence when waveform observation of the audio output is made by means of the oscillograph.

In view of what has been said, we believe that it might be well if you had a clear idea of what is meant by the waveform of an alternating current or voltage. No doubt you are familiar with the basic fact that an alternating current changes its direction of flow periodically. Now, the waveform of an alternating voltage or current is simply a representation of the strength and direction of the current or voltage at each instant of time during a cycle. As a general rule, when observations of waveform are made by means of the oscillograph, it is customary to view several cycles of the current or voltage, in order to minimize errors which would be introduced by the distortion resulting from the operation of the oscillograph when adjusted to show only one cycle of a waveform.

An example of a waveform of either voltage or current of a certain character to be described later, is shown in Fig. 1. The horizontal line is purely a reference line, which has been added to the oscillogram for the purpose of providing a means of distinguishing the positive and negative halves of the cycle. Note that to begin with the current is zero—that it increases in one direction, in this case the negative direction, to a peak value, then decreases to zero again. The cur-

(*Please turn to page* 3)



Compare the sine wave of Fig. 2, left, with the complex wave of Fig. 3 and note the differences in symmetry and regularity

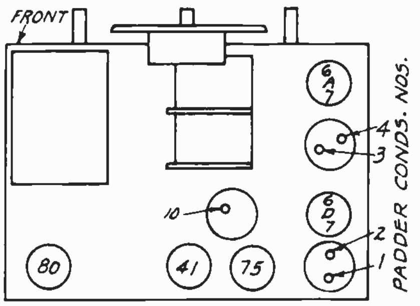
Airline 62-151, 62-157

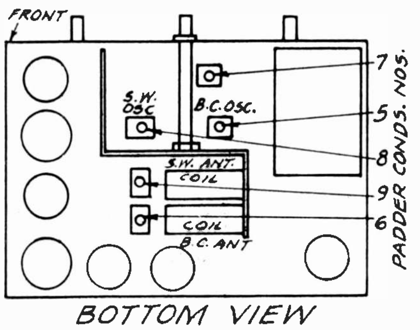
The servicing data on the above models is the same as that for Models 62-136 and 62-138 found on *Mont.-Ward pages 6-11 and 6-12 in Rider's Volume VI.* Please add these model numbers to your index.

●

Arvin 51

The voltage and alignment data for this model will be found below. The schematic diagram appeared on *Arvin page 6-18 of Volume VI of Rider's Manuals.* The accompanying diagrams indicate the locations of the tubes and trimmers.





Socket layout and trimmer locations of the Arvin Model 51

Voltage:

Tube	Plate	Screen	Cathode	Osc. Grid 1500 kc.	Anode Grid
6A7	265	100	3.0	3.5	150
6D6	265	100	3.0	—	—
75	135	—	1.7	—	—
41	251	265	17.0	—	—
80	330 AC				

Alignment:

Set test oscillator to 456 kc. Connect to 6A7 grid cap. Adjust trimmers 1, 2, 3, and 4 in the order named.

For the remainder of the adjustments the test oscillator is connected to the antenna and ground wires of the receiver.

Trimmer	Test Osc. Frequency	Set Radio Dial to	Set Wave Switch to
5	1,500 kc.	150	Broadcast .55—1.75
6	"	"	"
7	600 kc.	0.60	"
8*	15 mc.	15.0	Short Wave 18—5.5 mc.
9	"	"	"
10**	456 kc.	1.0	Broadcast

* To adjust oscillator padder on 6-18 mc. band, unscrew padder wide open, then tighten until first signal is reached and tuned to resonance.
** Balance for minimum signal. Wave trap to eliminate 456-kc. code signal.

●

Firestone-Stewart-Warner R-1322

The alignment data, received after the publication of Rider's Volume VI, for this set, whose schematic appears on *S-Warner page 6-15 in Rider's Volume VI,* will be found below. Keep the output of the test oscillator low, so that it will not actuate the AVC. The output indicator can be connected at the two terminals of the speaker socket to which the yellow leads are attached.

I-F. Alignment:

The i-f. trimmers are on top of the i-f. transformers, which may be reached by removing the front cover. Set the test oscillator to 177.5 kc., the i-f. peak, and connect its output to the 77 control grid and ground. Adjust the three i-f. trimmers for maximum output indication. Recheck the adjustments.

Dial Calibration:

If set is badly out of calibration, the oscillator shunt trimmer must be adjusted as described below. The gang condenser trimmers can be reached by removing the back cover. Connect a 0.00025-mf. condenser in series with the output of the test oscillator and the antenna lead of the set.

Set the test oscillator to 600 kc. Tune the set to maximum volume. Calibrate the dial at the low-frequency end by setting the pointer to 6.0 (600 kc.). Set the test oscillator to 1400 kc. Turn the tuning knob until the dial pointer indicates 14.0 (1400 kc.) and then adjust the oscillator shunt trimmer (third one from the shaft end of the variable condenser) until the signal produces maximum output. Then adjust the other two gang condenser trimmers as directed under R-F. Alignment.

R-F. Alignment:

Set test oscillator to 1400 kc. Tune set for maximum output. Adjust output of test oscillator to the minimum value that will give sufficient output deflection. Adjust the two condensers nearest to the shaft end of the gang condenser to give maximum output indication.

Zenith 250, 260, 272

Below will be found the socket layout for these models, the schematic for which appears on the following pages in *Rider's Manuals: Zenith 3-6 and 2734 in the Rider-Combination Manual.*

Socket Voltages:

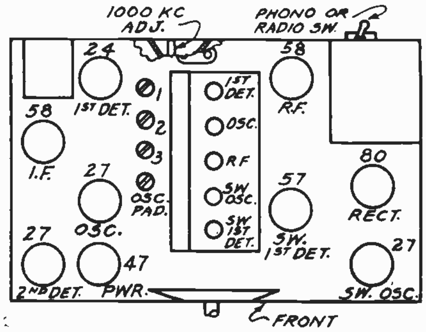
Tube	Position	Plate	Cathode	Screen	Suppressor	Plate MA.
58	R.F.	240	4	110	4	6.2
24	1st Det.	235	8	110	-	.5
57	S-W. 1st Det.	235	6	150	6	.5
27	S-W. Osc.	150	10	—	-	5.
27	Osc.	110	0	—	-	9.
58	I.F.	235	3	110	3	8.
27	2nd Det.	35	4	—	-	1.8
47	O.P.	215	—	230	-	28.
80	Rect.	110 each to ground				34. each

All controls maximum. Line—115 volts. Filament voltage of all tubes 2.4, with exception of 80, which is 5 volts.

Alignment Data:

Broadcast band. I-f. peak is 175 kc. Tuning condenser (three rear sections) 1500 kc. Oscillator padder 600 kc.

S-W. band. Set 1000 kc. adjustment shaft to the center of its tuning range and balance s-w. i-f. trimmers (1, 2, and 3) to 1000 kc. with s-w. oscillator tube removed. Insert tube and place s-w. tuning on scale by adjusting s-w. oscillator trimmer on condenser gang until a station on the 1.5 to 3.75-mc. band is resonated at its corresponding frequency on the dial.

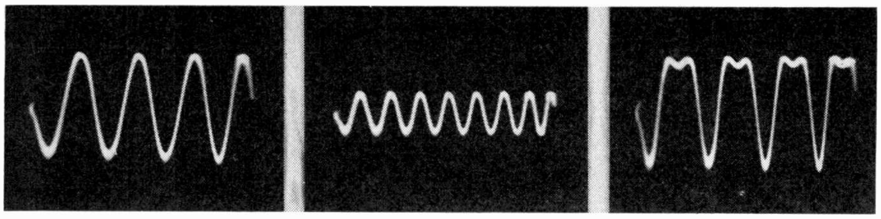


Locations of trimmers and tubes of the Zenith Models 250, 260, and 272.

●

RCA R-78

On page 9 of the November, 1935, issue, of SUCCESSFUL SERVICING the value of the resistor, R-7, was given at 465 ohms. This should have been 565 ohms. Please make this change in your *Rider Manual, RCA page 3-38 and on page 1910 of the Rider-Combination.*



The 1000-cycle sine wave, Fig. 4, left, and the 2000-cycle wave, Fig. 5, were combined. The resultant asymmetrical wave of Fig. 6 shows the presence of the second harmonic

Waveform and Harmonics

(*Continued from page* 1)

rent now reverses its direction, as indicated by the fact that it is shown above the horizontal axis, increases to a peak in this direction, and then finally returns to its zero value. This is a complete cycle of current and if this illustration were a waveform of voltage, the discussion would have been the equivalent of tracing out the complete cycle of voltage. The other cycles of the oscillogram are simply repeitions of that which has been described and the cycle of events is repeated over and over again for the duration of the current.

Sine and Complex Waves

The waveform shown in Fig. 1 is an example of what would be classified as a pure wave or sine wave. This might also be described as a fundamental waveform, because it consists of but one frequency. In other words, all waves, that is, current, voltage, or for that matter even sound, which consist of but one frequency, are said to be pure waves, and when examined visually, would appear as sine waves.

To attempt to give an exact description of the basis of a sine wave without reference to mathematics, would require more space than is available at this time. Nevertheless we feel that you can secure a fairly clear idea of what is being discussed by the comparison of this fundamental waveform and subsequent patterns, which are representative of other than sine waves. It is, however, possible to refer to certain significant features of a waveform, which are typical of a sine wave. Note how smoothly the change of polarity or direction occurs—that is, without any dips or wiggles in the pattern. Note also that the peaks are rounded and not sharp; further, that the wave is symmetrical both sides of the zero reference line. In addition, there is but one peak in each half cycle. Of course, this description should not be taken as being exact. Under certain conditions waveforms, which are not sine, may resemble a sine wave, but this qualitative description, when correlated with some of the comparisons which follow later in this discussion, should help clarify the difference between a pure or sine wave and a complex or distorted wave.

What is the basic difference between a sine wave and a complex wave? Essentially, the difference is that the sine wave contains but one frequency, whereas the

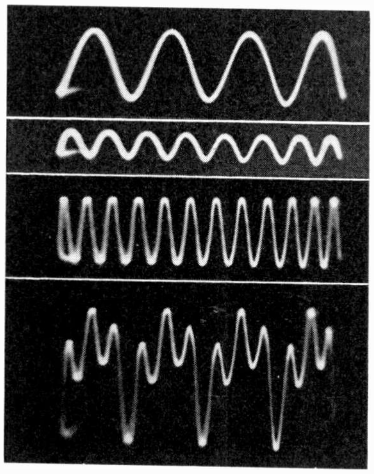


Fig. 10. A 1000-cycle sine wave and its second and third harmonics were combined, giving the wave shown at the bottom. Note the lack of mirror symmetry in the resultant wave.

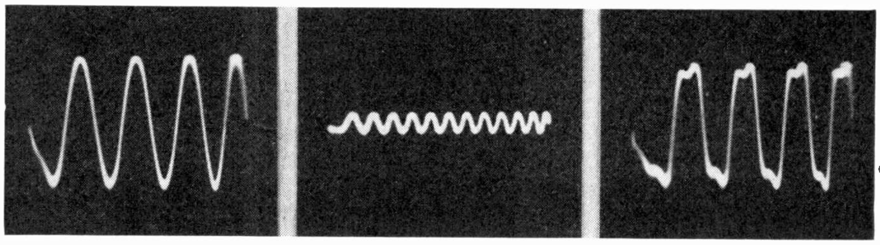
Oscillograms by Successful Servicing Laboratory

complex wave consists of a series of frequencies. This complex wave can be resolved into a series of sine waves—one of which is the fundamental frequency, and the remainder, the harmonic frequencies. These harmonic frequencies are integral multiples of the fundamental frequency—as, for example, two times the fundamental, three times the fundamental, four times the fundamental, etc. In contrast to the sine wave shown without the reference line in Fig. 2, observe the complex wave shown in Fig. 3. Note the lack of symmetry and the irregularity of the wave. Such a wave would be classified as a distorted wave or complex wave, but irrespective of the classification, the fact still remains that the reason for such departure from the symmetry of a sine wave is the presence of a number of different frequencies. Such a waveform can be considered as a composite picture of all of the frequencies of a certain amplitude and certain phase relation. The relative amplitudes of the different component frequencies and the phase relation between the harmonic frequencies and the fundamental frequencies, have a definite bearing upon the shape of the wave.

Harmonics and Waveform

It is instructive to examine specifically how the presence of harmonic frequencies changes the waveform of an alternating current. To illustrate this we combine two frequencies, each of which in itself is a pure sine wave, one corresponding to the fundamental frequency and the other to the second harmonic. The waves which are combined are shown in Figs. 4 and 5, and are respectively a 1000-cycle fundamental and a 2000-cycle second harmonic. The amplitude of the second harmonic voltage is kept low in order to simulate conditions which actually occur in practice. The phase relation between the fundamental and the harmonic is taken as it occurs, without any special effort to establish any one particular relation. These two voltages are combined by connecting the output circuits of the two oscillators in series and feeding this combination voltage to the vertical plates of the oscillograph. The effect of adding the two waves can be seen in Fig. 6, and it is apparent that the addition of the second harmonic voltage or the presence of the second harmonic in the composite wave, changes the waveform so that it is no longer sine in character. Instead of the symmetrical waveforms of the fundamental and the harmonic frequencies, we now have a wave which has asymmetrical or non-symmetrical positive and negative peaks, and by comparison with the original sine waves of Figs.

(*Please turn to page* 14)



The 1000-cycle sine wave, Fig. 7, left, and the 3000-cycle wave Fig. 8, were combined, giving the wave of Fig. 9. Note the "mirror symmetry" of the latter, due to the presence of the third harmonic and compare with Fig. 6

Atwater Kent Phonograph Connections

Certain Atwater Kent models have three terminals at the rear of the chassis for phonograph connections, instructions for which are given below.

The switch to change from radio to phonograph is not provided with the receiver. Some phonograph manufacturers furnish a special switch with their equipment, as for instance the RCA Model R-93, which has a switch connected as shown in Fig. 1. However, a double-pole, double-throw switch can be secured for this purpose, when one is not provided with the phonograph attachment. The part number is 30024. In using this switch the two center contacts must be connected together.

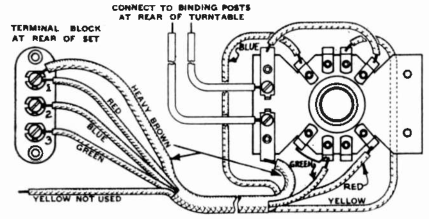


Fig. 1. Switch connections for phonograph.

The phonograph pick-up, which can be either high impedance, or low impedance with a step-up transformer, should be designed so that it will deliver at least 1 volt across a 100,000-ohm load. Late type Model 649 receivers, which are equipped with phonograph terminals, require 2.5 volts across a load of 250,000 ohms.

If the turntable is to be used some distance away from the set, it is generally advisable to use a low-impedance pick-up with a step-up transformer, which is mounted near the receiver. If this set-up is used, connect as is shown in Fig. 2. It is important to mount the pick-up input transformer so that it does not pick up hum from the receiver or from the phonograph motor. The cable between the pick-up and the transformer may be any desired length, but the cabling between the transformer, switch and set should be as short as possible.

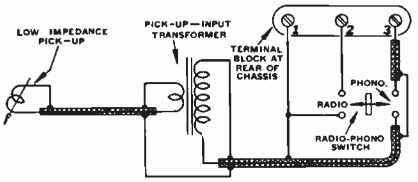


Fig. 2. Setup used when turntable is used at some distance from the receiver.

If the turntable is to be placed near the receiver, it is advisable to use a high-impedance pick-up, but the type mentioned in the previous paragraph will also be satisfactory. Connections for a high-impedance pick-up are given in Fig. 3. All leads should be as short as conveniently possible.

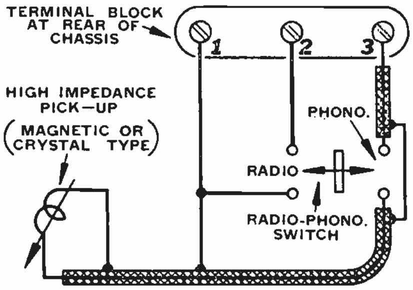


Fig. 3. When turntable is used near the receiver, the setup above is employed.

Owing to the circuit arrangement used in Atwater Kent sets, a separate volume control is not needed for the pickup, as the radio volume control regulates the phonograph. The tone control on the receiver also regulates the tone of the phonograph.

When connecting the phonograph be sure *to remove the short jumper wire* between contacts 1 and 2 on the terminal strip. This is attached at the factory and is required only in case the radio is operated without being connected to a phonograph. A scratch filter is not needed, unless specified by the pick-up manufacturer. The tone control in the set, which acts on the phonograph, aids in reducing scratch.

Philco 611 (Code 121)

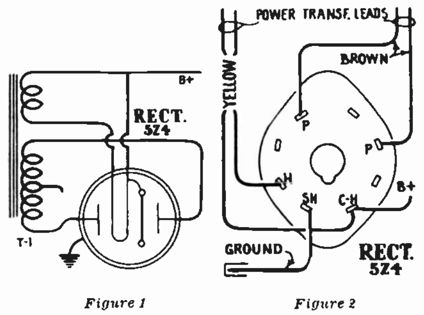
In Run No. 2, resistor No. 40 has been changed from a 1-watt unit to 0.5 watt with the same ohmic value. Resistor No. 5 in the antenna circuit has been removed and no substitution made.

In Run No. 4 the oscillator circuit was changed to series feed. The oscillator plate was disconnected from the lead connecting condenser No. 9 and resistor No. 41 and connected to the top of the lower primary winding. The bottom of this primary winding was disconnected from condensers Nos. 15 and 16 and connected to the junction of the leads from condenser No. 9 and resistor No. 41. The lead from resistor No. 10 to the top of the primary was changed so that it connected to the bottom of the secondary. Resistors Nos. 10 and 19 were removed from the circuit. Resistor No. 18 was changed, so that it connects from the 6A7 cathode to the switch side of condenser No. 9. The oscillator transformer has been changed from Part No. 32-1831 to 32-1973. The tuning condenser, No. 17, has been changed from Part No. 31-1528 to 31-1740.

The schematic diagram of Model 611 is on *Philco page 6-23 Rider's Volume VI.*

RCA Models C11-3, C13-3, C15-4 ...

With the exception of the cabinets, the substitution of a metal rectifier, the 5Z4, and other minor changes, Models C11-3, C13-3, and C15-4 are identical with Models C11-1, C13-2, and C15-3 respectively. The schematics for these three latter models will be found in *Rider's Volume VI on RCA pages* 6-115, 6-121, *and* 6-129 *respectively.* Please make the necessary additions to your index for Volume VI. In Figs. 1 and 2 are the schematic and wiring diagrams of the metal rectifiers, as used in these sets.



Diagrams of metal rectifier used in later models.

Models C11-1, C11-3 (*with metal rectifiers*):

Condenser C-24 (0.01 mf.) in the cathode circuit of the 6H6 detector has been changed to 0.05 mf., Part No. 4886.

Models C13-2, C13-3 (*with metal rectifier*):

Condenser C-60 (0.01 mf.) has been changed to 0.05 mf., Part No. 4886. This is also in the cathode circuit of the 6H6 detector.

The three power transformers, T1, have been changed from Part Nos. 8061, 8062, and 11194 to 11880, 11887, and 11251 respectively. These have the same voltage ratings.

Models 15-3, 15-4 (*with metal rectifier*):

Condenser C-47 (0.01 mf.) has been changed to 0.025 mf. (Part No. 4870).

The three power transformers have been changed in these models the same as they were in Model 13-2.

A mind always occupied with reminiscences hinders progress.

Superheterodyne Oscillator Innovations

An analysis of some of the 1936 superheterodyne receivers shows some innovations in the manner in which the oscillators of the sets are employed. It is possible that this explanation will help clarify some problems which may have already arisen, in the event that those, who read these lines, have had the opportunity of working upon some of these receivers.

It is a well-known fact that in the conventional superheterodyne receiver, the frequency at which the oscillator operates is *higher* than that of the received carrier. The difference frequency, created as a result of the operation of the mixer tube or first detector and picked up by the intermediate-frequency transformer in the plate circuit of the mixer, is the intermediate-frequency signal. The normal design of the conventional receiver, irrespective of the number of bands used, is that this relation between the oscillator frequency and the received carrier frequency is maintained intact.

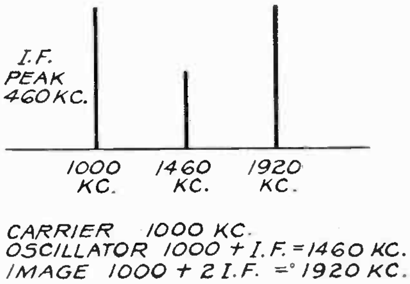


Fig. 1. In the broadcast band, the image frequency is higher than the received carrier by an amount equal to twice the intermediate frequency.

However, in some of the new receivers, a somewhat different arrangement is employed. These receivers are usually of the dual-band variety, wherein one band covers the normal broadcast-frequency spectrum of from 1600 kc. to about 540 kc., and a short-wave band, which covers from about 2520 kc. to about 1460 kc. Where a variety of this system is used, the high-frequency band covered is from 3900 kc. to about 1540 kc.

The innovations we speak of are of two varieties: one is that wherein the oscillator frequency is *higher* than the received carrier over the broadcast band by an amount equal to the intermediate frequency, and wherein *the same oscillator frequency is lower than the received carrier on the short-wave band* by a value

(*Please turn to page* 15)

Successful SERVICING

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A NEW ERA ON THE WAY

HOW good is a receiver after it has been serviced? . . . We will grant that the serviceman has taken great pains in repairing whatever defect existed, and if the receiver was out of alignment, he aligned it to the best of his ability. What then? . . . We still ask the same question—how good is the receiver after having been serviced?

For more than ten years, servicemen have serviced receivers and never did know whether or not the finished job was as good as it was supposed to be. To be more explicit, they did not know if the receiver possessed the required amount of sensitivity. We, of course, know that each of these receivers was given a test on the air, but in very few, if any, cases was the serviceman certain that the sensitivity of the receiver was in accordance with the manufacturer's original requirements. By this we do not mean that the serviceman is called upon to establish the authenticity of receiver manufacturers' statements, but we do mean that the serviceman should check the sensitivity of a receiver by some means other than that which has been used—namely, a test on the air. After all, it is possible that the receiving conditions in the service shop are better than those in the customer's home, or vice versa, so that some means is essential whereby a service man can guarantee satisfaction to the customer, when that serviced receiver is returned.

Time and again customers have complained that receivers did not possess the required amount of sensitivity, after being serviced. Since there was no definite basis upon which to operate, ill will on the part of the customer towards the service station was created. Then it is perfectly possible that, with all due respect for the ability of the serviceman, the finished job was not up to par in all ways. This has been a problem for many years—but, we believe, it is on the way out.

We recently had occasion to view some of the manuscript pages being prepared for forthcoming service notes covering Motorola receivers. One particular page possessed great significance. This page showed the required signal input, expressed in microvolts, for certain signal outputs, expressed in a-c. volts, as taken across the secondary of the output transformer of certain Motorola receivers and at certain specified frequencies. . . . The past years have witnessed many additions to service information. Starting with nothing more than the naked schematic, the average service manual published today contains a great wealth of information, which is intended to help the service man when he is called upon to repair a specific receiver. However, in all these years, information has been conspicuous by its absence, which would enable the service man to definitely check a receiver so as to ascertain whether or not the finished job was as good as it should be. We sincerely believe that this step, taken by the organization mentioned, is the forerunner of a new era in radio servicing activities.

It is about time that servicemen had some means of definitely checking a serviced receiver so as to make sure that it is operating correctly. A sensitivity check is just as vital as an alignment test or a selectivity test. We believe that this step taken by Motorola will result eventually in much better servicing operations and greater satisfaction to the public at large. We realize, of course, that certain dangers beset the receiver manufacturing industry when such sensitivity standards are established, but we do believe that it is perfectly possible, as evidenced by the data which we saw, for a receiver manufacturer to establish certain standards for his receiver without the fear that unjust condemnation—*due to improper testing in the service shop*—will be the result."

We further appreciate that all the servicemen now working upon receivers, are not technically equipped to make such tests. By "technically" we mean both as to knowledge and equipment. However, that does not mean that servicemen cannot become sufficiently well-equipped with knowledge and equipment so as to keep in step with such progress—for progress it certainly is.

It is not beyond conception to see every worthwhile service station equipped with a shielded room for proper sensitivity checking of a serviced radio receiver. Considering the volume done on an average, such operations are perfectly in order and will tend to justify the establishment of a proper and profitable service charge. As a matter of fact, such progress will do much towards developing a conscientious and stable servicing industry—one which will be respected for its ability.

Such progress should be of vital interest to the servicing industry at large, because it will help eliminate those men who cannot adapt themselves to the requirements of the times. It should also be of vital interest to the instrument manufacturing organizations, because it means the production of equipment of more technical form and of higher unit price. As a matter of fact, the type of signal generator assumed in the service notes which we saw, must be capable of proper attenuation so as to provide a signal output, properly calibrated, and at levels as low as 1 or 2 microvolts. In a sense it restores the output meter, calibrated in volts or even decibels, which was somewhat replaced by the cathode-ray oscillograph in connection with alignment operations. As a matter of fact, we can even see some organizations selling shielded rooms in knock-down kit form. All in all, it means more elaborate testing equipment and greater expenditure on the part of the servicing industry. The increased monies spent by the servicing industry will help the instrument manufacturer and, at the same time, will help the servicing industry itself, because, by requiring a greater financial investment, the financial standing of the industry is improved.

We feel certain that some men will condemn the approach of such a condition—but such condemnation will not stop the unalterable stride of progress. We, of course, realize that a long time will elapse before such sensitivity testing will become a commonplace activity among service stations—but commonplace it will become. . . . There is no such thing as standing still! . . . You either go forward or you move backwards!!

John F. Rider.

•

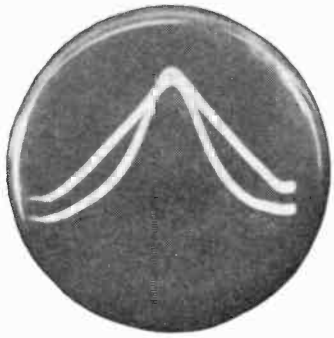
As soon as a man becomes satisfied with himself and with what he has done, he has ceased to improve and has begun to degenerate.

—George Eliot.

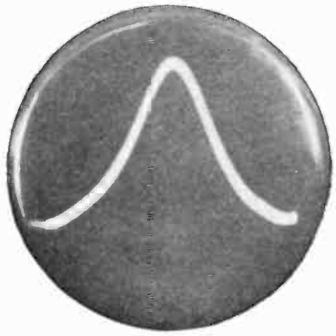
These figures show why Service Engineers say

"MY NEXT INSTRUMENT IS THE OSCILLOGRAPH BY RCA"

These four actual, unretouched photographs show conclusively that the RCA Cathode Ray Oscillograph makes it possible for you to align receivers with an accuracy impossible with the conventional output meter. For an aligning job that duplicates factory practice, it is necessary to align not merely for output, but for frequency and symmetry. Only an Oscillograph enables you to do this . . . Remember that the RCA Oscillograph not only speeds up your work and makes it more accurate, but can be used for many other types of service work—and has great effect on set sales. People prefer to deal with experts, and the RCA Oscillograph is the most impressive instrument in radio service work today. Put it to work in both shop and store. Write for details.



This i-f amplifier was aligned with output meter. Oscillograph shows distortion



And this is the proper alignment, obtainable in a minute or two with the RCA Oscillograph

Proper alignment of amplifier that is over-coupled, showing broad peak

In seeking for the results of No. 3 with a meter, you're apt to do this—peak the transformers at different frequencies

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Rolling REPORTER

Rolling Reporter,
Northwest Technicians Convention,
Minneapolis, Minn.

Dear Boss;

Not *very* much to report to you in the way of news . . . your Wife has called up **five** times—it's a wonder you wouldn't write . . . glad to hear that Mr. Rider's talk was so well received—better remind him to hurry back—he is slated for the **New Haven Servicemen's Association banquet on the 23rd** and for the **Radio Technicians Guild** doin's in Bahston on the 27th . . . tell him too that his seckaterry has accepted a flock of speaking dates for him—*he'll need seven league boots to keep 'em all*:

April 28th. Worcester, Mass.

May 4th. Buffalo, N. Y. Ass'n of Radio Service Engineers

May 5th. Youngstown, Ohio. Youngstown Valley Servicemen's Ass'n

May 25th. Galveston, Tex. National Technicians Ass'n. Convention.

Some day in June he's gotta go to Erie, Pa., and talk at the Registered Servicemen of Erie . . . then in August, a long jump to the Coast—Spokane. Wash—(the date is Aug. 6th, I think) and then there are *fourteen* other invitations from as many groups of Servicers on the way down the West Coast . . . they'll have to be okayed by him . . . Jean and I figgered out that the Boss will talk to at least **10,000 of the Servicing fraternity** this year—pretty popular guy, your Boss and mine . . . note your comment on the plane trip out west—**particularly** that crack about Air Hostess Flekke of the United Air Lines—if you were trying to get my goat you succeeded *beautifully*, sonny boy—*will I have to take up flying to get a tumble from you????* . . . heard a story you might wanna run next month—a Servicer (?) asked a salesman in a parts jobber's how much a WHOOZIS transformer would cost, and he was given a quote of $1.85. He tried to chisel the price down to a buck and a quarter, explaining, **"I quoted $2.50 for the whole job, and I gotta make a little profit"**—*It's things like that that make gals like me HATE guys like that* . . . Arthur Rhine dropped in to see you t'other day—there's a lad who is thorough in every thing he does . . . he told me that he never misses getting every bit of literature put out by parts and tube manufacturers—he can tell ya the details of every late development in radio—pass the tip along to any Servicers you contact, willya??? Our research engineer, **Jack Avins**, lectured to a group of 150 New York IRSM'ers on **SERVICE APPLICATIONS OF THE OSCILLOGRAPH** . . . I went to hear him—I didden understand what it was all about but the gang liked it very much—*they kept him on the platform over two hours* . . . Ad-Man Charlie Farrell gotta good natured "razzing" from CLAUDE MOORE of Pekin, Ill., for that letter on the back cover of last month's issue of this sheet . . . the "irrepressible Claude" also wanted to know if I was a blonde or a brunette—shall I tell him I'm a red head—and that I won't go to Pekin ***unless they give me the keys to the Seagram Distillery out there????*** Try to stop off in Pekin and meet that guy—he must be a "regular" . . . the **"HOUR A DAY WITH RIDER"** series is sweeping along like a forest fire—*the first press run will be sold out within thirty days* at the rate the orders are coming in . . . **Fred Horman** has been ill with intestinal "flu" since his return from the West . . . the **RIDER SURVEY** has been completed—copies were received from the printer and are going out to advertisers . . . for the first time in the history of the radio biz, parts and tube m'frs will be able to UNDERSTAND the Serviceman . . . shall I send you a copy???? . . . So you can spell, hey? OK, have someone dictate this sentence and you write it down: ***"An embarassed cobbler passed a harassed pedler who was sitting in languorous ease on a cemetery wall, gnawing the desiccated bones of a rhinoceros, while gauging the symmetry of a lady's contour and her beauteous coiffure."*** You're not allowed more than two mistakes . . . I made FOUR . . . a reader of your colm sent you two cute, fat rabbits for Easter—we named them Pat and Mike—*we were wrong*—their names are Jean and Adele—you are now the possessor of **ELEVEN** rabbits—they're in your bottom drawer—please WIRE and tell me what'll I do with them—*They're driving me nuts!!!* Hope nobody sends you a coupla female elephants!! The ***HUNDRED PERCENTERS*** are multiplying, too—y'gotta stack of membership applications T H I S H I G H on your desk . . . willya stop over in Indianapolis and see **Norm Keevers**? I hear he is doing nicely after his terrible auto accident, and out of the cast . . . so much mail that I can't begin to wade through it—how's about getting me an assistant??? ***NOT A BLONDE,*** my fine gentleman . . . I see by the papers that the Democrats are gonna use the line we used in last months issue as a campaign slogan **"1936 A.D. (*After Depression*)"**—*is that a knock or a boost????* . . . how time flies—the lads in the drafting dep't are already readying *VOLUME VII of RIDER'S MANUALS* . . . plenty of instrument m'frs are including cathode-ray oscillographs in their lines this year . . . which makes your prognosticating batting average about 1,000% . . . well, the more the merrier—that means that plenty of Servicers will buy J.F.R.'s book, **"The Cathode Ray Tube at Work"**—coupla fellows told me the other night that they cannot get enough info from the m'frs on the service applications of the oscillograph, and depend entirely on our book for the method of procedure . . . *how about telling the m'frs about this angle?????* Glad to note your remark anent the m'frs taking the serviceman market seriously . . . the **RIDER SURVEY** shows that it is *BEEG* . . . "Tex" Leonard tells us that, as a result of J.F.R.'s talk in Minneapolis, various groups of Servicers got together and pledged themselves *to boost service charges to a point which would represent a fair profit* . . . BUT—they were fellows from the smaller towns and cities—the lads in the big cities think that it will be difficult to get any higher prices . . . what I wanna know is—**did the butcher, the baker and the candlestick maker refrain from charging the Servicer's wife 40 cents a pound for meat and fifty five for butter when it was necessary to get that price in order to show a profit???** Which reminds me . . . I need a RAISE—the cost of living is going up . . . and not a TWO BUCK raise either, Mister Bigheart . . . Didja meet **Joe Burstein** in Chi??? Hope you didn't forget Aileen's birthday—it was April 11th. y'know—just to make sure, I sent flowers in your name—*you owe me seven bux* . . . I'm gonna learn to be a "Ham"—have started taking code—then, when you're on the road, you can drop into some "shack" and I can tell you what's what . . . already I've learned what to say to YOU—

. . . . EIGHTY EIGHT.

Your Girl Every Day

Zenith 460

The changes found below were made on the model 460 sets after serial number 502101 on the control head and number 202101 on the speaker chassis. The schematic diagram of the early model will be found on *Zenith page* 4-1 *in Rider's Volume IV.*

The condenser block, Part No. 22-184 was replaced by one with the same electrical specifications with a slightly smaller container, Part No. 22-198. The power transformer, Part No. 95-163 was replaced by Part No. 95-197. The i-f. transformers, Part Nos. 95-159, 95-161, and 95-162 were replaced by Part Nos. 95-198, 95-199, and 95-200 respectively.

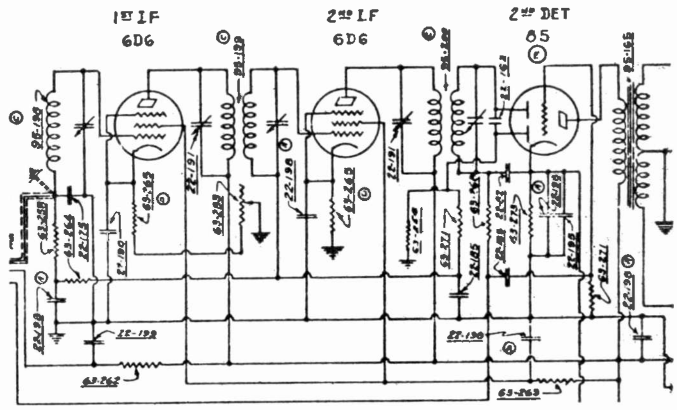
The bias resistors, Part No. 63-282 (2200 ohms) were replaced by 220-ohm resistors, Part No. 63-265.

A 0.0001-mf. condenser, Part No. 22-162, was inserted between the diode plates of the 85 2nd detector and the wiring changed, as shown in the accompanying schematic. The 490,000-ohm resistor, Part No. 63-258, was connected between the lower diode plate and ground. Note other changes in the AVC wiring.

The operating voltages for the revised chassis are as follows:

Tube	Position	Cathode	Grid	Suppressor	Screen	Plate
6C6	1st Det.	7	0	7	125	180
6D6	1st I.F.	1.8	*	1.8	110	200
6D6	2nd I.F.	1.8	*	1.8	110	200
85	2nd Det.	8.	0	——	——	185
89	O.P.	20.	0	20.	200	200

* Depends on applied signal strength.



The partial schematic of the Zenith Model 460 has the changes mentioned above incorporated in it.

Philco 623

Run No. 4. The first i-f. transformer was changed from Part No. 32-1793 to 32-1671. The i-f. tube was changed from a type 34 to a 1A4. These changes were made to increase the sensitivity.

Run No. 3. The bottom terminal of the volume control, which is shown grounded in the schematic on *Philco page* 6-29 *of Rider's Volume VI,* is now connected to the positive terminal of the filament supply. The volume control has been changed from Part No. 33-5115 to 33-5142.

Run No. 6. The 10,000-ohm resistor, No. 4, has been removed.

Run No. 9. The oscillator circuit was changed to series feed. Condenser No. 49 and resistor No. 50 were removed and the wires connected to the ends of these parts were connected together. The wires between the police tap at the left of switch section No. 2 and the joint in the wire just above that was broken and condenser No. 49 was inserted. This new condenser has a value of 0.0006 mf. and its part number is 30-1049.

The connection between the bottom (S.W.) primary and secondary of the oscillator transformer was broken and condensers 14 and 15 connected between the bottom of the secondary and ground. The 25,000-ohm resistor, No. 16, was removed. The lead going to the top of the primary was disconnected and brought down to the bottom of the secondary, The 20-ohm resistor, No. 9, was also removed.

A lead from the bottom of the primary was connected to the lead running from condenser No. 8 to resistor No. 20. The oscillator plate wire was disconnected from this lead and brought to the top of the primary.

In the broadcast and police section of the oscillator transformer, resistor No. 17 was disconnected from the bottom of the upper section of this transformer and connected to the switch side of the condenser No. 8.

The oscillator transformer was changed from Part No. 32-1831 to 32-1973. and condenser No. 30 was changed from 0.006 mf. to 0.00011 mf.

●

You Stamp Collectors

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Stewart Warner R-136 Chassis Alignment

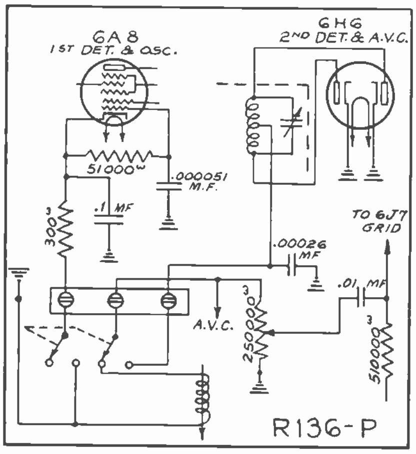
Connect the output indicator across the primary of the output transformer (red and yellow wires on the speaker terminal strip) located under the speaker field cover.

I-f. Alignment:

Turn volume control to maximum and keep it there for entire alignment procedure. Set test oscillator to 456 kc., the i-f. peak, and connect to the 6A8 control grid and the chassis. Adjust the four i-f. trimmers (shown at 1 and 2 on the chassis layout on *page 6-18 of Rider's Volume VI*) for maximum output deflection. Recheck the adjustments.

Broadcast Band Calibration:

Check position of dial pointer on shaft by turning the rotor plates to full mesh. The pointer should indicate 540 kc. Turn the range switch to extreme



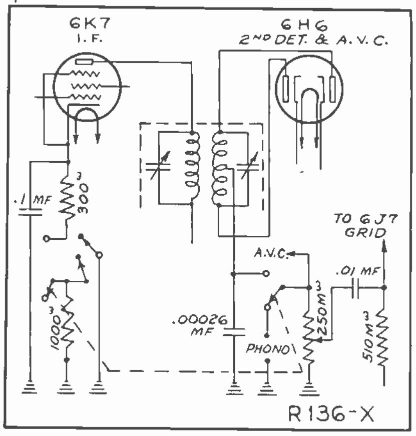
Schematic diagram of the Stewart Warner R-136-P chassis with phonograph pickup indicated.

clockwise position. Connect the output of the test oscillator to the set's A and G terminals and ground both set and oscillator. Adjust test oscillator and dial to 1400 kc. Adjust trimmer No. 3 for maximum output without changing the setting of the condenser gang.

Broadcast Band Alignment:

Connect a 500-ohm carbon resistor in series with the test oscillator output and the set's antenna terminal and let it remain connected for the rest of the adjustments that are outlined below. Set oscillator at 1400 kc. and tune the receiver to the signal for maximum output. Adjust trimmers Nos. 4 and 5 for maximum output. Do not touch trimmer No. 3 as this will change calibration.

Adjust test oscillator to 600 kc. and tune set to this signal. Adjust trimmer No. 6 for maximum output. Retune gang condenser to a peak and readjust



The phonograph connections for the Stewart Warner chassis R-136-X. For the complete schematic see page 6-18 in Rider's Volume VI. For other data see January and March, 1936 issues of Successful Servicing.

trimmer No. 6 for maximum output. Continue to do this until maximum output is obtained.

First S-W. Band Calibration:

Turn range switch to center position. Adjust test oscillator to 5.5 mc. and set the set's dial to the same frequency. Adjust trimmer No. 7 for maximum output. If there are two peaks, the proper one is that with the trimmer screw farthest out.

First S-W. Band Alignment:

Set test oscillator to 5.5 mc. and tune receiver to maximum output. Adjust trimmers Nos. 8 and 9 for maximum output.

Second S-W. Band Calibration:

Be certain that the D to G connector on the receiver terminal strip is in place. Turn the range switch to the extreme counter-clockwise position. Adjust test oscillator to 16 mc. and the dial of the set to the same frequency.

Adjust trimmer No. 10 for maximum output. Check this by tuning the receiver to about 15.1 mc. If a repeat signal is not heard at this point, even with increased test oscillator output, retune the receiver to 16 mc. and adjust trimmer No. 10 to the proper peak with the screw farther out.

Second S-W. Band Alignment:

Adjust test oscillator to 16 mc. and tune set for maximum output. Adjust

(*Please turn to page* 14)

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Stewart Warner R-136 Chassis

(*Continued from page* 12)

trimmers Nos. 11 and 12 for maximum output. Check to see if these trimmers are adjusted to the proper signal rather than the image, by tuning the set to approximately 15.1 mc. If the repeat signal is equal to or stronger than that at 16 mc., retune to 16 mc. and readjust Nos. 11 and 12 to the proper peak with the trimmer screws further in.

●

Belmont Condenser Tolerances

The mica condensers used in Belmont receivers are coded with an additional dot indicating the tolerance. Below will be found a list of the tolerances in percentages and the color of the dots.

% Tolerance	Color of Dot
2½%	White
5%	Green
10%	Blue
15%	Yellow
20%	Red
More than 20%	None

●

Waveform and Harmonics

(*Continued from page* 3)

1, 2, 4 and 5, this resultant wave is said to be distorted.

While we know that this complex wave of Fig. 6 is the combination of the voltages in Figs. 4 and 5, an analysis of Fig. 6—with Figs. 4 and 5 not available—would develop the fact that it was composed of a 1000-cycle fundamental and a 2000-cycle second harmonic. The point that we especially want you to note is that this distortion of the waveform has been brought about by the addition of the harmonic frequency.

Another significant fact gathered from Fig. 6, is that which relates to the symmetry of the pattern and the order of the harmonic. The primary consideration is that the presence of even harmonics, such as the second, fourth, sixth, etc., alters the resultant waveform in such manner that the positive and negative peaks are no longer symmetrical. This happens to be an actual fact and is evident, although only the second harmonic is included in the actual waveform shown.

The Third Harmonic

Let us now examine the effect of the presence of the third harmonic. How will this odd harmonic alter the character of the composite wave? Will this

(*Please turn to page* 16)

Superheterodyne Oscillator Innovations

(*Continued from page 6*)

equal to the intermediate frequency. Perhaps an example or two will clarify. For example, if the broadcast band covered is from 1000 kc. to 540 kc., and the intermediate frequency is 460 kc., the frequency range of the oscillator is from 2060 kc. to 1000 kc. This frequency band can be used to heterodyne another band of frequencies, which is 460 kc. higher at all times. In other words, if a short-wave band, with a high limit of 2520 kc., and a low limit of 1460 kc., is mixed with this oscillator band of from 2060 kc. to 1000 kc., the required intermediate frequency of 460 kc. will be available throughout the band. An example of such a receiver is the Stewart-Warner R-142-A and R-142-AS chassis, which are used in the Models 1421 to 1429 receivers.

In this connection it is interesting to note that the relation between the image frequency and the carrier frequency changes as the tuning band is changed. For example, if you refer to Fig. 1 you will find that for any received carrier on the broadcast band, the image frequency is higher than the received carrier by an amount equal to twice the intermediate frequency. This condition is applicable to all conventional types of

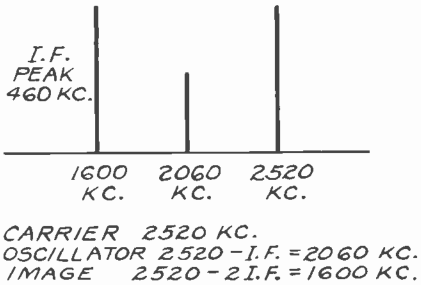


Fig. 2. This diagram illustrates the shift of the image frequency when the high-frequency band is being received.

superheterodyne receivers. However, when the receiver we mentioned is tuned to the high-frequency band, the oscillator frequency is *below* the carrier, so that the image frequency, which is *higher* than the received carrier on the broadcast band, is *lower* than the received carrier on the high-frequency band. Again we repeat that the reason for this is that the operation of the receiver is such that the oscillator frequency is lower than the received carrier frequency. The shift of the image is shown in Fig. 2.

In this type of receiver only the radio-frequency and mixer circuits are changed when bands are switched. The oscillator

(*Please turn to page 17*)

Waveform and Harmonics

(*Continued from page* 14)

also cause the waveform to become asymmetrical? In order to establish this, a 1000-cycle fundamental wave, shown in Fig. 7, is combined with a 3000-cycle wave, shown in Fig. 8, and the resultant wave, representing the combination of this fundamental and its third harmonic, is shown in Fig. 9. It is apparent that as in the previous case, the composite waveform is distorted—that is, differs markedly from the original sine waves. In contrast to the effect of the second harmonic, the presence of only the odd harmonic does not destroy the symmetry of the wave. The wave of Fig. 9 possesses a type of symmetry, such that if the lower half of the wave were folded over at an imaginary horizontal reference line, as shown in Fig. 1, this half of the wave would be identical in shape to the adjacent positive half of the wave. This type of symmetry is known as *mirror-symmetry* and is characteristic of current or voltage waves which have only odd harmonics. When a wave has this type of symmetry between positive and negative peaks, it definitely establishes that the wave does not contain any even harmonics. This is true, irrespective of the phase relation between the fundamental and the harmonics. However, the presence of both even and odd harmonics alters the character of the composite wave in such manner that it lacks this mirror-symmetry. This is illustrated in Fig. 10, wherein the fundamental of 1000 cycles is mixed with a 2000-cycle and a 3000-cycle voltage, so as to simulate a fundamental and its second and third harmonics. The composite wave shows the absence of mirror-symmetry.

There are, of course, an unlimited number of combinations of harmonic frequencies for a given fundamental, and each of these resultant waves will be different in waveform, depending upon the number of the relative amplitudes and the phase relation of the respective harmonics. We have given several illustrations above, but, unfortunately, do not have space to go into greater detail. However, we feel that enough has been shown to bring out the following points: *That the waveform is very intimately tied up with harmonics; that the pure sine waveform is the only one which does not contain any harmonic frequencies; and that any departure from the pure sine waveform, no matter how it is brought about, implies that the wave contains frequencies, in addition to the*

(*Please turn to page* 18)

Superheterodyne Oscillator Innovations

(*Continued from page* 15)

circuit remains unchanged and is maintained intact for both the broadcast and the short-wave bands. This is shown in Fig. 3.

The second variety is that which is used in the RCA T5-2 receiver. In this set the tuning range of the oscillator circuit re-

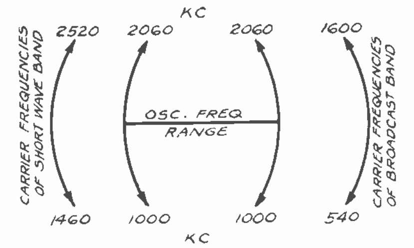


Fig. 3. The same range of oscillator frequencies is used for both the broadcast and s-w. bands in some Stewart Warner sets.

mains intact, but when the radio-frequency circuits are set for the short-wave band, the heterodyning frequency is the second harmonic of the fundamental oscillator band. This is shown in Fig. 4. For example, the broadcast range of the receiver is from 540 to 1720 kc. With an

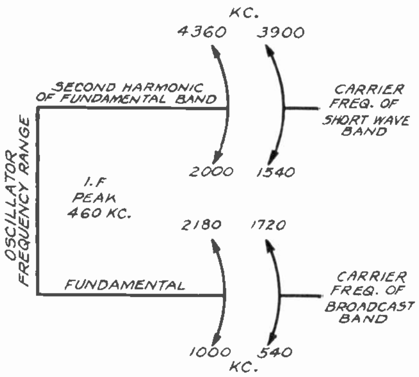


Fig. 4. The second harmonic of the oscillator frequency is used for heterodyning on the s-w. band in certain RCA receivers.

intermediate frequency of 460 kc. and the oscillator frequency *higher* than the carrier frequency, the heterodyning frequency band extends from 1000 to 2180 kc. The short-wave band range is from about 1540 kc. to approximately 3900 kc., and this band is heterodyned by the second harmonic of the fundamental range of the oscillator, namely by frequencies of from 2000 kc. to 4360 kc. This band represents the second harmonic of the fundamental range of from 1000 to 2180 kc.

•

Life is accustomed to give nothing to a man without a world of toil.

—*Horace.*

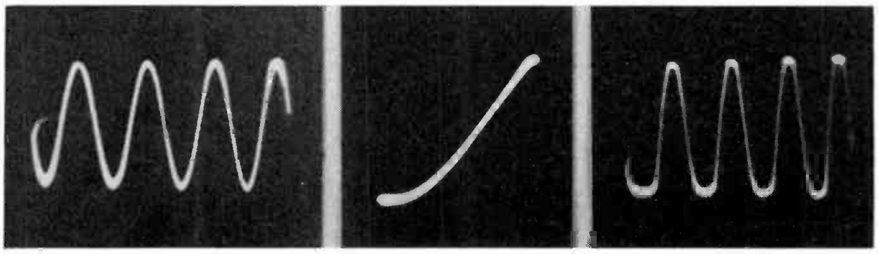
Waveform and Harmonics

(*Continued from page* 16)

fundamental, which are in harmonic relation to the fundamental.

Harmonic Distortion in Audio Amplifiers

Perhaps a few words relating to the previous paragraph may be of interest. It is possible, in the operation of a radio receiver or an amplifier, to alter the character of a wave of voltage by improper operation of the vacuum tube. Although a sine wave of voltage is fed into the tube, a complex wave of voltage may be taken out by whatever device is connected in the output circuit of the tube. Distortion of the wave may be accomplished by under-biasing or over-biasing and the result will be an output wave of voltage different in character from the sine wave input. An analysis of this output voltage will show the presence of the original fundamental fed into the tube and harmonic frequencies. An illustration of just what we mean is shown in Figs. 11, 12 and 13. Fig. 11 is a sine wave of voltage of approximately 1000 cycles, which is fed into an amplifier, which has an operating characteristic similar to that shown in Fig. 12. Note the bend in the lower portion of this characteristic and the slight bend in the upper end. The resultant output voltage for the 1000-cycle sine wave fed into this amplifier, is shown in Fig. 13. Note a slight flattening of the positive peaks of this wave, and the very definite flattening of the negative peaks. Such a wave can be resolved to show the presence of a number of different harmonics. As a matter of fact, this wave illustrates the presence of a definite second harmonic.



The sine wave of Fig. 11 was put through amplifier, whose operating characteristic is shown in Fig. 12. The wave of the output voltage is shown in Fig. 13. Compare with Fig. 11 and notice the distortion

Now just what does this mean as far as the quality of reproduction in the usual case where the amplifier works into a loud speaker? Under these conditions let us assume that the wave shown in Fig. 11 represents a pure 1000-cycle tone. From the discussion just given, we can see that the output of the speaker will contain not only this 1000-cycle tone, but, in addition, harmonic frequencies introduced as a result of the bend in the tube characteristic. Specifically it means that the speaker will be reproducing tones which were not present in the signal fed into the amplifier. This is appropriately called *harmonic distortion*.

Up to this point we have shown the connection between waveform and harmonics. We should like to leave with you some physical picture as to the mechanism by means of which a current can contain several frequencies at the same time. How, for example, can an ordinary oscillator, which is generally said to be oscillating at one frequency, be producing additional harmonic frequencies at the same time? It is easy enough to see how because of the operating conditions the waveform of the oscillator may depart from that of a pure sine wave—that is, how it may be a complex wave. We just saw this in the case of the oscillograms of Figs. 11, 12, and 13, which showed the effect of operation over the non-linear portion of the characteristic. Having established that the waveform of an oscillator may be complex or distorted under certain conditions, it follows that the wave must contain harmonic frequencies. This we clearly illustrated when we combined harmonic frequencies with a fundamental sine wave and showed that this produced a complex wave. In the same way, it follows that *whenever a waveform is caused to change from a sine waveform to a complex waveform, that change is simultaneously accompanied by a generation of harmonic frequencies.* As far as the motion of the electrons, which of course constitute the current, the fact that the waveform is different from the sine waveform simply means that the motion of the electrons at the fundamental frequency is modified, so that in addition to oscillating or vibrating at the fundamental frequency there are superimposed additional "wiggles" or vibrations at the harmonic frequencies. It is these vibrations at the harmonic frequencies, which are responsible for the distortion of the waveform.

Silvertone 1822, 1831

In some receivers carrying these model numbers a felt ring between the small speaker and the baffle was omitted, with a rattling of the speaker resulting. This is due to the fact that when the mounting screws of the speaker draw the speaker tightly against the baffle, the speaker frame may become slightly bent, throwing the cone off center. The felt ring acts as a cushion mounting to prevent this bending. Do not tighten the mounting screws any more than is necessary. If this felt ring is missing, one should be inserted, its part number being R9959.

●

Silvertone 1904, 1906, 1908, 1911, 1914, 1938, 1954, 1964, 1984

Several changes have been made in the chassis used in the above models and they should be noted on the schematic, appearing on *Sears page 6-45 of Rider's Volume VI.*

The resistor, Rl, has been changed from 30,000 ohms to 40,000 ohms. R3 has been increased from 5000 to 20,000 ohms. R5 has been decreased from 50,000 ohms, 0.5 watt, to 25,000 ohms, 1 watt. This last change was made to correct motorboating that was sometimes experienced on the s-w. band "C," due to the 6A7 tube variations.

A tone control circuit has been added. One side of a 0.02-mf. condenser is connected to the lead coming from the grid of the 6F6 to the 200,000-ohm resistor, Rll, and the other side of this condenser is connected to one side of the 500,000-ohm tone control. The variable arm is grounded.

A condenser, 0.1 mf., 300 volts, has been shunted across the 8-mf. condenser, C20.

Metal glass tubes are used in the i-f., a.v.c., and output stages. These tubes are the same types as shown on the schematic in *Rider's Volume VI.*

Note the added model numbers above that should be included in your Volume VI index.

●

Correction

On page 2 of the January, 1936, issue of Successful Servicing, the third line of the second paragraph in the left-hand column should read, "one of the type which has a *high* input impedance."

●

Talents are absolutely nothing to a man unless he have the faculty of work along with them.
—*James Russell Lowell.*

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Suppose you have an Atwater Kent Model 155 on your bench and you want to find out some-thing about the circuit. You look in your Index to Rider's Manual, Volume VI and see that the sche-matic of the early type is on A-K. page 3-179 and that of a second type is on the page following. You check up on the serial number of the set and find that it is above 7,086,900 and then you notice that there is a *third type,* with serial numbers above 7,088,700, the schematic for this type being on A-K. page 4-1. If these three types were not indexed in this way, you would have to compare each of the schematics with the set itself and that is one sweet job—for you, but *not* for me.

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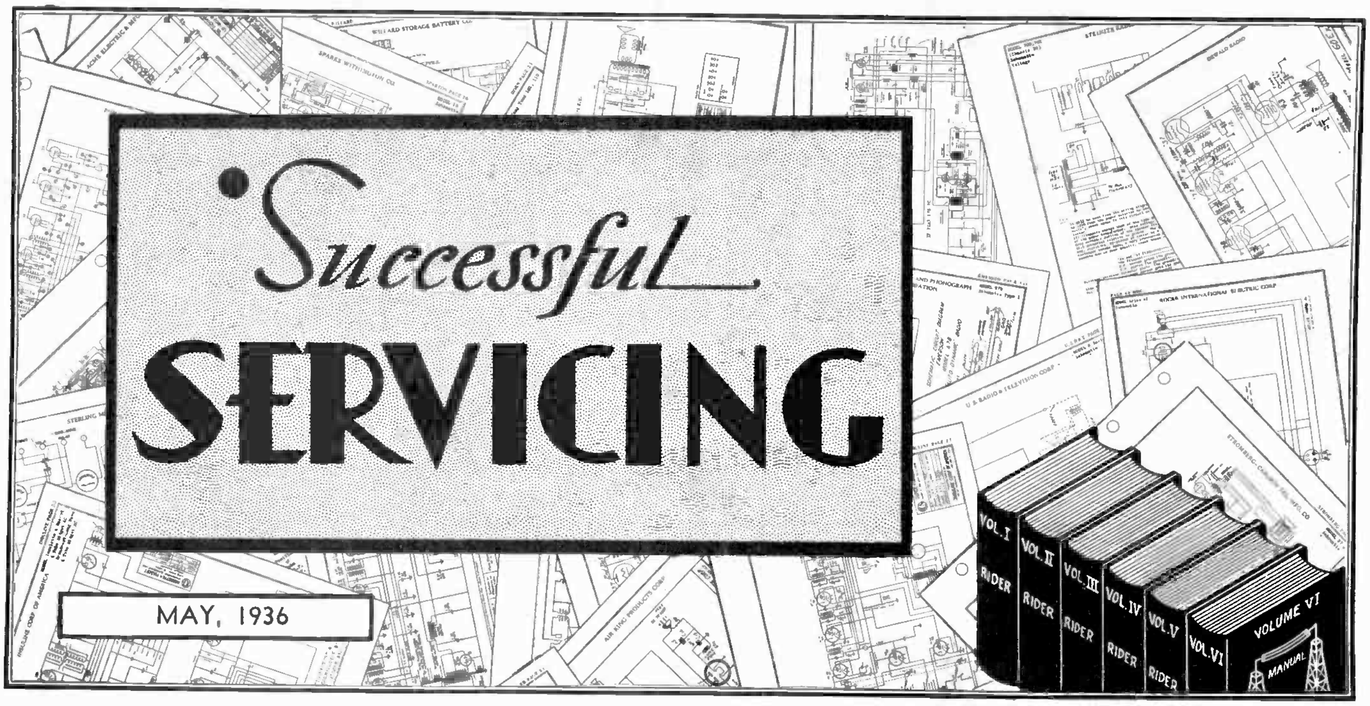


EXAMINE THE SCHEMATIC BEFORE SERVICING

The Importance of Familiarizing Yourself with the Circuit

By JOHN F. RIDER

WHAT do you do when a receiver with which you are not thoroughly familiar is brought into your shop for service? If your actions are like those of ever so many servicemen, you begin the process of servicing by connecting the receiver to the power supply line, and taking measurements of various kinds. . . . Of course, we are not certain of this, but more than likely you give very little thought to the value of the schematic wiring diagram as an essential part of the servicing operation. . . . This in itself is not strange, because like all human beings we learn to take certain things for granted, and being creatures of habit, we seldom deviate from a selected path.

Be that as it may, we still feel that one of the best ways to get off to a good start when servicing a receiver, is to familiarize yourself with what is in the receiver. This means an examination of the schematic diagram. We make this statement with but one reservation: if you are familiar with the receiver in question, have already worked upon it, know the circuit arrangement, and are familiar with special features—then it is not necessary to study the diagram. . . . If, however, you are not thoroughly familiar with the set, then, by all means, devote the required few minutes to learn the pertinent facts concerning the electrical structure. The extent of your technical knowledge enters into this problem only in that the more you know, the more easily can you analyze the diagram. As a matter of fact, we hazard this statement, that even the finest of engineers, if called upon to service a strange receiver, would first of all examine the wiring diagram. The purpose of this article is to indicate in a general way the lines along which such investigation of the schematic diagram should be made.

In connection with this discussion we assume that you possess the schematic. Where you secure the schematic makes no difference—just so long as you have it. In general, there are two occasions when you find the need to refer to the wiring diagram. The first is the preliminary operation to establish the particular structure of the receiver. This precedes the actual analysis of the receiver itself; that is, the actual localization of the defect. The second occasion is after having localized the defect, you then refer to the schematic to establish the actual components employed in that part of the receiver which contains the defect. As you see, the first occasion is general, whereas the second is specific.

The preliminary inspection of the schematic diagram should not consume very much time. As previously stated, the more thorough your technical grounding, the more rapidly can you interpret what you see. At any rate, it is perfectly fitting and proper to devote at least ten minutes to the general inspection of a wiring diagram. More often than not you will discover certain peculiarities in the circuit combinations used in the receiver, which, without recognition, would normally complicate your test and result in a great loss of time. . . . Is it not better to devote a few minutes at the start of the test to the inspection of the diagram, and thus minimize the time required for the analysis of the receiver itself? We assure you that the time saved in analysis will more than compensate for the time spent in the inspection. This statement is not a matter of theory but actually the result of practice.

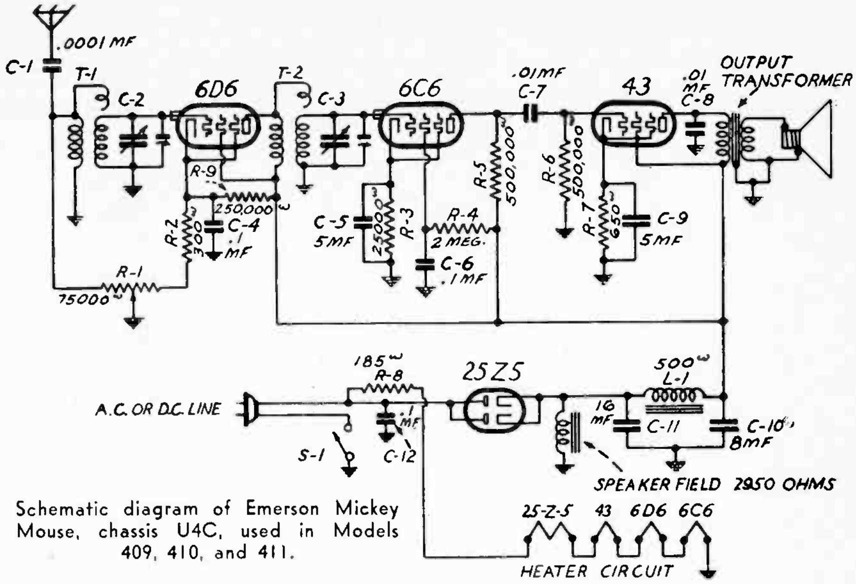
Types of Receivers

What is the first thing to check when you examine a schematic? It is our belief that you should first establish the type of receiver. . . . Is it a TRF receiver, or is it a superheterodyne? As you no doubt know, the kinds of tests which you can make upon receivers are influenced by the type of receiver. Inasmuch as the distinction between a TRF

(Please turn to page 3)

A New Mickey Mouse

Emerson has announced a new chassis, the U4C, for their Mickey Mouse receiver, models 409, 410 and 411. The original chassis, the A4, that was employed in models bearing the same numbers, was shown on *Emerson page 4-8 in Rider's Volume IV*. No confusion should result in identifying these models, as the tube complement is entirely different.



Schematic diagram of Emerson Mickey Mouse, chassis U4C, used in Models 409, 410, and 411.

Voltage:

Tube	Plate	Screen	Cathode	Fil.
6D6	100	102	3	6.3
6C6	30	21	2	6.3
43	95	101	13	25.0

The voltage across the speaker field (from the 25Z5 cathode to chassis) is 118 volts. The voltage across the choke (25Z5 cathode to the screen of the 43 tube) is 16.5 volts. The line voltage for the above readings is 117.5, 60 cycles, a.c.

Alignment:

Rotate the variable condenser shaft 25 degrees from the *minimum* position. This may be done by affixing a protractor, or a similarly calibrated scale, to the condenser shaft. With the condenser in this position, feed a 1425-kc. signal to the antenna and adjust both trimmers on the variable condenser for maximum response. Use as weak a signal as possible.

In the early production of these receivers, R-9, was omitted and R-4 was a 500,000-ohm carbon resistor.

Fada 1462

The later production of this model has been changed from that schematic shown on *Fada page 6-19 of Rider's Volume VI*. The 6C5 tube has been removed and a 6H6 added, the latter supplying delayed a.v.c. action. The accompanying schematic shows that portion of the circuit that has been changed, beginning with sets above serial number 22,102.

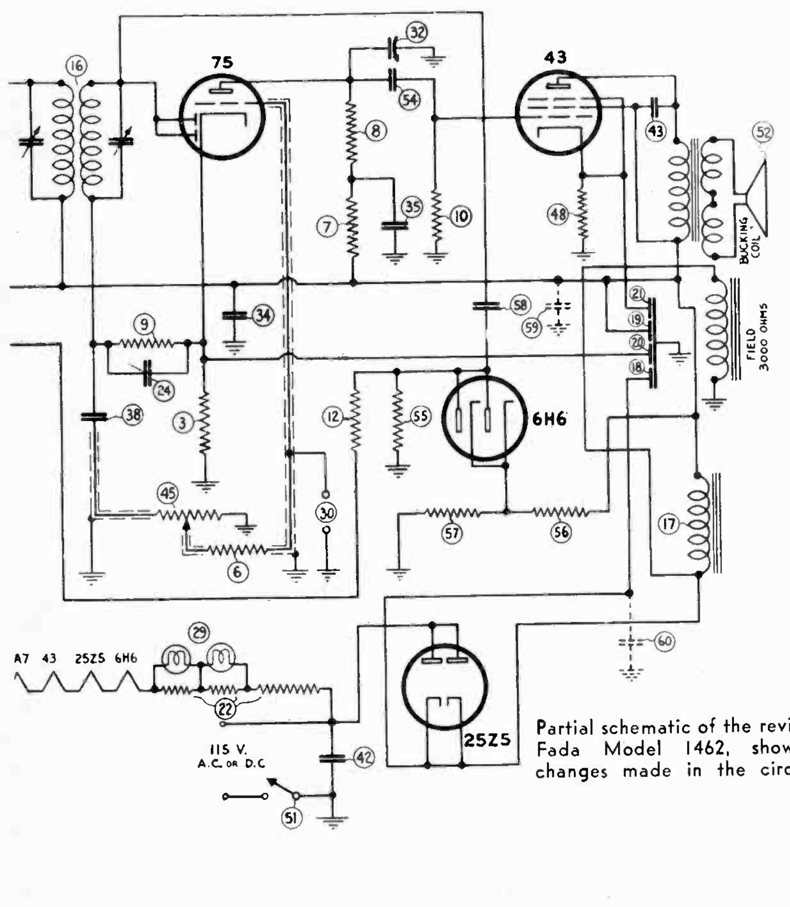
Note that the 1.0-m.f. condenser, No. 33, on the early model has been removed from across the 10,000-ohm resistor, No. 3, in the cathode circuit of the 75 tube. The condenser block, Part No. 20.1, comprising condensers Nos. 18, 19, 20 and 21, has been changed to Part No. 20.36. Condensers Nos. 18 and 19 are still 16 mf. but Nos. 20 and 21 are now 5 mf. instead of 4 mf. In this block the blue leads go to the 16-mf. sections and the red leads go to the 5-mf. sections. The green lead is the common to the 16-mf. condensers; the black lead to the 5-mf. condensers. Carbon resistors have been substituted for wire-wound types in Nos. 47, 48, and 49 with values of 350, 625 and 250 ohms respectively; the part numbers for these three resistors are 30.48, 30.47 and 30.45 respectively.

The values of the new parts used are as follows:

Circuit No.	Value	Part No.
55	500,000 ohms	30.5
56	250,000 "	30.4
57	10,000 "	30.2
58	0.0001 mf. (mica)	15.3
59,60	8.0 mf.	20.25

The three resistors are carbon type. The two 8-mf. condensers are for 25-cycle operation only.

In the first models of the revised circuit, resistor No. 56 was 50,000 ohms, this having been changed to the value stated above.



Partial schematic of the revised Fada Model 1462, showing changes made in the circuit.

Examine the Schematic

(Continued from page 1)

receiver and a superheterodyne is found ahead of the demodulator tube, you would examine the portion of the receiver between the antenna and the demodulator. . . . If it is a TRF receiver, you would establish, as a matter of information, the number of r-f. stages used,

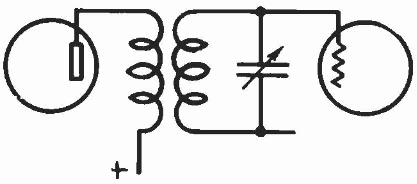


Fig. 1. A conventional r-f. transformer with tuned secondary that is used in TRF receivers.

also the type of r-f. stages, that is, the types of r-f. transformers. Are they transformer coupled, using the conventional single tuned circuit, such as shown in Fig. 1, or do the transformers employ both inductive and capacitive coupling, such as shown in Fig. 2? Is there a band-pass preselector stage, using dual tuned three winding transformers, such as shown in Fig. 3? If it is a superheterodyne receiver, it is identified by the fact that a second detector is used and also an oscillator. Does the receiver use a preselector or is there no tuned stage ahead of the mixer tube? Does it use a single tube as a combination mixer and oscillator or has it a separate oscillator tube? Is the mixer circuit of the type wherein the oscillator winding is in series with the i-f. transformer winding, as for example in Fig. 4, or is the tube of the 6A7 variety, wherein a separate set of elements is used for the mixer function and a separate set of elements is used for the oscillator function? . . . Is the receiver a multi-band job, or does it cover a single band? If it is a multiband receiver, how many bands? . . . If it is a multi-band receiver, are all the tubes in the circuit on all bands, or are some tubes cut out,—as is commonly done in a number of different modern installations? . . . If it is a multi-band receiver, is the oscillator circuit changed simultaneously with the preselector, or

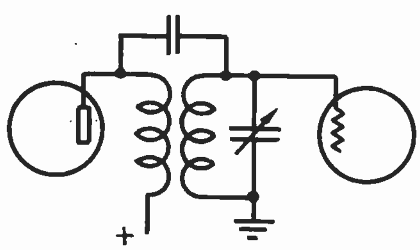


Fig. 2. An r-f. transformer which has both inductive and capacitive coupling.

mixer stage? Information of this type is of great value in connection with alignment operations.

If the receiver is a superheterodyne how many i-f. stages does it have? As a rule, the number of i-f. stages in a superheterodyne receiver is one less than the number of i-f. transformers employed. As a rule, a receiver with three i-f. transformers consists of two stages of i-f. amplification. Is the superheterodyne receiver arranged for high fidelity operation; in other words, does the i-f. amplifier have a selectivity control? There are various types of such controls. One consists of a variable resistance in the third winding of the i-f. transformer, such as is shown in Fig. 5. Another may employ a switching arrangement, whereby additional coils are brought into place when the selectivity is changed. (See Fairbanks-Morse, model 100, diagram

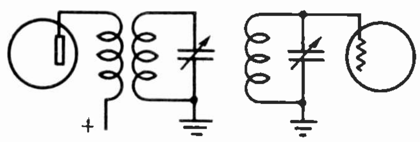


Fig. 3. An example of a pre-selector stage, using a three-winding transformer, two of the windings being tuned.

on page 2, November, 1935, SUCCESSFUL SERVICING. Also, Wells-Gardner, ODM diagram, page 1 of the same issue).

A V C and Noise Suppression

Does the receiver incorporate automatic volume control or is there r-f. or i-f. manual control? Is the AVC and detector action performed in the same tube or are separate tubes employed for these functions? . . . Information of this type is extremely valuable, because it aids in the interpretation of what voltages are established at the different terminals of the tube circuits and in many cases, it is necessary to make point-to-point tests instead of regular plug-meter type measurements.

You are interested in knowing if the demodulator or second detector in a superheterodyne receiver or the detector in a TRF receiver acts as a demodulator only or does it also perform the function of an audio amplifier, as, for example, in some of the duo-diode triode type tubes. In view of the fact that in some receivers which employ the duo-diode triode type of tube, oscillator action is incorporated in a separate tube, whereas in other receivers this type of tube acts as a demodulator, audio amplifier and AVC tube, it is necessary to know what roles are being performed by the tube so as to expedite testing. You should be

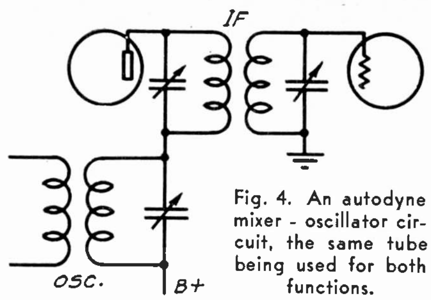


Fig. 4. An autodyne mixer - oscillator circuit, the same tube being used for both functions.

interested to establish if the receiver employs reflexing, as, for example, the 6B7 shown in Fig. 6.

The presence of interstation noise suppressor systems influences the voltage analysis, because under certain conditions the noise suppressor system will develop low operating voltages at the tube elements, whereas in other cases it will develop high operating voltages. Time and again troubles develop in these systems and result in a condition similar to that of a dead receiver. If, for some reason the noise suppression system is continually operative, there will be no signal in the output of the receiver. An excessive voltage drop across some one resistor, related to the noise suppression system, will cause confusion in the analysis of the receiver, unless you realize that a noise suppression system is used and that the voltage being measured is related to this system.

Bias Systems

Modern receivers employ a varied number of bias arrangements. They differ in the manner of developing the bias voltage. Unless you have some idea how the bias voltage is developed and how it is applied to the various tubes, you will not be able to interpret properly voltage measurements made between certain common reference points. You may have difficulty, because in some cases the bias voltage is applied to the control grids of the tubes through higher resistance units, as shown in Fig. 7. Then again, it is possible that the bias voltage for the audio system may be developed across a filter choke in the

(Please turn to page 18)

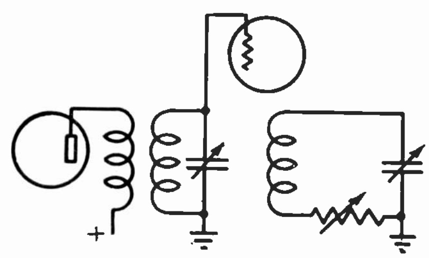


Fig. 5. One type of selectivity control is to have a variable resistor in series with the third winding of the i-f. transformer.

DeWald 609

In order to eliminate blasting effects, several changes were made in the DeWald model 609, the schematic of which appears on *DeWald page 6-11 of Rider's Volume VI.*

The resistor R-2 and the condenser, C-5, in the cathode circuit of the 6A7 tube were removed and the junction of the cathode and R-3 was connected to the junction of the 6K7 cathode and R-1, the volume control, which has a resistance of 25,000 ohms. A resistor, R-10, has been added and is shunted across the volume control; R-10 has a value of 3,000 ohms.

Originally the secondaries of the i-f. transformers, L-4, were grounded. These are now connected together and run to one end of a 500,000-ohm resistor, R-11. The other end of R-11 is connected to the grounded end of R-9 in the cathode circuit of the second detector, 6J7. A 0.05-mf. condenser is connected between this same point—the grounded end of R-9—and the formerly grounded ends of the i-f. transformers' secondaries.

Zenith 811, 862, 865, 866, 1162

The model 811 (Chassis 5609) employs a 6-inch speaker, Part No. 49-93; models 862 and 1162 (Chassis 5610) use a 12-inch dynamic speaker, Part No. 49-94. The schematic shown on *Zenith page 6-5 in Rider's Volume VI* is used in both of these chassis. Below will be found a sketch showing the locations of the trimmers and the tube sockets.

Alignment:

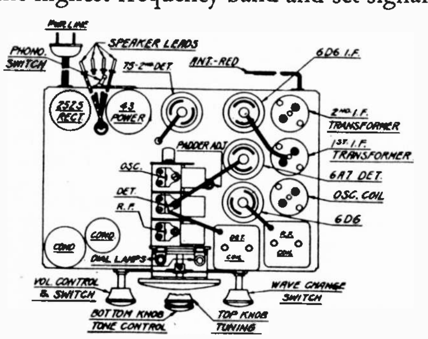
Balance i-f. transformers at 252.5 kc. with signal generator connected to the grid of the 6A7 and the chassis ground.

Adjust wave-trap padder (located beneath the chassis at rear right side) for weakest signal with 252.5 kc. signal generator connected between antenna and ground.

Turn wave-band switch clockwise to the highest frequency band and set signal generator to 15 mc., still connected to the antenna and ground. Balance oscillator trimmer on gang condenser for correct dial reading at this frequency.

Turn wave-band switch counter-clockwise to standard broadcast position. Adjust broadcast oscillator trimmer (located beneath the chassis at the right center) for correct dial reading at 1400 kc. and adjust r-f. and 1st detector trimmers on gang condenser for loudest signal.

Set signal generator at 600 kc. Adjust oscillator broadcast padder through hole in top of chassis, simultaneously rocking the dial back and forth, for loudest signal.



Top view of the Zenith chassis 5609 and 5610, showing tubes and trimmers.

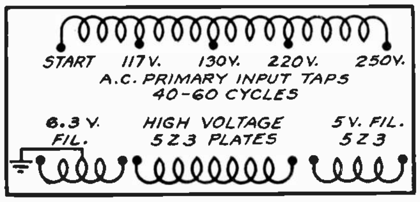
Hetro Air-Ace, Series M

Several changes have been made in the 9-tube receiver, whose schematic is shown on *Hetro page 6-15 of Rider's Volume VI.* The tube complement has been changed and is now as follows:

New Tube	Old Tube	Position
6K7	6D6	R.F.
6A8	6A7	Mixer-Osc.
6K7	6D6	1st-2nd I.F.
6R7	85	2nd Det.
6C5	76	A.F.
6B5	42	O.P.
5Z3	80	Rect.

Note. On models using glass tubes only, the 6A7 is used instead of the 6A8.

A new power transformer is used, Part No. P-836, instead of No. T-789.



Terminals for power transformer used in Hetro Air Ace, Series M.

The connections for this are shown in the accompanying sketch.

The resistor, R-7, in the cathode circuit of the output tubes, has been changed from 600 ohms to 250 ohms and is now known as R-17. The resistor, R-8, 700 ohms, in the cathode circuits of the i-f. tubes, has been changed to 250 ohms and is the same as R-1. Also the second i-f. tube cathode is no longer connected to the condenser C-2 and R-1, which was connected to the cathode of the first i-f. tube, but a condenser and resistor similar to C-2 and R-1, connects it to ground. The condenser, C-2, in the secondary circuit of the second i-f. transformer, has been eliminated and the secondary is now directly connected to ground, instead of R-2.

The input transformer to the output stage has been removed and a tapped a-f. choke substituted for it. The center tap is grounded, as was the secondary of the transformer formerly used, and each end goes to the grid of the 6B5 tubes. A 0.05-mf. condenser, C-4, replaces C-14, 0.1 mf., in the plate circuit of the 6C5.

The two condensers, C-15, 0.004 mf., have been removed from across the primary of the output transformer and one of them has been connected from the plate of the 6R7 to ground. The tone control, C-4 and R-15, has been moved from across the plates of the output tubes to the plate circuit of the 6R7. One side of C-4 is connected to the plate and the other side to one end of R-15. The arm of this resistor is connected to the junction of C-11 and R-11, which is grounded. R-15 has been changed to 500,000 ohms instead of 40,000 ohms and R-11 has been changed to 1500 ohms from 5000 ohms. R-14 in the cathode circuit of the 6C5 has been changed to 3000 ohms from 6000.

Philco 660

We have been advised by the manufacturer that trimmer No. 29, in Fig. 2 shown on *Philco page 6-40 of Rider's Volume VI,* should be labelled "Police" instead of "Standard" and trimmer No. 27 should be "Standard" instead of "Police."

The resistor, No. 47, shunting the Shadowmeter has been removed, as of November 1, 1935.

In Run No. 5 condenser No. 19, 0.05 mf. has been changed to 0.1 mf., Part No. 30-4170.

RCA R-34

This receiver is a combination of the chassis of the R-35 and the R-15 loud speaker. The service notes and schematic of the R-35 will be found on the following pages of *Rider's Volume I: Revised Edition, RCA pages 1-29 and 1-30; Early Edition, *523 and *524; and on pages 1856 and 1857 in the Rider-Combination Manual.* Please make these additions to your Rider Manual Index.

TRANSFERRING POWER EFFICIENTLY IN A.-F. AMPLIFIERS

Why Matched Source and Load Impedances are Necessary

If you have had occasion to work upon audio amplifiers, you no doubt have seen numerous references to the transfer of voltage or power between two points in a system. As a rule, that point which supplies the voltage or power, is known as the *source* and that point which receives the voltage or power, is known as the *load*. If you are talking about a vacuum tube as representative of a source of voltage or power—depending upon how the tube is used—then the plate circuit that is within the tube is classified as being the source and the circuit outside the tube is classified as being the load. If you speak about a generator which is producing power, then you would speak about the generator as the source of the power and the device which receives this power, as, for example, a motor—which requires the power for operation, as the load. If, for example, you talk about the output circuit of a public address amplifier, the output transformer, in particular the secondary winding, would be the source of the power and the voice coil would be the load.

A certain definite relation exists between the source and the load with respect to the amount of power which can be transferred from the source to the load. This relation plays an important part upon the efficiency as well as the distribution, in the event that you are working with the electrical equivalent of sound. The relation we speak of depends upon the relative impedances of the source and the load. There are three possible impedance relations which may exist between the source of power of voltage and the load applied. One of these relations is when the impedance of the source is greater than the impedance of the load. The second relation is when the impedance of the load is equal to the impedance of the source. The third relation is when the impedance of the load is greater than the impedance of the source.

The effort to select an impedance for the load which will bear the proper relation to the impedance of the source, so that the desired operating conditions exist, is what is known as *impedance matching*. There are a great number of variations of impedance matching. At this time we are going to concern ourselves with the effect of impedance matching upon the transfer of power.

A simple illustration of the electrical structure, comprised of the source of voltage and the load, is that shown in Fig. 1, wherein E represents the voltage, Z_S represents the impedance of the source, and Z_L represents the impedance of the load. This circuit is, in effect, the equivalent of the output stage of an amplifier, as shown in Fig. 2, wherein the impedance of the vacuum tube is Z_S, and the combination of the output transformer and speaker voice coil is the equivalent of Z_L or the load impedance. E, in Fig. 1, is the equivalent of the signal voltage fed into the vacuum tube,

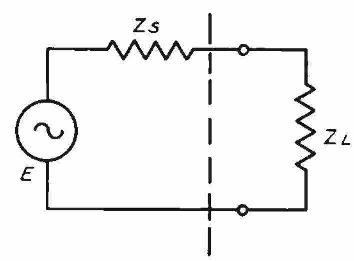


Fig. 1. E is the a-c. voltage source and Zs represents its impedance. Z_L represents the impedance of the load.

inclusive of whatever amplification takes place within the tube, so that E is really the amount of signal voltage available within the tube.

As you can see, the simplified version of the vacuum tube circuit, shown in Fig. 2, is the simple series circuit shown in Fig. 1. The voltage causes current to flow through this series circuit. Since the circuit is a series circuit, the current is the same in all parts of the circuit and a voltage drop is established across Z_S the impedance of the source, and Z_L, the impedance of the load. Since the load resistance is in series with the impedance of the source, and since the voltage E, which is available, is definitely fixed, it stands to reason that varying the value of Z_L will naturally change the amount of current flowing in the circuit, and will also vary the relative values of the voltage drop across Z_S and Z_L.

The voltage, which is dropped across the impedance of the source itself, is naturally lost, since it takes place within the device which supplies the voltage. The only voltage which can be used, is that developed across Z_L. Now we know that the relative voltage drops across resistors used in a series circuit depends upon the relative values of these resistors. If we make Z_L greater than Z_S. the greatest amount of voltage will be developed across Z_L, and the minimum amount of voltage will be lost across Z_S Thus, from the viewpoint of taking the greatest amount of voltage out of a vacuum tube, we would make the load impedance many times as great as the impedance of the source. However, in the output system of an amplifier, we are concerned with the transfer of power rather than voltage. This means that we are concerned with the flow of the maximum amount of current and voltage in the load circuit, rather than the presence of the maximum amount of voltage across the load impedance.

At first glance it would seem as if the best method of getting the greatest amount of current flow through the entire circuit is by making Z_L very small. Such is actually the case, but since power is a function of current squared times resistance, the optimum condition is to secure the maximum amount of current through the highest value of resistance. Since we are interested in taking power out of the tube, it stands to reason that we desire the load resistance to be the highest value and still secure the maximum amount of current through it. If the impedance of the source is the higher of the two impedances, then the greater amount of power is lost in the source.

Because of the characteristics of a series circuit with respect to voltage, current, and resistance, the maximum

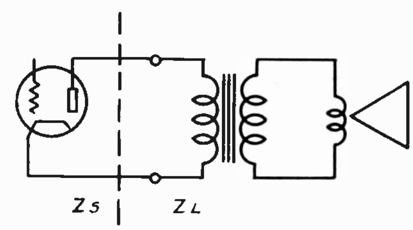


Fig. 2. In this output circuit Zs is the impedance of the tube and Z_L is the load impedance, represented by the transformer and voice coil of the speaker.

amount of power, which means the maximum amount of current consistent with the highest value of resistance, is developed across the load impedance Z_L when its numerical value is equal to the impedance of the source. When this condition exists, the voltage E is divided equally between the impedance of the source and the load impedance. This means that half of the total voltage available is lost across the impedance of the source and half of it is available across the load. *Hence maximum power can be taken from a tube when the im-*

(Please turn to page 22)

Westinghouse WR-21

Intermittent oscillator operation in this model may be due to a high resistance ground return in the oscillator coil. The coil is grounded through a spade terminal, this being one of the two spade terminals mounting the coil in its aluminum can. The can is riveted to a strap which in turn is screwed to the chassis. Apparently the oxide film on the aluminum causes the high resistance contact and the consequent intermittent operation. The repair can be made by drilling another hole in the can bringing out a ground wire. The schematic for this receiver will be found on *page 5-2 in Rider's Volume V*.

●

Fada 1463

This receiver is identical with model 1462, except that it covers three wave bands instead of two. The accompanying schematic diagram shows the revision of the antenna and oscillator circuits. The changes noted elsewhere in SUCCESSFUL SERVICING for Model 1462, (i. e. the inclusion of the 6H6 tube and circuits) also apply to this model, the rest of the schematic being the same as that shown on Fada *page 6-19 of Rider's Volume VI*.

If you will compare the accompanying schematic with that on page 6-19 it will be seen that for the most part, the values of the parts are the same. In this case, the same numbers are employed in the list of parts, although the reference numbers are different. Note the changes in the resistances of the antenna and oscillator coils, as shown in the sketch.

●

Silvertone 1822, 1831, 1824, 1830

A simple circuit change will correct noisy volume controls. Its effect is to remove the d-c. diode current from the volume control and in practically all cases, it will be found that the trouble will be corrected without changing the volume control. However, if the volume control is replaced, the circuit change should be made in addition to prevent noise difficulties.

Connect a 1-megohm resistor across the outer terminals of the tone control, as indicated in Fig. 1, the schematic, and Fig. 2, the wiring diagram.

Unsolder the two leads from the ungrounded outer terminal of the volume control and solder both these leads to one side of a 0.02-mf. condenser. Connect the other side of this condenser to the volume control terminal from which the two leads were removed.

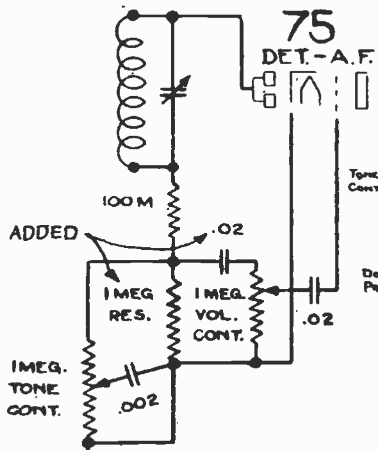


FIG. 1

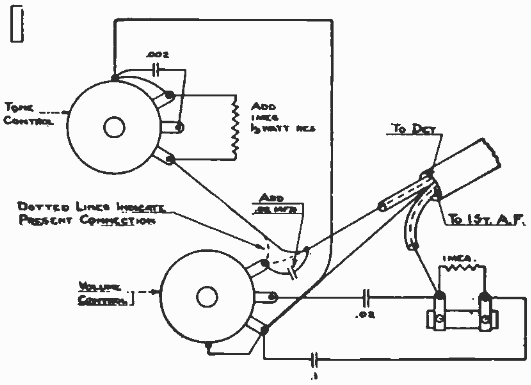
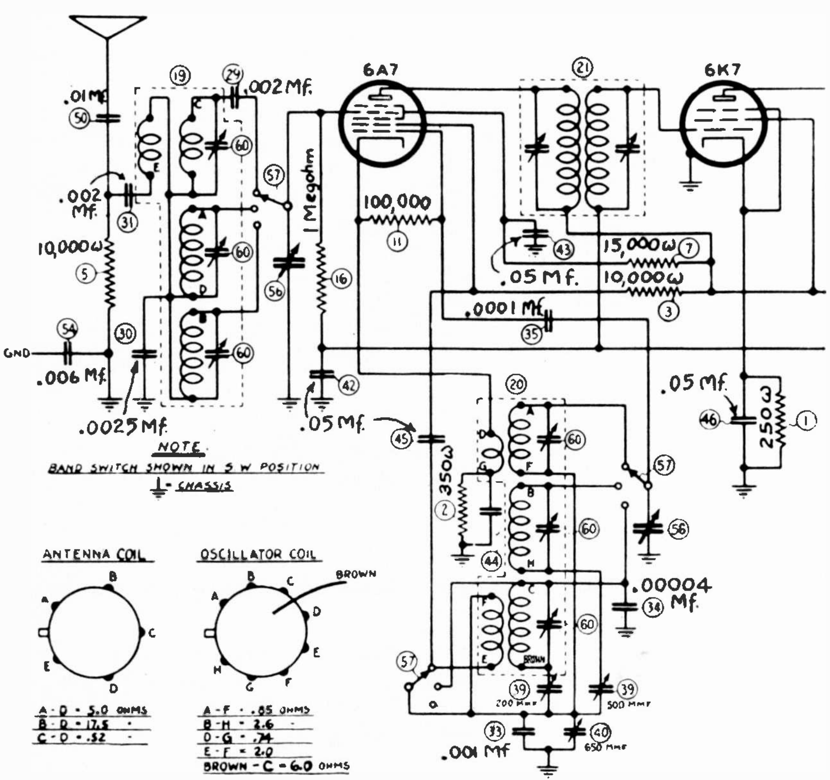


FIG. 2

By the addition of a 1-megohm resistor and a 0.02-mf. condenser, as shown in the diagrams above, noisy volume controls are quieted in these Silvertone sets.



Fada Model 1463 is the revised Model 1462. This schematic shows the partial circuit for the new 1463, which is for three wavebands.

●

Sparton I-F. Peaks

The following receivers manufactured by Sparks Withington have an i-f. peak of 172.5 kc.:

Models 9-X, 13, 14-A, 15-X, 16-AW, 17, 25-X, 27-X, 28, 30-A, 33, 34, 35, 36, 111-X, 620-X, 750-A, 750-X, 870-A, 870-X.

The following Sparton models have an i-f. peak of 456 kc.: 71, 71-B, 81, 82, 333.

Model 60 has an i-f. peak of 900 kc.

Note: The s-w. converter in Model 16-AW operates on an intermediate frequency of 900 kc.

It is suggested that you write these i-f. peaks on the schematics for these models in your Rider Manuals.

●

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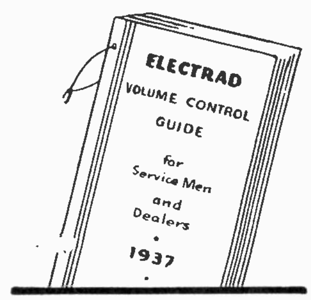

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Dedicated to financial and technical advancement of the radio service man.

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Vol. 2 May, 1936 No. 9

REFRIGERATION SERVICE

THE general consensus of opinion among receiver manufacturers who have entered the refrigeration field is that it is easier to teach refrigeration service to a radio serviceman than to teach radio service to a refrigeration serviceman. . . .

There was a time, several years ago, when the general belief was rampant that refrigeration servicemen could not be drawn from the ranks of radio men. In other words, the refrigeration serviceman was an individual of one kind and a radio serviceman was another kind. It was felt that in order for an individual to be a competent refrigeration serviceman, it required weeks and weeks of training in the refrigerator manufacturer's plant, and it was necessary that he have a mechanical leaning.

According to conversations we have had with various radio and refrigeration service managers and with the service managers of large retail outlets handling refrigerators as well as radio receivers—such training is not imperative and they found it feasible to select the better radio men—the men with alert minds—and to teach them refrigeration service. About two years have elapsed since this experiment was tried and these men feel that the results justify the conclusion that refrigeration servicing is within the province of the radio serviceman.

Take this for what it is worth to you.

●

2,985,000 Recommendations

According to the statements of 2,096 independent servicemen, including full-time and part-time workers, we estimate that each of the 15,000 independent servicemen, who were questionaired in the recent Rider Survey, were asked 199 times during 1935 to recommend the purchase of some receiver by their service customers.

According to these figures, these 15,000 independent servicemen made 2,985,000 recommendations during 1935. Who is there who can doubt the influence of the radio servicemen upon the sale of radio receivers in America? . . . Day by day the influence of the servicemen is becoming greater and greater in the radio receiver field.

●

64.2% Sell Receivers

And furthermore, according to the answers of 2,633 independent servicemen, we estimate that of the 15,000 independent servicemen, who were questionaired in this same survey, 64.2% or 9,630 sell radio receivers.

According to information received, these 9,630 men, who sell radio receivers, employ one or more working arrangements. Some of them have a working arrangement with the retail dealer on a commission basis. Others secured the receivers from the manufacturers' distributors or from the retail dealer with the distributor's cooperation. Some sold custom-built sets, which, we believe, mean the products of those manufacturers who advertise their receivers as being custom-built receivers rather than receivers built at home. Finally some of the independent servicemen carried a small stock of new receivers.

●

They'll Pay the Price

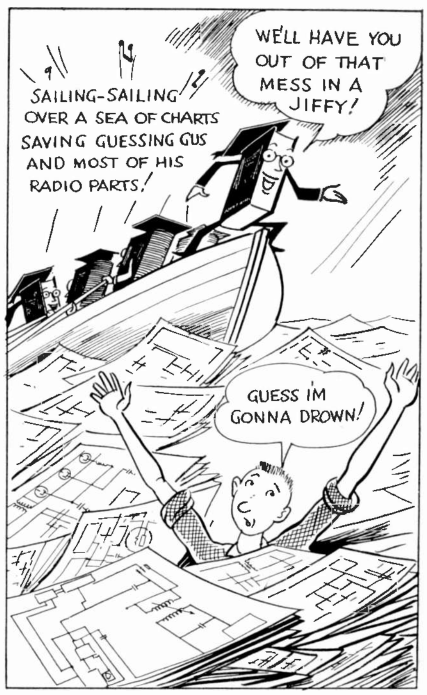
We recently received the shock of our lives—fortunately one which delighted rather than killed. We visited in Buffalo, New York, and spoke at a meeting of the Associated Radio Engineers of Buffalo. . . . Buffalo is quite close to the mill area, and a great many of the wage earners, living in Buffalo, N. Y., and such towns as Depew, Lancaster, Lackawanna, Tonawanda, are within the wage-earning class. Yet the members of this Association have established *a minimum service charge of $4.50,* exclusive of parts but inclusive of pickup and delivery. Some time ago the rate was around $3.50, and the price was "jacked" up, because the men realized that they were not making money. . . . Strange as it may seem, the men also learned that they could get the price of $4.50 and the analysis of the financial picture was that the men are still not making the required amount of profit on their jobs. It is the consensus of opinion among the men that they are going to raise their minimum service charges (inclusive of pickup and delivery, but not including parts) to $6.00 and $6.50. The ideas of the Buffalo group are concurred with by the servicemen of Jamestown.

These men realize that when it is necessary to exact a certain charge in order that the business earn its justified profit—there can be no quibbling or hesitation! Each and every man in the group experienced a reduction in business when the prices were originally raised, but they stuck to their guns and after awhile their business at the higher prices reached the volume they had at the lower prices. It most certainly gave us pleasure to talk to one man in particular, who had made servicing sufficiently profitable to be able to spend $500.00 for a test bench, fully equipped—and still be able to say that he can meet all of his obligations on time and still have money left in the bank.

These figures are far above the average in the forty-eight states of the Union, which was definitely established by our recently conducted survey, but it also shows that if the men in a community can be convinced to see the business of servicing from the businessman's angle—deliver the money's worth for the charge made—have the courage to ask the charge, the customer who wants his receiver serviced will pay the price.

JOHN F. RIDER.

RIDER'S LIFE SAVERS



I REMEMBER——
the first **auto radio** I ever saw—in 1922—at Quincy, Ill.—a youngster yclept *"Bill" Lear* made it—a crude thing, compared with present day jobs. "Bill"is the brilliant youngster, now famous as the inventor of the "Learoscope", a homing compass used for "blind" flying. ***"Bill" sure started something in 1922 . . .*** The RMA Radio Show—1929 in Chicago—everybody talking about the "marvelous NEW screen grid tube"—***seems silly NOW, doesn't it????*** . . . when radio receivers were sold without tubes . . . when DX was SUMP'N! . . . when I spent over $300.00 for a kit of parts and tubes for a 13 tuber guaranteed to get LONDON—spent three weeks assembling it—and the *damb thing wouldn't perk* . . . The N. T. G. programs on WHN—first to introduce the "guest star" . . . the thrill I got when I finally assembled a set all by my own self—first words I heard were *"Alabama—twenty two for Underwood"* . . . when **Johnny Rider** was a radio feature writer on the New York Sun . . . when **Dave Sarnoff** was working in a minor capacity for the old Marconi Co.—*he's doin' all right now, I hear*——the funny looking loud speakers that were made up to resemble huge morning glories . . . when a "fair-to-middlin' " set cost from $300.00 UP (*Them was the happy days*) . . . when YOU stayed up until all hours trying to coax KDKA into your receiver—you finally brought it in, and bragged about it for a month, until you met a lad who brought in CALIFORNIA every night—***were YOU SQUELCHED!!!!*** . . . when I collected $17.00 for replacing a condenser and two resistors—and the customer THANKED ME! . . . when **Joe Burstein** (now of BURSTEIN & APPLEBEE, Kansas City) used to sell his entire stock of parts within ten minutes after a shipment arrived (*Remember, Joe??*) . . . I remember a lotta other things—mebbe YOU have some good "I remembers"—send 'em in, willya????

TELEVISION, well, its coming!——and from all indications it's gonna be within eighteen months——YOU LADS had better get yourselves on speaking terms with the Cathode Ray tube, and ***FAST***, on accounta the Cat-ray tube is the main ingredient of the 1937 television receiver——Haven't you a good picture of a lotta servicers goin back to their former occupations??

JUMBOESQUE . . . With this issue of Successful Servicing we expand . . . quite a jump from the good ol' days back in September, 1934, (remember?) when S. S. was only a pup, eight pages big . . . **watta lusty guy it's become** . . . the loyalty and response of our 20,000 (*count 'em*) readers naturally accounts for the influx of advertisers, and said influx of advertisers naturally accounts for the beaming face of "Ad-man" Charlie Farrell . . . we hope to be **SO BIG** that every issue of Successful Servicing will be a liberal education in itself . . . YE EDITOR tells your Reporter that there will be puh-lenty of "sirloin" from now on, covering all subjects . . . y'know, RIDER has a happy knack of dishing up just what the Servicer wants, **and needs.**

(NOT SO) VITAL STATISTICS . . . It is estimated that about thirty billion persons have been born into the world since its creation. A Cynic Observes that only five thousand of them have really amounted to anything. *How many of the five thousand were servicers?* . . . Leo *FRANKFURTER* was born at 43 *Frankfurter* Strasse, in *Frankfort*-an-Main, Germany, where his father manufactured *FRANKFURTERS*——***HOT DOG!*** After extensive research a Colgate University Psychologist reports that goods piled in a jumbled heap will sell more readily than the same merchandise arranged in neat stacks . . . *Radio Receivers, fr'instance?* . . . A few dozen pairs of starlings brought to the United States only 45 years ago to combat insects account for the billions of these pests that now fill the air. *Wish I could get hold of the guy who brought the first pair of pseudo HILL-BILLIES to a radio studio!!!* . . . An average of sixteen fires a day occur right here in New York, from mishandling of gasoline. Better be careful, Mister . . . The average man has twelve million brain cells——some of the Servicers we know must have THREE BILLION to hear them talk.

EGO . . . Our Girl Everyday is getting almost as much fan mail as a movie star——as a matter of fact, she is continually humming "California Here I Come." . . . Wish some of you guys would lay off, on accounta a good gal is hard to find.

MR. FARLEY'S DEPARTMENT . . . AUF-WIEDER-ZEYN, West Milton, Pennsylvania. Sorry you were flooded out—we are amazed at the wonderful spirit shown by flood sufferers, particularly those Servicers who have lost practically everything in the way of test equipment, etc. We haven't heard of one who lost his courage . . . That **"ZEYN"** gag was not ours at all, so don't give us any credit for it. The Little Gal who sits at our right furnishes all of the German, French, and Spanish translations—**R. STICKLER, Llwynypia, Glam, South Wales, England** . . . Thanks for your kind remarks about "The Cathode-Ray Tube at Work," and our other publications——We agree with your opinion that the cathode-ray tube is definitely "the instrument of the near future for real scientific methods of Servicing."——*Howinell do you pronounce the name of your home town??*——**R. H. KOCH Prestonburg, Kentucky.** Mister, you sure are a RIDER fan——No, we haven't an oscillograph that a fellow could buy cheap——We only have seven of them in our laboratory and they are continually employed in making various experiments . . . The HOUR A DAY series will include some tube dope . . . We haven't set a date for a revised edition of PRACTICAL TESTING SYSTEMS . . . You are not a One Hundred percenter—as far as we are concerned, you are a One Thousand percenter . . . **Ivan L. Crowe, Chicago, Ill.** Sorry the XYL called you for supper, making you cut your letter short—ask her to give us a break next time, willya?? Sorry, too, that RIDER didn't talk at Chicago—he was detained in New York until the second day of the show, and the management of the Show could not find a spot for him on the program—better luck next time, we hope. You and your fellow "HUNDRED PERCENTERS" should have some interesting news before long—I betcha that Volume VI will keep the young and old Crowes in shoes for the next coupla years—

SMART . . . A southern Servicer plotted a diagram of his neighborhood, placing his store in the center. He then listed all the names of the occupants of the houses within a radius of several blocks. He checked off, on this list, the names of those who owned radio receivers and had never utilized his services. Then he organized a campaign to solicit their business, stressing quality replacement parts and quick and competent service. *He reports that his business soon increased* 30%. He now has plotted the territory within a mile radius of his store and has two men who do nothing but canvass for new business on a commission basis . . . **That, my friends, is SUCCESSFUL SERVICING!!**

The Rolling Reporter

Howard Grand

The following alignment instructions are for both the Series 1 and 2 of this receiver. The schematic of the Series 1 model was published on *Howard pages 6-15 and 6-16 of Rider's Volume VI.* It is suggested that the two high-fidelity, broad i-f. stages be aligned with a cathode-ray oscillograph; however, since these stages are broad, they are not liable to get out of alignment easily after they have once been set.

I-f. Alignment:

The alignment of the broad i-f. channel has been mentioned above. On some sets the trimmers extend through the top of the cans. Note that the last stage has a tuned primary.

The regular selective i-f. stages are coded "A" on the accompanying layout and they are aligned in the usual way by feeding a 465-kc. signal into the grid of the 78 mixer. The trimmers should be carefully tuned to resonance, as they are quite critical. The sensitivity of the i-f. stages should be between 25 and 50 microvolts.

Oscillator and R-F. Circuits;

Always adjust the oscillator stage before the r-f. in any particular band. Before aligning have the dial pointer set exactly on the 180-degree line, which is the line straight across the middle of the dial with tuning condenser in the full maximum position. Bend the plates on the oscillator section only and only on the broadcast band if necessary. Seal trimmers with wax.

After the high-frequency adjustments have been made on s-w. bands, a check may be made by advancing the signal generator to 930 kc. higher in frequency, which is the image of the receiver oscillator. After increasing the output of the signal generator, a signal should be heard which will be an indication that the original adjustment has been made on the correct frequency.

Alignment:

Set band switch to 2nd (highest frequency) band and dial hand to 15 mc. Adjust trimmer "C" to 15 mc. fed into antenna. Align r-f. circuit trimmers "D," "E," and "K" at the same frequency. Set dial hand to 6 mc. on same band and adjust padding condenser "F" to resonance.

(Please turn to page 14)

From Set Manufacturers to the Homes of America . . .

AS TIME MARCHES ON — Raytheon's momentum increases and it will be further accelerated by Raytheon's new line of "G" tubes.* Thousands of new sets will be equipped with Raytheon "G" tubes, paving the way for more Raytheon replacement sales.

Leading set manufacturers prefer Raytheon quality and performance, Raytheon's painstaking attention to details, Raytheon's research and production engineers. That's why Raytheon is the fastest growing tube producer today.

Raytheon dealers and servicemen are capitalizing this established, ever growing replacement market.

A COMPLETE LINE — "G" types, standard glass and Genuine All-Metal types. New technical information now available. Write for it.

RAYTHEON PRODUCTION CORPORATION

420 Lexington Ave. . . . New York City
55 Chapel St. . . . . . Newton, Mass.
445 Lake Shore Drive . . . Chicago, Ill.
555 Howard Street . San Francisco, Cal.
415 Peachtree St. N. E. . . . Atlanta, Ga.

RAYTHEON
TRADE-MARK
4-PILLAR RADIO TUBES

** Glass tubes with octal base. 6A8G base illustrated.*

Howard Grand

(Continued from page 12)

Set band switch to next s-w. band (5.5 to 1.7 mc.) Turn dial hand to 5.5 mc. and adjust trimmer "G" to 5.5-mc. signal. Align r-f. circuit trimmers "H" and "I" to the same frequency. Rotate dial to 1.7 mc. on same band and adjust padding condenser "J" to resonance.

Set band switch to broadcast position. With dial hand at 1500 kc., peak trimmer "L" to resonance. Peak trimmers "M" and "N" to 1500 kc. Turn dial hand to 550 kc. and adjust padding condenser "O" to 550 kc. Check dial at 950 to 1550 kc. and bend oscillator plates if necessary at any point to align with calibration of the dial.

The long-wave band is aligned with the band switch set on that band and trimmer "P" adjusted to 390 kc. with dial hand at the same frequency. Adjust r-f. circuits with trimmers "Q" and "R." Turn dial to 150 kc. and align padding condenser "S" to resonance.

Beat Oscillator Adjustment:

Set dial to some frequency, for example 5 mc., and adjust trimmer "T" until note is heard.

Whistle Trap:

This is located in the amplifier and consists of a high-frequency choke and trimmer, which has been peaked to 10,000 kc. at the factory.

•

RCA TMV-122-B Oscillographs

The effectiveness of sweep synchronization at the higher frequencies in models bearing serial numbers up to 1000 can be improved by replacing condenser C-18 with a 1/4 watt, 10,000-ohm resistor. This condenser is easily accessible, being mounted at the top of the resistor-condenser board, which is in a vertical position near the front of the chassis. As may be seen by reference to the schematic which appears on page 100 of Rider's *"The Cathode-Ray Tube at Work"* this condenser is shunted across the secondary of the synchronizing transformer T-2 and so tends to bypass the synchronizing voltage at the higher frequencies. There is no necessity for making this change unless the oscillograph is used at frequencies above 25 kc. Later production oscillographs bearing serial numbers above 1000 do not require that any change be made.

CORNELL - DUBILIER
CONDENSERS
are thoroughbreds

"THOROUGHBRED" is the only word for them, wise servicemen agree. Compact, efficient, and dependable, Cornell-Dubilier capacitor units are thoroughbreds to the Nth degree, in eye-appeal, mechanical and electrical characteristics. Condenser wrecking handicaps may be lurking in the circuit, severe voltage surges, and other factors that cause condenser failure, but Cornell-Dubilier units will come through with flying colors. They'll come through for you, sure thing!

On your next job take this hot tip. Put your condenser money on C-D's. They can always be depended upon to lead the field in QUALITY, PERFORMANCE, AND SERVICE. Bank on a thoroughbred and increase your income.

C-D introduces to the service field several new types worthy of the Cornell-Dubilier name . . . tested and approved in the C-D laboratories . . . manufactured to the C-D twenty-six-year-old tradition of quality and performance. Here is a list of these new and efficient electrolytic condensers.

TYPE JR
Dwarf-Midget Dry Electrolytic Condensers

Tiny Silver-coated Cardboard Containers, Equipped with Color-coded Flexible Wire Leads and Mounting Feet

Compact, Dependable and Inexpensive. Excellent electrical characteristics. For use in limited space and tight-squeeze radio service jobs. Adequately protected against humidity. No need for an endless variety of special expensive exact duplicate replacements.

200v D.C. Working Voltage • 250v D.C. Peak Voltage

SINGLE Section Units: Red Lead Positive; Black, Negative.

Cat. No.	Cap. Mfd.	Size	List Price
JR-204	4	2 7/16 x 3/4 x 1/2	$0.65
JR-208	8	2 7/16 x 1 x 9/16	.80
JR-210	10	2 7/16 x 1 x 9/16	.90
JR-212	12	2 7/16 x 1 1/8 x 11/16	.95
JR-216	16	2 7/16 x 1 1/8 x 11/16	1.05

DUAL and TRIPLE Sections, Separate Units, No Common.

Cat. No.	Cap. Mfd.	Size	List Price
JR-244	4-4	2 7/16 x 1 1/8 x 11/16	$ .90
JR-218	4-8	2 7/16 x 1 1/8 x 7/8	1.15
JR-288	8-8	2 7/16 x 1 1/8 x 1	1.25
JR-2816	8-16	2 7/16 x 1 1/4 x 1 1/8	1.45
JR-2888	8-8-8	2 7/16 x 1 1/4 x 1 1/8	1.90

450v D.C. Working Voltage • 525v D.C. Peak Voltage

SINGLE Section Units: Read Lead Positive; Black, Negative.

Cat. No.	Cap. Mfd.	Size	List Price
JR-502	2	2 7/16 x 3/4 x 1/2	$0.65
JR-504	4	2 7/16 x 1 x 9/16	.75
JR-508	8	2 7/16 x 1 1/8 x 11/16	.95
JR-510	10	2 7/16 x 1 1/8 x 7/8	1.15
JR-512	12	2 7/16 x 1 1/8 x 1	1.30

DUAL Sections, Separate Units, No Common.

Cat. No.	Cap. Mfd.	Size	List Price
JR-544	4-4	3 x 1 1/8 x 7/8	$1.20
JR-548	4-8	3 x 1 1/8 x 1 1/8	1.35
JR-588	8-8	3 x 1 3/8 x 1 1/8	1.50

Type RHM—The most outstanding Midget Condensers

The widely accepted "Handy Mikes"—*now available with mounting feet at no extra cost.*

Working voltage 450v D.C. Peak Voltage 525v D.C.

Cat. No.	Cap. Mfd.	Size	List Price
RHM-9010	1	2 1/2 x 1 1/8 x 1/2	$0.55
RHM-9020	2	2 1/2 x 1 1/8 x 5/8	.65
RHM-9040	4	2 1/2 x 1 1/8 x 3/4	.75
RHM-9080	8	2 1/2 x 1 3/8 x 1 1/8	.95

TYPE JEH, Rated at 150v D.C., 200 v D.C. Peak

Solve the Many Problems of AC-DC & Midget Repairs

Dual Section Separate Lead Sections, Color-coded, in Flange Type Cardboard Containers, made by the famous "Hi-Formation" Construction. Finest Electrical Characteristics.

Cat. No.	Cap. Mfd.	Size	List Price
JEH-6404	4-4	2 7/8 x 1 1/4 x 3/4	$0.85
JEH-6408	4-8	2 7/8 x 1 1/4 x 1	.95
JEH-6808	8-8	2 7/8 x 1 1/4 x 1	1.20
JEH-6416	4-16	2 7/8 x 1 1/4 x 1 1/4	1.25
JEH-6816	8-16	2 7/8 x 1 1/4 x 1 1/4	1.35

TYPE EH Units in Flanged Cardboard Boxes

Size: 2 1/4 x 1 x 1

Two new units of useful characteristics to fit many purposes

EH-2250 25 mfd. at 25v D.C. 35 v. D.C. Peak ...... $ .65
EH-7080 8 mfd. at 200v D.C. 250v D.C. Peak ...... .80

TYPE ED Hi-Formation Tubular

Size: 3-3/16 x 1 dia.

A small size 8 mfd. unit to supplement our very complete line of these exceptionally fine condensers.

ED-9080 8 mfd. at 450v D.C. 525v D.C. Peak ...... $ .95

The C-D trademark on the label of the condensers you buy represents the biggest value for your money. C-D quality is no mere claim to superiority. It is reflected in the dominant leadership of C-D condensers in the radio and servicing field for over twenty-six years.

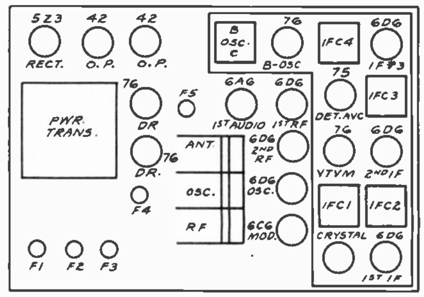
Write for catalog on the complete line of Cornell-Dubilier condensers today.

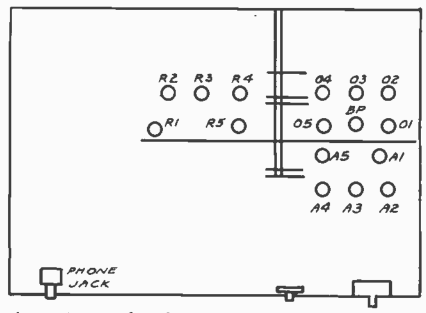
ELECTROLYTIC • MICA • PAPER • DYKANOL

CORNELL-DUBILIER CORPORATION
4365 BRONX BOULEVARD
NEW YORK

Patterson PR-16

Below will be found two diagrams showing the socket layout and locations of trimmers and other components of the PR-16, the schematic of which is shown on *Patterson page 6-1 in Rider's Volume VI.*





Locations of tubes and trimmers on top and bottom of the Patterson PR-16 chassis.

The following legend will identify the components in the layouts of the top and bottom views of the chassis: F1, F2, F3 are 16-mf. filter condensers; F4 and F5 are 8-mf. filter condensers; A1 to A5 inclusive are the antenna coils and trimmers for the broadcast and bands, 2, 3, 4, and 5 respectively. B.P. is the low-frequency padder. R1 to R5 are the r-f. coils and trimmers for the broadcast and bands 2, 3, 4, and 5 respectively. O1 to O5 are the coils and trimmers for the oscillator section for the five wave bands mentioned above. The remainder of the components are identified on the layouts in the usual manner.

Voltage:

Tubes	Function	Grid	Plate	Screen	Cathode
6D6	R-f.	0	250	100	1* 38**
6C6	Osc.	0	75	130	0
6C6	1st Det.	0	230	100	5
6D6	I-f. (1, 2, 3)	0	180	115	1† 30††
76	Beat Osc.	0	70	...	0
76	Meter Cont.	0	250	...	8
6A6	1st A-f.	0	150	...	4
75	2nd Det.-AVC	0	0	...	0
76	Drivers	0	250	...	12
42	O.P.	45	380	380	0

* R-f. gain control, maximum. ** R-f. gain control, minimum position. † Manual control, maximum. †† Manual control, minimum.

(Continued on next page)

Patterson PR-16

(Continued from page 16)

Note: Whatever a minimum control measurement is made, the control should be returned to maximum position before proceeding to other measurements.

When taking readings on the 76 beat oscillator tube, the beat oscillator switch on the front panel must be turned on before these readings can be made. It should be turned off again before proceeding to other measurements.

When taking the following measurements, set all controls for normal broadcast reception; no antenna; band switch on B.C. band (no signal being received), and the a-f. volume control set at minimum.

Electrolytic Condenser:

F1 and F3 — 16 mf. (Can insulated from chassis).
Center to ground, 380 volts +
Can to ground, 45 volts —
F2 — 16 mf. (Can grounded.)
Center to ground, 250 volts +
F4 — 8 mf. (Can grounded.)
Center to ground, 250 volts +
F5 — 8 mf. (Can grounded.)
Center to ground, 220 volts +

Speaker Field

Rectifier filament side to ground, 380 volts +
Set side to ground, 250 volts +
Rectifier plates, (5Z3) to ground, 370 volts a.c.

•

1936 Arvin Receivers

Although the servicing data of Arvin models 18, 28, and 33 have not as yet been published in Rider's Manuals, we feel justified in running this notice from Noblitt Sparks, inasmuch as it may save you a headache when you're installing one of these models.

The manufacturer reports that in some instances these sets have been received in the field in such a condition that they would not operate, when removed from the carton. This is caused by breakage of lead wires between the variable condenser and coil assemblies that are located directly beneath the condenser gang.

To repair this defect, loosen the two screws holding the serial number plate in the chassis. The variable condenser may be laid down horizontally in the chassis, after the two tubes alongside it have been removed.

Slide back the insulation on each of the green wires away from the point of

(Please turn to page 21)

Examine the Schematic

(Continued from page 3)

negative leg of the power supply, and ground may be at a higher potential than the minus end of the bias supply circuit, as for example in Fig. 8. There are very many combinations employed in the many thousands of different types of receivers and it is essential, for your own welfare, that you familiarize yourself with what is being used. The manner in which biased voltages are distributed to i-f. and r-f. tubes is very important in multi-band receivers, because in many

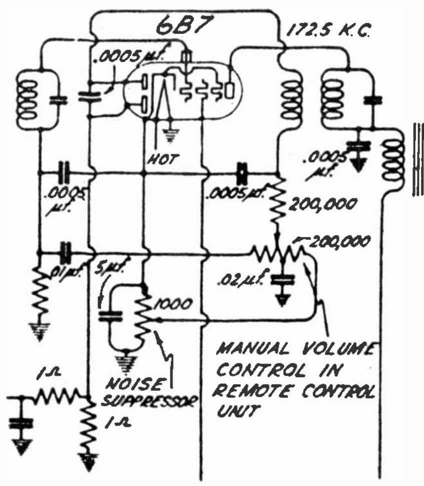


Fig. 6. An example of reflexing in the second detector of a superheterodyne, where the 6B7 is also an i-f. amplifier and controls the a.v.c.

cases certain stages are cut out of the circuit when the tuned band is changed. If, by chance, you check the receiver on one of these bands, which does not employ all of the tubes, you would note an incorrect bias reading which would cause confusion, because you are not aware of just what changes have been effected.

Tuning Indicators

Tuning indicator circuits used in receivers are operative when certain specified voltages exist across the respective terminals. As far as testing of the receiver is concerned, it is necessary that you know the general type of tuning indicator being used. . . . Is the tuning indicator system tied in with a separate rectifier circuit? Does the operation of the tuning indicator depend upon an accurately resonated i-f. transformer? The answer to these and other questions relating to tuning indicators should be known to you before you start operations upon the receiver. It is not imperative that you be aware of the specific compo-

(Please turn to page 19)

Examine the Schematic

(Continued from page 18)

nents of each and every circuit, but you certainly should know the general structure of the system.

Audio Systems

As far as audio systems are concerned there are some variations, but no great number. However, those which differ from the conventional are of varied

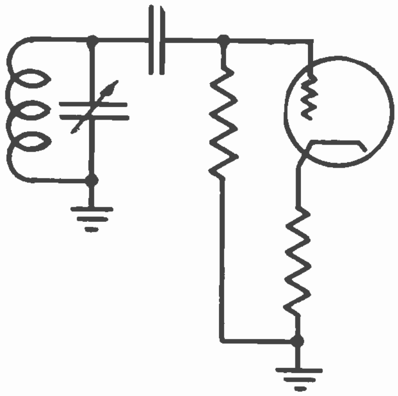


Fig. 7. The additional resistor connected between ground and the grid supplies the correct bias to this element of the tube.

type. . . . You should know if the audio system is conventional with just a single channel—or if more than one channel is used. In other words, is there a channel for bass response and another for the treble frequencies? What is the arrangement of the output with respect to these dual audio channels? Are various filter circuits located in the audio system, so as to provide bass and/or treble compensation? In many cases, failure of such filter systems may result in the interconnection of systems, which normally would be isolated. Knowing of the presence of such a filter and the possible consequence of a defect may point to the actual trouble, when certain results are established as the consequence of measurements made upon the audio system. You must certainly be interested in knowing if any automatic action exists in the audio circuits, as, for example, automatic audio volume control or automatic bass control.

Does the receiver employ one, two or three speakers and how are these speakers arranged? Are any filter circuits affiliated with these speaker systems? Does one output transformer feed all the speakers—or does the receiver employ more than one output transformer?

Power Supply

What type of power is used? Is the receiver a.c. or d.c. or of the universal variety? . . . Does the power supply employ a power transformer and conventional rectifier or is the power transformer omitted and a voltage doubling system used? Is the receiver chassis at ground potential or is it above ground potential, as in the case of a number of the universal type receivers? Are the tube filaments or heaters connected in series or in some other combination? Is it possible to isolate trouble by removing one of the tubes without interfering with the operation of the balance of the tubes? . . . If the answers to such questions are known before the actual analysis is made, much trouble, annoyance, and waste of time will be obviated.

After reading these lines, you may feel that an examination of this type will consume altogether too much time. We grant that the more complicated the receiver, the greater is the time required for such an analysis. However, the very complicated receivers are by far in the minority, so that an examination of the average schematic wiring diagram can be made within 10 or 15 minutes. As far as the very complicated receivers are concerned, we feel justified in saying that a preliminary inspection of the schematic is vital. As a matter of fact, an expenditure of half an hour devoted to the examination of a schematic wiring diagram covering a 15- or 18-tube receiver—or, for that matter, a 20- or 24-tube receiver, is most certainly worthwhile. Believe it or not, examinations of this type constitute a very excellent

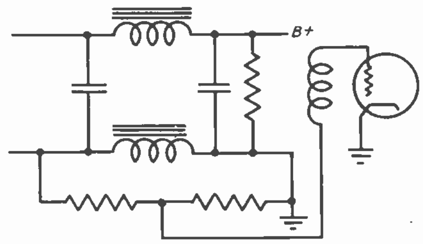


Fig. 8. An example of the grid bias for an a-f. tube being taken off a resistor shunted across a choke in the negative leg of a power unit filter, thus making the grid negative with respect to ground.

means of acquainting yourself with the variations to be found in different receivers, and with the developments being incorporated in receivers, as a means of keeping abreast of the times that ranks next, if not on par, with concentrated study.

●

Who does the best his circumstance allows, does well, acts nobly; angels could do no more.—Young.

New Havenites Eat

One of the most successful and well attended Servicemen's gatherings ever held in New England took place on the night of April 23rd, the occasion being the first annual banquet of the New Haven Radio Servicemen's Association; 147 Servicemen were present, in addition to the invited guests and officers. Delegations attended from Hartford, Waterbury, Danbury, Bridgeport and other towns.

After a sumptuous repast, the tables were cleared for action, and the various speakers went to work with a will. Ralph G. Hurd, Bridgeport advertising man and formerly Radio Editor of *The Bridgeport Times Star,* acted as toastmaster and very capably. Addresses were given by J. T. Hesse, the Secretary of the Association; Mr. J. E. Guetens, President of the Association; Carl Weidenheimer, Manager of the W.I.C.C., New Haven; Charles H. Farrell and John F. Rider.

Guests at the New Haven Radio Servicemen's Association Banquet, held at the Garde Hotel, New Haven, Conn., April 23, 1936. Reading from left to right: C. Amento, Treasurer; C. Weidenheimer, Manager of W. I. C. C.; J. T. Hesse, Secretary; W. Saars, Vice President; John F. Rider, Guest Speaker; Charles H. ("Ad-man") Farrell; R. G. Hurd, Toastmaster; J. E. Guetens, President; P. Hollenback.

Mr. Rider's address consumed the best part of two hours and covered the general topic of better business methods for Servicemen.

The officers and members of the New Haven Radio Servicemen's Association were so gratified with the success of the first annual banquet that plans are now being made for a state-wide conclave of Servicemen, to be held sometime in August. The conclave will be an all-day session—will probably be held on a Sunday and provisions will be made to accommodate the wives and sweethearts. There will be athletic events, a shore dinner and a number of well-known speakers will be invited to address the Servicemen at the business meeting.

Boost It!

The week of May 24th—30th, inclusive has been set aside as *National Radio Service Week.* Thousands of servicers throughout the United States have pledged themselves to be "on their toes" to capitalize on the tremendous amount of publicity which will be brought to bear on the set owning public, in an effort to have them consult their serviceman for an inspection of their receivers and having them put into proper working order where necessary.

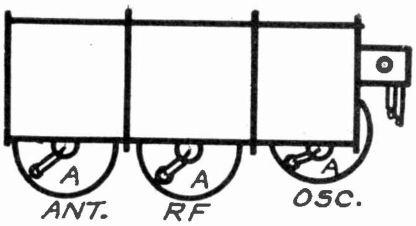
Both national networks have promised their whole-hearted cooperation in giving *National Radio Service Week* as much publicity as possible. National advertisers will make individual announcements during the week, and the net result should be an increase in business for every servicer in the United States.

National Radio Service Week should be an annual occurence, and every servicer is urged to get behind this movement to put the large number of radio receivers, which are now operating below their required efficiency, into proper working order.

1936 Arvin Receivers

(Continued from page 17)

break about a quarter inch and solder the wires in place on the lug at the bottom of the condenser gang. *Caution*—Use rosin core solder only. Then replace the



Locations of leads to condenser gang that sometimes are broken in transit.

condenser in its original position and reassemble the plate in place. Check the set for proper operation.

This difficulty has, of course, been corrected quite some time ago by anchoring the lead wires securely to the lugs at the bottom of the condenser gang.

●

Warning

It is reported that an agent, operating under the name of Donald Wood in the vicinity of Wellsville, Ohio, is offering Rider's Manual with a one-year subscription to a weekly magazine. **We have no agents, nor is anyone authorized to offer Rider's Manuals in connection with any magazine subscriptions.** Take this warning and tell your friends.

●

Here's An Idea

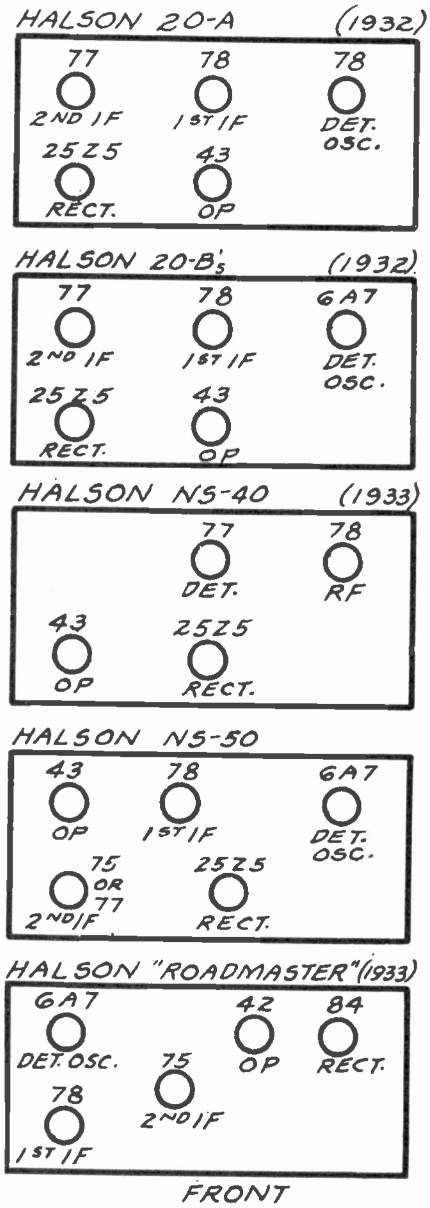
Any of your customers own a motor boat? If they haven't a receiver aboard, why not sell 'em an auto set and install it for 'em? Any auto receiver will operate on a boat, so that its installation will not be very difficult.

If the boat is a cruiser, the antenna can be strung from the mast, a single wire being satisfactory, if the length of antenna can be at least 25 feet. If this distance is not available, use a two-wire antenna with a two-foot spreader, taking the lead-in off the low end whenever possible.

If the craft is a runabout type with no mast, a bonded screen antenna, such as is used in an automobile, may be successfully employed. This antenna, which should have an area of about six or seven square feet, can be tacked to the underside of the deck structure as far as possible from the engine. Be careful of any grounded objects in the vicinity of such an antenna. Any sort of wiring should be rerouted as far as possible from it.

In all cases, the lead-in should be shielded at points where it passes through an area where interference might be picked up. The copper braid should be kept to a minimum.

Sometimes metal piping, as rails or supports, if properly insulated can be used for an antenna, but be sure they are well insulated.



Halson Layouts

The accompanying socket layouts of Halson receivers are for those schematics that will be found on the following pages in *Rider's Manual, Volume IV:*

Model	Page
20-A	4—1
20-B	4—1
NS-40	4—3
NS-50	4—3
Roadmaster	4—5

Transferring Power Efficiently

(Continued from page 5)

pedance of the load is equal to the impedance of the source.

For example, if the impedance of the vacuum tube shown in Fig. 2 is 1000 ohms, maximum power can be taken from this tube when the load impedance, which consists of the output transformer plus the speaker, is 1000 ohms.

What will happen as far as power transfers is concerned, if the impedance of the source, in this case the tube impedance, is higher than the load impedance, and if the reverse is true? The following examples, based upon an available voltage E of 100 volts, a tube impedance of 1000 ohms, and load impedances of 100, 1000 and 10,000 ohms, will illustrate the change in transfer of power.

I.

When $R_L = 100$ ohms

$$I = \frac{E}{R_S + R_L} = \frac{100}{1000+100} = .091 \text{ amperes}$$

$$P_L = I^2 R_L = (.091)^2 \times 100 = .825 \text{ watt}$$

II.

When $R_L = 1000$ ohms

$$I = \frac{E}{R_S + R_L} = \frac{100}{1000+1000} = .05 \text{ amperes}$$

$$P_L = I^2 R_L = (.05)^2 \times 1000 = 2.5 \text{ watts}$$

III.

When $R_L = 10{,}000$ ohms

$$I = \frac{E}{R_S + R_L} = \frac{100}{1000+10{,}000} = .0091 \text{ amperes}$$

$$P_L = I^2 R = (.0091)^2 \times 10{,}000 = .825 \text{ watt}$$

What conclusions can we draw from the computations above? In the first place, we note that in accordance with the statement previously made, the greatest amount of power is delivered to the load when the impedance of the load is made equal to that of the generator or source. In this case, the impedance of the generator is a pure resistance of 1000 ohms and consequently the maximum amount of power—2.5 watts—is deliv-

IN INDIANA

In a thriving town in the state of Indiana, there is available for sale a household appliance and radio business. The owner is broken in health, and must move to a different climate. If any readers of SUCCESSFUL SERVICING are interested in acquiring a going business, they may address their inquiries to Mr. G. C. B. Rowe, in care of this office, who will forward them to the interested party.

ered to the load when the load resistance is 1000 ohms. The effect of too small a load impedance upon the output can be seen from the first example in which the power is computed for a load of 100 ohms, which is one-tenth the value of the source resistance. Under this condition, the power delivered to the load drops from 2.5 watts to .825 watt, representing a power loss of about three to one and expressed in decibels, a loss of 4.8 db. Similarly, we note that when the load impedance is made higher than the source impedance, as in the third example, that the power output also falls. For the case where the load impedance is ten times the source impedance, the power drops to .825 watt, which again represents a loss of 4.8 db.

We have taken three representative cases in the above examples and noted that to deliver maximum power to the load, the load impedance must be made equal to the generator or source impedance. The greater the extent to which this match is *not* made, the greater will be the power lost as a result of the mismatch of impedances. More serious, however, than the power loss due to mismatching is the fact that in most circuits, more especially in vacuum tube circuits, the mismatching of impedances is accompanied by the introduction of distortion. It is important, then, that impedances be matched not only to prevent the loss of power, but to prevent the introduction of excessive harmonic distortion.

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Emerson 108, 110

The changes listed below have been made in Chassis U5A, on models bearing serial numbers above 758,100. The schematic for models 108 and 110 appeared on *Emerson page 6-17 of Rider's Volume VI.*

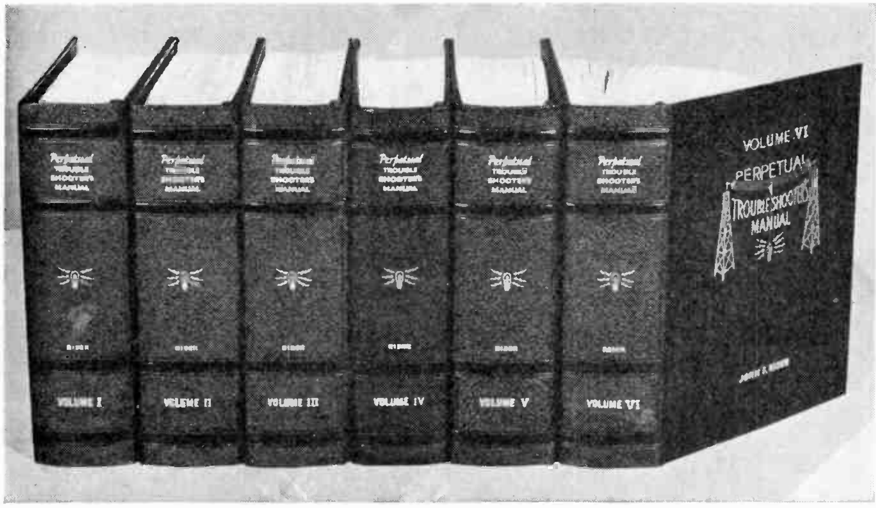
Resistor, R-9, changed from 500,000 ohms, Part No. KR-56, to 50,000 ohms, Part No. KR-53. Resistor, R-11, changed from 500,000 ohms to 200,000 ohms, Part No. LR-61. Resistor, R-12, changed from 500,000 ohms to 100,000 ohms, Part No. KR-54. Condenser, C-13, changed from 0.01 mf., Part No. CCC-127, to 0.02 mf., 200 volts, Part No. FC-29. Condenser, C-14, from 0.1 mf. to 0.9 mf., 200 volts, Part No. BBC-131.

●

The firefly only shines when on the wing; so it is with the mind; when once we rest, we darken.—Bailey.

$35.00 AN OUNCE

and they weigh 128 ounces!



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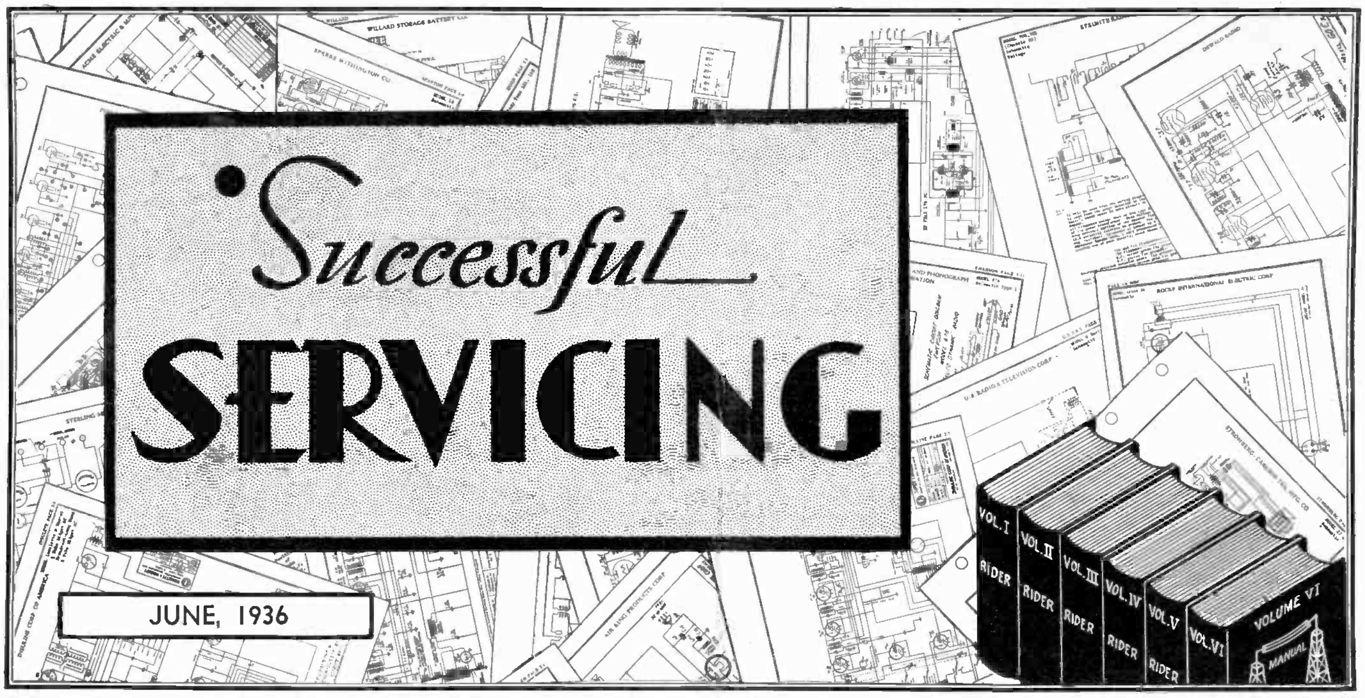


AUTOMATIC VOLUME CONTROL

A Brief Résumé of the Functioning of AVC Circuits

By JOHN F. RIDER

DURING the past several years automatic volume control has become an integral feature of practically all commercial receivers. When we stop to consider the conditions of signal input which are encountered, it is not difficult to see why this has come about. In practice, signal voltage may vary from as little as two or three microvolts to as high as several volts, the latter condition occurring near broadcast stations. This, as you can see, is a variation of more than a million to one.

The desirability of an automatic control system, which will keep the output constant in spite of this tremendous variation in signal strength, is so obvious that we hardly need to mention it at this time. However, we might point out that simplification in volume control design, the prevention of blasting when tuning from a weak station to a comparatively strong one, the prevention of passing over a weak station when retuning from a strong station, the fact that the second detector works at constant input signal so as to insure linear operation, the overcoming of some of the detrimental effects of fading—all these are factors which have been responsible for the widespread incorporation of avc in modern receivers.

It is only natural that during the number of years that avc has been in use, numerous improvements should have been made in the design of these systems and this is, in fact, the case. In the course of this article we shall have occasion to deal with a number of these systems which are widely used, and to explain the manner in which they operate.

We have stated that the function of avc is to keep the output constant, regardless of the value of signal voltage which is fed to the receiver. This,

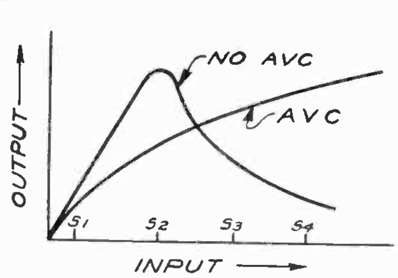


Fig. 1. Variation of output with signal input of sets with and without avc.

you should appreciate, is an ideal condition, which is not usually attained in practice. Actually the average receiver, which is equipped with avc, does not have a uniform output which is independent of the signal strength . . . The output does increase somewhat as the input to the receiver is increased. To what extent, then, do the various avc systems in common use accomplish this goal of constant output? To answer this question we shall start at the beginning and consider the performance of a receiver which is equipped with a simple type of avc system, as against that of one which is not so equipped. We shall then examine how the outputs of these two receivers compare for the same value of signal input and the results will be indicative of the value of avc.

The upper curve in Fig. 1 will show you how the output varies with signal input in the case of a receiver which is not avc-equipped. If you examine the figure, you will note that the output increases uniformly in direct proportion to the input—until a certain point, designated as S2, is reached. At this level the maximum output is reached and for signal levels beyond this point the volume drops off rather sharply. But this is not the only characteristic of this system. For not only does the output drop off, but it also becomes distorted. To show this point clearly, the output of the receiver for points corresponding to S1, S2, S3 and S4, is shown in the four oscillograms in Fig. 2. You will note that the output is undistorted

(Please turn to page 3)

Remler 42—Short Wave

Several changes have been made in the Remler model 42, starting with serial number 57061. The schematic diagram of the earlier model is shown on *Remler page* 6-4 *in Rider's Volume VI* and the schematic for the revised chassis is shown herewith.

If a doublet antenna is used, the lead-in wires are connected to the blue and yellow leads. The antenna and r-f. coils are in the can nearest the front of the chassis and the mixer coil is in the shield within the chassis. The first i-f. transformer is mounted in the shield between the 6A7 and 6D6 tubes; while the second i-f. transformer is located between the 6D6 and 75 tubes. The oscillator coil is within the set and is trimmed by the condenser adjacent to the coil.

Trimmers for the short-wave section are located at the top of the r-f. coil and on the right end of the chassis within the coil shields. No trimmer is provided for the oscillator s-w. position. The oscillator padder for the broadcast position is at the right end of the chassis. Trimmers for the i-f. transformers can be reached through holes in the shield cans.

The i-f. peak is 450 kc. In removing the chassis from the cabinet, pry off the knobs with a wooden screwdriver with a piece of cardboard against the cabinet and pull off the pointer from the condenser shaft.

The voltage readings are the same for this revised model as those given on page 6-4.

Westinghouse WR-101

The schematic diagram of the model WR-101 receivers, which carry serial numbers preceded by U6A, is shown on *Westinghouse page* 6-2 *in Rider's Volume VI*. A change in chassis has been made, the new one having serial numbers preceded by U6F. This new chassis is used with the same model number, i.e. WR-101.

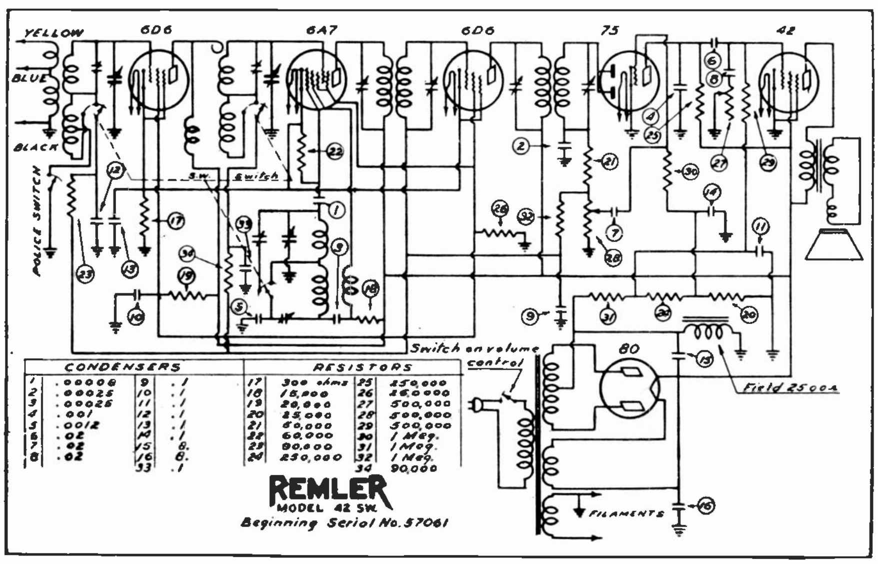
The same three wave bands are covered in both chassis, but numerous changes have been made. There is a new tube complement and the functions of the tubes have been changed, as will be seen by comparing the following list with the schematic mentioned above. The tubes in chassis U6F, the new one, are as follows:

Tube	*Function*
6A7	Pentagrid oscillator-modulator
6K7	I-f. amplifier
6H6	Diode detector and a.v.c.
6F5	A-f. amplifier
43	O.P. pentode
25Z5	Rectifier

The voltage analysis for the chassis U6F is as follows:

Tube	*Plate*	*Screen*	*Cath.*	*Osc. Pl.*
6A7	99	43	1.1	80
6K7	99	80	1.8	—
6H6	—	—	0	—
6F5	50	—	0	—
43	87	99	0	—

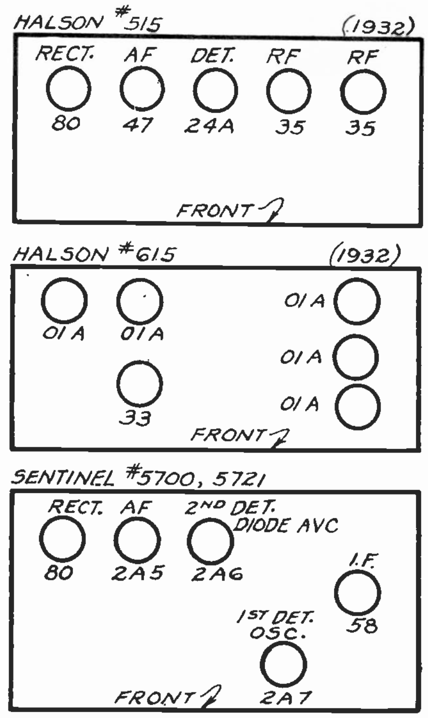
The filament voltage for all the above tubes, except the 43, is 6.3; that of the 43 is 24 volts. Voltage across speaker field is 120. Voltage across filter choke is 9.5.



Remler Model 42 short wave receiver has been revised starting with serial number 57061. Compare this schematic diagram with that for the early chassis.

Halson and Sentinel Tube Layouts

Below will be found two socket layouts of Halson receivers and one of Sentinel, which were received after the publication of the latest Rider Manual. We are including them



Socket layouts for Halson and Sentinel chassis.

here so that you can make proper reference to them on the page in your Manual on which the schematics of the sets appear.

The schematics for the Halson receivers were run on the following pages: Model 515, 3-1 *in Rider's Volume III and* 1271 *in the Rider-Combination Manual;* Model 615, 3-3 *in Rider's Volume III and* 1273 *in the Rider-Combination*. The Sentinel 5700, 5721 will be found in *Rider's Volume V, page* 5-27.

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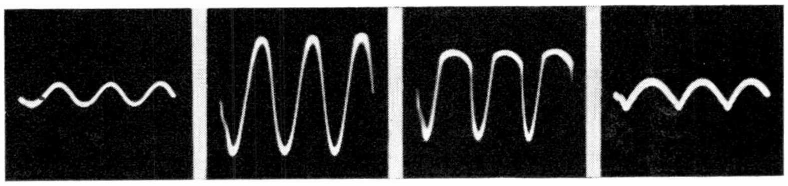
Replacing AVC Filter Condensers and Resistors

When it becomes necessary to substitute a condenser or resistor in the avc filter system, it is always advisable to replace the unit with one which has the correct value of capacity or resistance. The effect of replacing the defective unit with too large a value of capacity or resistance is to make the avc action sluggish, while the effect of too small a value is to cause instability and distortion. This latter effect is due to insufficient filtering action, as a result of the decreased value of capacity or resistance.

Automatic Volume Control

(*Continued from page* 1)

until the maximum output is reached at a value of signal input corresponding to S2. For a value of input greater than this, as the oscillogram in Fig. 2C shows, the output becomes distorted due to the fact that the last i-f. stage has overloaded. Similarly, as the signal input is further increased, the output decreases, due to greater overloading, and it is even more distorted. This is shown in Fig. 2D and corresponds to the condition of input shown as S4 in Fig. 1.



Figs. 2A, 2B, 2C and 2D, left to right. These oscillograms correspond with the four points designated along the horizontal axis of Fig. 1, and represent the demodulator output for a receiver not equipped with avc. The distorted output shown in Figs. 2C and 2D is due to overload and represents input in excess of S2 in Fig. 1.

Effect of AVC on Output

How is this output-input characteristic modified in the case of a receiver which incorporates a simple avc system? Referring to Fig. 1 you will note that the lower curve, which is representative of this case, shows a considerably different characteristic. For low values of signal input, the output increases with an increase in signal input, but not quite so rapidly as for the receiver which is not equipped with avc. As the signal input is still further increased, the output, instead of increasing at a uniform rate, tapers off gradually and remains practically constant for further increases in signal input. For purposes of comparison with Fig. 2, the oscillograms in Fig. 3 show the output for the same values of signal input and you will note that whereas overloading caused distortion in the previous case, the incorporation of avc has not only prevented overload and consequent distortion, but also has substantially helped to produce a uniform output.

A close examination of Fig. 1 will show you that a receiver which is equipped with simple avc has a lower sensitivity for very small signal inputs as against one which does not have avc. The reason for this condition is that the control voltage acts to cut down the sensitivity of the receiver as soon as a signal is received and this happens no matter how weak the incoming signal may be and despite the fact that the maximum sensitivity is desired under these conditions. To overcome this sacrifice of maximum sensitivity at low signal inputs, the type of circuit known as "delayed avc" was introduced. The improved performance of this circuit depends upon the fact that *the application of the control voltage, which cuts down the sensitivity of the receiver, is delayed until the signal strength reaches a certain predetermined value.* The value of signal strength at which the avc starts to function is known as the "threshold voltage." For values of signal input below the threshold voltage the full sensitivity of the receiver is available, since there is no additional bias placed on the controlled tubes through the avc system. However, as soon as the signal input exceeds the threshold value, the avc begins to function and the gain is effectively controlled so as to provide a constant volume output.

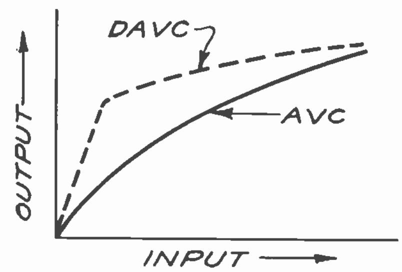


Fig. 4. The difference between receiver output with an avc system and one with davc action is easily seen by comparing the two curves above.

Delayed AVC Action

This action is illustrated graphically in Fig. 4, in which is shown the relative performance of a receiver which incorporates a simple avc system as against one which incorporates a delayed avc system. In this figure the output is plotted against the signal input for the two types of avc. Let us consider first the solid line curve which represents the simple avc system. You will note that the effect of the immediate application of the control voltage is to cut down the output for weak signals. On the other hand, referring to the broken line curve, it is apparent that the delayed avc performance is quite superior to that of the simple avc. For signal strengths below the threshold value, there is no avc action and as a result, the sensitivity of the set is greater than for the previous case. For signal strengths above the threshold value, indicated by the sharp break, the avc action takes control of the receiver gain and acts to hold the output at an essentially constant value. We might note that delayed avc provides, on the whole, a considerably more uniform output over a wider range of signal voltages as indicated by the flatness of the delayed avc characteristic.

The circuit which is by far the most commonly used in delayed avc circuits, is shown in its basic form in Fig. 5. You will note that the avc tube consists of a simple diode rectifier which is coupled to the last i-f. tube. The

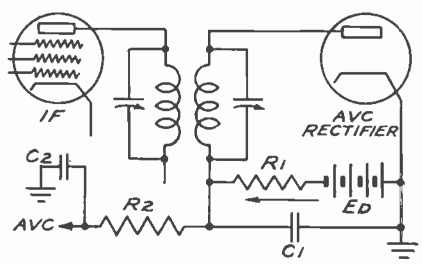
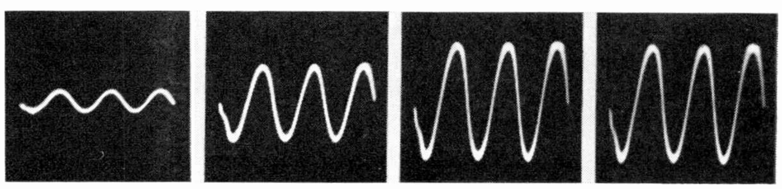


Fig. 5. The essential elements of a circuit commonly used in receivers having delayed avc is here shown. Note the battery for introducing the negative bias on the diode plate.

point, however, that you should especially observe is that there is a negative voltage, E_D, introduced in series with the load resistance, R1, which places an initial negative bias on the diode plate. This voltage constitutes the

(*Please turn to page* 5)



Figs. 3A, 3B, 3C and 3D, left to right. These oscillograms show the output corresponding to the avc curve in Fig. 1. Note the absence of distortion and that after a certain input is applied there is practically no change in the output level.

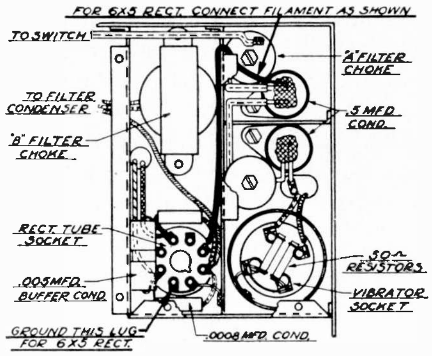
Motorola Golden Voice

We have been advised by the manufacturer that intermittent operation of their Motorola Golden Voice models, is due to low battery voltage delivered to the set from the car's battery. Check all connections between the car battery and the radio set to avoid undue voltage drop in the car wiring, as the OZ-4 rectifier tube will fail to start and fail to operate on a battery voltage of less than 5½ volts.

The OZ-4 tube requires 15 milliamperes or more of drain to produce ionization and proper rectification in this tube, and on battery voltages of less than 5½ volts the plate current drain of the receiver is insufficient to provide the 15 milliamperes starting current. Should the car wiring and the condition of the car battery indicate that at times the voltage may fall below 5½ volts, replace the OZ-4 rectifier tube with a 6X5 metal filament type rectifier.

With the exception of a few Golden Voice sets the filament contacts of the rectifier socket have been wired at the factory and the 6X5 rectifier may be plugged in the socket in place of the OZ-4. This will completely eliminate the difficulty due to low battery voltage.

On those Golden Voice sets not having the filament contacts of the rectifier socket wired, this wiring can be inserted by inverting the chassis and removing the cover from the hash compartment and connecting the filament contacts of the rectifier socket, as shown in the accompanying sketch. One contact to ground as indicated by



Connections when using a 6X5 in Motorola Golden Voice set

the heavy arrow at the bottom of the socket and the other contact to the .5 mfd. condenser as indicated by heavy arrow at the top of the sketch. When replacing cover be sure that all screws are tight.

•

Bosch 480, 481, 484

On *Bosch page* 6-28 *of Rider's Volume VI*, instructions will be found for aligning both editions of the 480 and the other two models mentioned. The accompanying illustration shows the bottom view of the chassis and the locations of the various trimmers. We suggest you make a note on page 6-28 where this Figure 2 may be found, when you need it in a hurry.

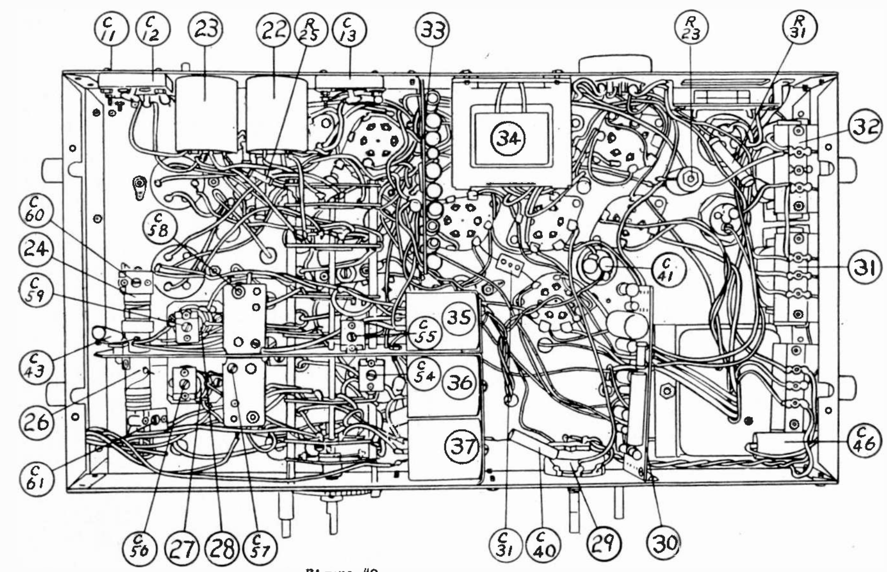


Figure #2

#22 Red band oscillator coil #107483
#23 Purple band oscillator coil #107484
#24 G.B. R.F. coil #107491
#25 Tuning Ind. #107608
#26 G.B. antenna coil #107486
#27 R.B. antenna coil #107487
#28 R.B. R.F. coil #107492
#29 Tone control and switch #107584
#30 Resistor strips #107509
#31 Filter choke #103554
#32 Filter choke #107504
#33 Resistor strip #107508
#34 Input transformer #107564
#35 B.B. R.F. coil #107490
#36 B.B. preselector coil C107489
C37 B.B. antenna coil #107485

The locations of the trimmers and other parts are here shown in the bottom view of the Bosch Model 480.

Atwater Kent 60

The first or early type of Model 60 —*see A-K page* 3-29 *in Rider's Volume III and page* 167 *in the Rider Combination Manual*—has a single volume control and the second or late type—*see A-K page* 3-31 *in Rider's Volume III and page* 169 *in the Rider Combination Manual*—has a dual volume control made up of combined wire-wound and carbon resistors.

First or Early Type:

When replacing the bleeder resistor, use No. 16295 wire-wound resistor, 4000 ohms. When replacing the first r-f. bias resistor, use No. 16253 wire-wound resistor, 1500 ohms and replace the r-f. bias resistor with No. 16988, 160 ohms.

Second or Late Type:

The bleeder resistor No. 1 was made in two types. The first type, No. 16905, consists of two 3000-ohm wire-wound resistors riveted together and connected in series. The second type, No. 17041, is a single 6000-ohm wire-wound resistor with a tap at the center. Use No. 17041 for servicing.

In early production of the second type Model 60, bleeder resistor No. 2 was wound on the same fibre base as the first r-f. bias resistor, the part number of the combined unit being No. 16872. If either section of this combined unit is defective, remove the unit and use a No. 16253 (1500 ohms) as r-f. bias, and a No. 15660 (1050 ohms) as bleeder No. 2. Later production of the second type Model 60 used a separate No. 15660 resistor as bleeder No. 2.

In early production of the second type Model 60, the first r-f. bias resistor was wound on the same fibre base as bleeder resistor No. 2, the number of the combined unit being No. 16872. If either section of this unit is defective, remove the unit and use a No. 16253 as a first r-f. bias resistor and a No. 15660 as bleeder No. 2. Later production of the second type Model 60 used a separate No. 16253 as first r-f. bias resistor.

Use a No. 16988 resistor (160 ohms) for replacement of the r-f. bias resistor.

•

The day is immeasureably long to him who knows not how to use and value it.—Goethe.

Automatic Volume Control

(*Continued from page* 3)

delay voltage. Now, during the passage of a signal, the voltage on the diode plate will be the sum of the signal voltage induced in the secondary winding of the i-f. transformer and the delay voltage. Furthermore, we know that no current will flow in the diode circuit until the signal voltage exceeds the delay voltage so as to make the plate positive with respect to the cathode. **It thus follows that no control voltage will be produced until the peak value of the signal is equal to the delay voltage.** If during any one transmission the signal voltage is less than the delay voltage, there will be no avc action. In other words, the avc action is delayed and thus the appropriateness of the term "delayed avc."

This action, which has just been briefly described, is shown more clearly in Figs. 6, 7 and 8. Fig. 6 shows the action when the peak value of the i-f. input to the avc rectifier is less than the value of the delay voltage. This input voltage is represented by the modulated wave which is drawn superimposed on the delay voltage. It follows, from the figure, that the actual voltage at the plate of the avc rectifier fluctuates between a maximum and a minimum value, as indicated on the diagram, but that at no time does the plate attain a positive potential with respect to the cathode.

As Fig. 7 shows, this condition still holds true when the signal is increased so that the peak value of the modulated wave is equal to the delay voltage. Although the signal does cause the plate voltage to rise to the point where the effect of the delay is overcome, no plate current flows, since this is only sufficient to raise the plate voltage from a negative value, E_D, to zero.

However, if the signal input is still further increased, so that the signal voltage exceeds the delay voltage then during a portion of the positive swing of the signal, as Fig. 8 shows, the diode plate becomes positive with respect to the cathode and current flows through the diode load, R1. The intervals, during which current flows, are indicated by the blackened area, in Fig. 8. The average flow of current, through the diode load R1 as a result of this pulsating current, causes an average value of d-c. voltage drop, which is indicated by the horizontal, dashed line above the zero voltage axis. It is this voltage drop which is distributed to the several controlled tubes in the circuit and which acts as the automatic control voltage.

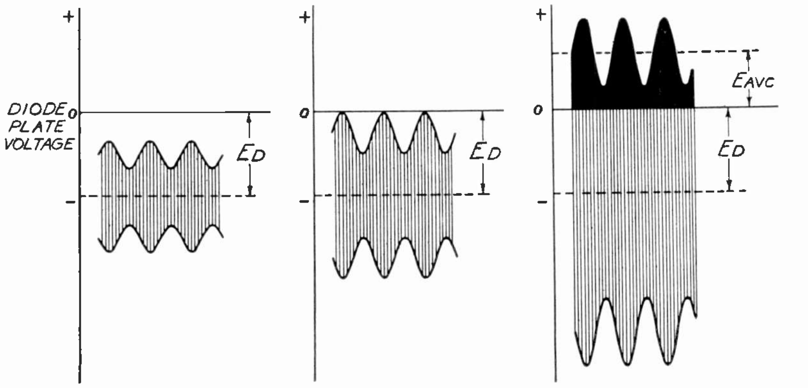


Fig. 6, left, shows the action when the peak value of the i-f. input to the avc rectifier is less than the delay voltage. Fig. 7 shows the peak value of the i-f. input equal to the delay voltage and Fig. 8, right, shows the i-f. input greater than the delay voltage. The resulting action is explained in the text.

Separate Delay Rectifier Necessary

In view of the foregoing discussion explaining the action of the davc rectifier, it is apparent that the same rectifier cannot be used to act as both the second detector and avc rectifier. The most obvious reason for this condition is that the davc rectifier does not begin to function until the signal reaches a certain value. And even after this value is reached, the output of the rectifier is distorted, in that, for a range of signal strengths near the threshold condition, the current flows in the rectifier only on the modulation peaks. In a typical receiver layout, then, the necessity for securing a delayed avc action would apparently call for an additional tube to serve as the davc rectifier. Actually, the availability of multi-unit tubes of the 55, 2A6, etc., types makes it possible to secure this action without increasing the number of tubes required to do the job.

A comparatively simple delayed avc circuit, employing a 55 tube to perform the functions of detection, delayed avc, and audio amplification, is shown in Fig. 9. This happens to be the layout used in the Atwater Kent Model 555, which employs a 57 tube as a combined first detector and oscillator, a 58 as an i-f. amplifier, and a 47 in the output stage. One of the first things which we note about the avc circuit is that the first detector is not controlled, the grid return being made directly to ground; the bias of this stage is obtained by means of a cathode resistor. As can be seen from the grid return of the 58 i-f. amplifier, this tube is connected to the avc circuit through the filter resistor R4, which is 500,000 ohms.

Fixing our attention on the avc diode D1, we note that this diode is coupled to the i-f. stage through C2, which is .00025 mfd. The load for D1 is the 2-megohm resistor, R3,

(*Please turn to page* 12)

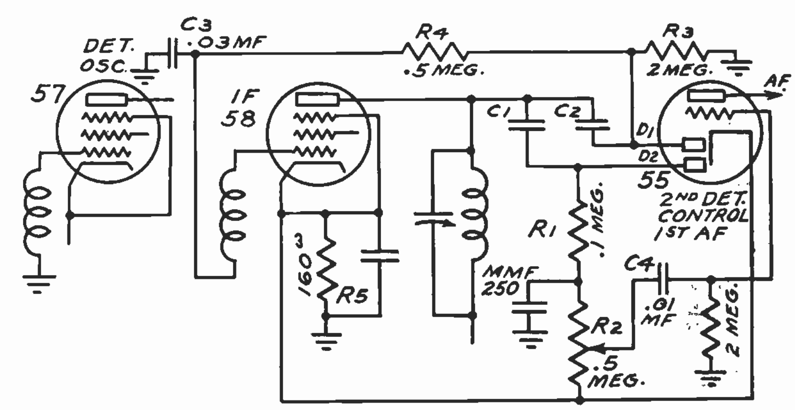


Fig. 9. The type 55 tube performs the triple function of second detector, first a-f. amplifier, and delayed avc control. The d-c. voltage for control purposes is developed across the resistor R3.

Successful SERVICING

Reg. U. S. Pat. Off.

Dedicated to financial and technical advancement of the radio service man.

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Vol. 2 June, 1936 No. 10

FREE INSPECTION

FREE service is in again. . . . Very few if any letters received in this office miss the subject. . . . We have been asked for our opinion. . . . When the truth is known, there is no such thing as *free* inspection. . . . One way or another the customer pays for it. . . . The reason for this statement is that the cost of the free inspection call is reflected in the usual service charge made by the service organization—that is, if the business is properly run. . . .

It matters not how you apportion or where you apply the cost of the free inspection call. . . . Some cost is involved and this can be classified as sales promotion—if you so desire it —but as a sales promotion expense, it reflects upon the regular service charge, because it adds just so much more to the cost of the time sold. . . .

It is impossible to forget that the time involved in a free inspection call is time not available for productive labor and the total number of hours available for sale is lessened by the number of hours devoted to free service. . . .

The man who charges for his inspection call can establish a lower hourly service charge than the man who gives free inspection.—Whether or not the difference in hourly rate will attract the customer to respond to the paid inspection call is a matter of finances. . . . There is no doubt about the fact that the free inspection call is a lure—but to offset the value of such operations in the minds of service station operators—there are many thousands of such operators who have never had any trouble collecting for their inspection calls. . . . Which is preferable is up to the man who is running the business and his type of clientele. . . .

•

Individual Problems

THE editorial "They'll Pay the Price" in the May issue of SUCCESSFUL SERVICING has elicited a number of replies. . . . It seems as if some of our readers felt that any reference to the fact that certain minimum charges existed in a town meant that similar charges should be established in all cities. . . . Such was not the intent of the editorial. . . . The figures were quoted simply to show that charges, which were generally classed as being high, are not necessarily high. . . . It is, of course, true that each community has its own problems and normal, satisfactory charges in one city would be too high for some other town or definitely low with respect to charges exacted in a third locality. . . . For that matter the same is true in different parts of the same city—if the city or town is large enough. . . .

We have never suggested uniform charges. . . . We don't think such tactics are feasible. . . . However, we have consistently called for *profitable* charges—whatever they may be. . . . That is the important consideration. . . . In each and every town—in each and every locality—the financial problems are individual. . . . That cannot be denied, but you will also find that, as the consequence of substantially uniform national prices for test equipment—automobiles—insurance—magazine and technical data subscriptions—and numerous other items—operating costs do not differ very widely—not among full-fledged service station operators. . . .

•

Shielded Rooms

WHO is going to be the first manufacturer to announce shielded test rooms, available in knockdown form, for sale to the service industry ? ? ? ? . . . It's going to take some pioneering—but we think that it is a worthwhile item. . . . Today the "air" test is the major test in the service shop. . . . The day is not far distant when the shielded-room test is going to be the major test. . . .

Television

THE existing flurry about television seems to have caused apprehension among many servicemen. . . .

We do not wish to appear in the guise of a soothsayer—nor to have the answers to perplexing problems—but somehow or other we cannot see how the development of television is going to interrupt the present equilibrium of the servicing industry. . . . Television on a very local scale is not very far distant—but television on a national scale is still quite a way off—if only because it is going to take a long time to establish the required number of stations. . . .

In the interim, we believe that the servicing industry can wend its way along its normal channels. . . . It is perhaps true that the sale of new non-television receivers may be curtailed somewhat when television programs are started—but servicing will not be hurt—because the people interested in television and who are awaiting the erection of a station in their community, will continue having their receivers serviced and maintained in an operative state. . . .

Of course, the servicing industry should keep one eye cocked on television—if only to prepare for its advent from the technical angle and to be ready to take over when the occasion arises. . . .

JOHN F. RIDER.

Gus Gets Wise

Here's a new

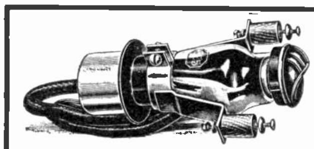
RCA AUDIO OSCILLATOR

...essential in service work

AND AVAILABLE ON EASY TERMS*

Every shop needs an audio oscillator. For instance, when trying to locate a speaker rattle without one, you have to tune in a program and wait until the rattle frequency happens along. With the oscillator you just run up and down the scale until you hear the rattle. You do the job in a few minutes, impress the customer, earn your fee in quick time. Other uses: checking P. A. systems, demonstrating fidelity, testing transformers and amplifiers, determining frequencies observed on screen of RCA Oscillograph. Also used in conjunction with RCA Test Oscillator. Case is same size as the latter instrument . . . This new RCA Audio Oscillator is an outgrowth of the famous $215 laboratory model RCA Audio Oscillator, designed and made by same engineering and factory staff. Price made possible by quantity production. Now ready for delivery. Ask your distributor for complete information.

New RCA Beat Frequency Oscillator has many features not obtainable elsewhere. Wider frequency range, 30 to 15,000 cycles. Tapped output transformer permits matching impedances of 5,000, 500 and 250 ohms, all balanced to ground. Easily and quickly calibrated at 30, 60, 120, 180, 240 cycles, with neon indicator. Entirely AC operated. Output 60 milliwatts. Weight only 10¾ pounds. Contains 4 new-type RCA acorn tubes, plus rectifier. Tubes alone cost $20.35. Complete with tubes ready to operate, $64.50 f. o. b. Camden, New Jersey.



For your customers who want to

TUNE BY EYE

RCA offers a genuine RCA Cathode Ray Tuning Indicator Kit. Can be installed in almost any receiver that has automatic volume control. The kit is complete, everything you need, including tube, socket, cable, clamp and bracket, escutcheon. Easily and quickly installed. Price $3.00. Stock No. 9688.

1935 VOLUME *of RCA Victor Service Notes* NOW READY!

Includes not only all the RCA Victor Service Notes, but a wealth of technical charts and data. Substantially bound in durable cloth. Price $1.00 f. o. b. Camden.

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RCA Parts

Rolling REPORTER

WHEN SERVICING IS NEWS . . . And are servicers an important factor in the life of the country? You're happy hooting, they are! Lookit the gathering of all good men and true out at Cleveland, who nominated Mr. Landon and what happened when the P.A. system went haywire during Senator Steiwer's speech? Who did a frantic SOS go out for? "GET A SERVICEMAN . . . *GET SIX SERVICEMEN* . . . **GET A DOZEN!!!**" And then did the same call go up when two main hacksawed radio cables were found? Right you are again—it did and in such volume that a couple of men were rushed to the convention town *by plane* to give a hand. And where did that story break in the newspapers about how servicers worked all night so that Mr. and Mrs. Delegate could hear the spell-binders? **Right smack on the front page, b'gosh.** . . . Incidentally, do you remember what your Reporter prognosticated last February in this here colyum of sagacity and augury? ? Just take a peep at what we scribbled then. . . . Were we right or *were we* **RIGHT**? ? ? ?

WHO CARES DEPARTMENT . . . The standard size for champagne bottles going from the smallest to the largest is: half-nip, nip, pint, imperial pint, quart, magnum, jeroboam, rehoboam, methuzela, salmanazar, bathazar (*waiter, a bathazar of Sec in a silver bathtub of ice.*) . . . Installment plan analysts explain that once a purchaser is past his first two or three payments he is almost certain to keep them up to the end unless extraordinary circumstances intervene. *Getting that second payment is the hardest of all* . . . One of the lads in the RIDER shipping Department strolled into a local theatre recently—'twas Bank Night . . . the prize was $80.00 . . . yeah, you guessed it—he **WON!** for 30 cents he got eighty bux, saw two feature pictures, a comedy and a news reel. ***(WHAT, NO MICKEY MOUSE???)***

FACT . . . . . YOUR REPORTER recently hadda confab with the sales manager of one of the larger receiver manufacturers. The PowWow brought out an interesting sidelight on this interesting Servicing business of ours—This manufacturer has conducted hundreds of service meetings throughout the country and these meetings have been attended by thousands of forward looking Servicers—The subject of a recent meeting was a discussion of the superhetrodyne circuit, and the reactions of those who attended this meeting showed how great is the interest in this particular type of circuit. . . . And speaking about service meetings, a large number of the boys have told us that they'd like to see *actual demonstrations* . . . they wanna see just how it's done—something like a hospital operating theater, if you get the idea. You know, a surgeon snatching out some part of a guy's innards and explaining to his audience just why it went on the fritz and how to do the repair job. These servicers wanna **see** how an expert takes a cathode-ray oscillograph and other modern equipment, locates the trouble and brings the set back to life.

TREND?? . . . We have received suddenly a flood of letters from fellows working in garages asking about the home study of radio. The first few passed more or less without comment, but when we got such a mob of them, it set us to wondering "How come?" Does this sudden interest on the part of the Knights of the Greasy Overalls mean that the Radio Servicer is going to lose out on the servicing of auto radio sets??? ***Think it over, youse guys,*** THINK IT OVER. . . .

MR. FARLEY'S DEPARTMENT—*ECONOMY RADIO SERVICE, COVINGTON, KENTUCKY.* . . . Brother, your name is on our mailing list to receive SUCCESSFUL SERVICING from now on.—Thanx for your enthusiastic comments—You will find that it will get better and better as it grows older. *EDWARD H. DUFOR, POUGHKEEPSIE, NEW YORK.* You took the words right out of our mouth when you said that the RIDER publications "brush off the cobwebs"; that is exactly what they are designed for and it is pleasant to know that a lotta readers get the idea.

THEODORE C. SEYBOLDT, CHICAGO, ILLINOIS. We always "excuse pencil" when the pencil writes such a cordial message—Our future success rests entirely with lads like yourself—*LABATTO F., AMSTERDAM, HOLLAND.* Thanx for your nice comments on "Servicing Superheterodynes."—We have sold hundreds of copies of this book throughout Europe. . . . *JOE NAPORA, UNIONTOWN, PA.:* We have added Mr. Pyro's name to our list—For the benefit of jobbers I am quoting your words verbatim: "Just obtained 'the Cathode Ray Tube at Work,' which completes my RIDER library. Obviously my next piece of test equipment will be the oscillograph." *R. W. SHELTON, PADUCAH, KENTUCKY.* Thanx for sending along that ancient circular—J. F. R. got a kick out of your remarks about his school-boy complexion and lack of approaching baldness. . . . *BILL BELLOWS, KENNEWICK, WASHINGTON*—We wish every Serviceman thought as you do. *H. G. MOORE, ROCHESTER, NEW YORK*—Thanks for your cordial comments.—*GORDON CRAWFORD, OANARU, NEW ZEALAND*—There will be plenty more swell books for your Servicers—the AN HOUR A DAY WITH RIDER series will keep you right up to date.

YATES—first name Cecil, of Santa Anna, California, sends in an "I remember the old Auditron, two filament, baseless tubes—still have the first two I wore out." Brother Yates also tells us that he has all of the RIDER MANUALS including Volume I and II, which were put out in 1929.—He thinks he is entitled to be a hundred and *one* percenter.

CONGRATS:

A group of ten condenser makers, employed by the Solar M'f'g. Co., in N'Yawk, chipped in two bits apiece and gotta ticket on the Irish Sweepstakes . . . *they won $50,000*—that's a cool Five Grand ($5,000.00 to YOU) apiece . . . **it's about time that somebody in the radio business gotta break.**

The Rolling Reporter

Repairing Sparton Speakers

The following instructions are for repairing speakers, used in Sparton models 53, 57, 65, 65-T, 66, 66-T and 655. The tools needed are a plug gauge for centering the pole piece, a celluloid spacer for centering the voice coil around the pole piece; cement for fastening the cones to the housing; and a wrench fitting the nuts holding the voice coil spider.

Preparation for Cone Installation

Cut around the outer edge of the paper cone with knife. Remove the two 6 x 32 nuts which hold the spider in position. Unsolder the voice coil leads and lift out cone. Remove cone ring and scrape off all particles of old cone and cement, making sure that none of the scrappings fall near the pole piece or into the voice coil space. Clean the speaker thoroughly, being sure to remove all dust and loose particles which might get into the voice coil and cause rattles. An air-hose may be used to advantage in this procedure. At this point, a careful check should be made of the field coil for short circuits, open windings, or grounds. The normal field coil resistance is 3,000 ohms for the Models 53 and 57 speakers, and 2400 ohms for the Models 65, 65-T, 66, 66-T, and 655 speakers.

Installing Cone Head

Note: Do not attempt to install a new cone head on a speaker with loose welds between cone frame and field coil housings since proper voice coil clearance is impossible under such conditions.

Spread a heavy coat of cement around the edge of the cone head. Drop the cone into position so the voice coil leads fall in the correct place and so that the holes in the spider will center on the brass studs without binding. Place the celluloid spacing strip around the pole piece so as to assure the proper voice coil spacing. Press, and smooth the rim of the cone down on the cement. Spread another coat of cement on the rim of the cone and put on the cone ring, pressing down firmly. Tighten nuts gently but firmly on the spider. Lay the speaker face down on some level surface, and allow the cement to dry for at least 30 minutes, after which remove the celluloid spacer, solder the voice coil and transformer connections and test. This speaker should now be ready for use and should not rattle. If it still has a tendency to rattle, it indicates that the voice coil probably rubs. To readjust, loosen the two nuts holding the voice coil spider, then move the voice coil over slightly to a position where it works up and down freely; then tighten nuts. Particles of steel filings or other foreign matter will also cause rattles and must be removed.

Caution: The cement furnished dries quickly. Be sure it is still wet when the cone and ring are put on; otherwise they may not be held tight and cause rattles.

Field Coil Replacement

Note: It is impossible to install a new field coil correctly without first removing the cone and voice coil; it is therefore recommended that the cone and voice coil be removed before attempting this operation.

The pole piece is a tight press fit in the field coil housing, but can be driven out easily from the back end by using a hammer and a bolt or a short piece of rod as a punch. After the pole piece is driven out, remove the old field coil and put a new one in, taking care that the side of the coil having the recess for the voice coil space is turned towards the front. Place the centering gauge in the voice coil opening. Drop in the pole piece and drive home with hammer and punch, being careful to keep the punch on the center of the pole piece so as not to mar or burr the edge. Care must also be taken to prevent damage to the assembly and gauge.

If the pole piece is centered properly, the gauge will be loose and come out easily. If not, hold the punch at an angle and tap pole piece over to its proper position. Remove gauge and install the new cone head.

•

G.E. A-70, A-75

On *G. E. page* 6-19 *of Rider's Volume VI* please change the value of the condenser, C-44, in the line between the switch S-6 and the resistor, R-4, in the cathode circuit of the 6A8, from 100 mmf. to 50 mmf.

In the list of replacement parts on *G.E. page* 6-23, delete "RC-235 Capacitor 100 mmf. (C-44)" and substitute for it "RC-210 Capacitor 50 mmf. (C-44) Mica Dielectric". In the stock number column you will find RC-091. Change the C-29 to C-28.

Atwater Kent 55 and 60

If the first a-f. bleeder resistor is defective in either of these models, replace with a No. 15660 resistor (1050 ohms).

When either the yellow (No. 15544) or the maroon (No. 15545) second a-f. bias resistor requires replacing, do not use a new yellow or maroon resistor, but follow the procedure found below.

Remove both the yellow and maroon resistors and replace the yellow one with a white resistor (No. 16724), 40,000 ohms, 1 watt, and the maroon resistor with a black (No. 15592), 65,000 ohms, 1 watt.

These changes affect only the second a-f. bias resistors in Models 55, 55C, 60 and 60C.

•

Atwater Kent 55

The early type of Model 55—*see A-K page* 3-21 *in Rider's Volume III and page* 159 *in the Rider-Combination Manual*—can be distinguished from the late type—*see A-K page* 3-23 *in Rider's Volume III and page* 161 *in the Rider-Combination Manual*—by the volume control. The first type has a single wire-wound volume contral of 6000 ohms, with the movable arm going to the screen grid of the 1st r-f. tube and the late type has a dual wire-wound and carbon volume control. The wire-wound unit of 6000 ohms has its movable arm connected to the screen grids of the r-f. tubes and the carbon unit of 10,000 ohms is connected in the antenna circuit.

Early or First Type:

This set has only one bleeder resistor, which is connected in series with the positive lead to the volume control. In *early production* of the first type (also known as the Early type) the bleeder is a 6000-ohm tubular resistor No. 15286A (colored purple over the entire resistor) or a 4000-ohm tubular resistor, Part No. 15286B (with a purple band about 3/4 inch wide). In later production of the first type Model 55, the bleeder is a 4000-ohm wire-wound resistor, Part No. 16295, which supersedes No. 15286A. No. 15286B is superseded by wire-wound resistor No. 16330.

This set has only one bias resistor and in all cases it is 160 ohms, which value is critical. In early productions of the first type Model 55, the r-f. bias resistor was wound on the same fibre base with the filament-shunt resistor, the part number of the combined unit being 15274. If either section of this unit is found to be defective, remove the resistor and use a No. 16988, 160-ohm resistor as the r-f. bias, and a No. 17077 flexible 10-ohm resistor as the filament shunt. In later production of the first type of Model 55, the r-f. bias resistor is a separate unit and, when defective, should be replaced with a No. 16988 resistor.

Late or Second Type:

This set has two bleeder resistors, which are connected in series with the wire-wound section of the volume control. Bleeder No. 1 (4000 ohms) is in the positive lead to the volume control and bleeder No. 2 (850 ohms) is in the negative lead to the volume control. Bleeder resistor No. 1 is Part No. 16295.

Bleeder resistor No. 2 was made in two different styles. At first it was wound on the same fibre base with the r-f. bias resistor, the part number of the combined unit being 16868. If either section of this unit is defective, remove the resistor and install a No. 16988 as the r-f. bias and a No. 16340 as bleeder No. 2.

Later production of the second type Model 55 used a separate No. 16340 as the No. 2 bleeder.

The early production of the second type Model 55 had a combined r-f. bias resistor and bleeder No. 2, the part number of the combined unit being 16868. If either section of the unit becomes defective, remove the unit and replace with a No. 16988 as bias resistor and a No. 16340 as bleeder No. 2.

Later production of the second type Model 55 used a separate No. 16988 as the r-f. resistor.

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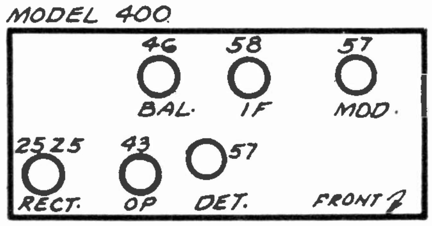
Majestic 400

The accompanying illustration shows the socket layout for the Majestic Model 400, the schematic diagram

MODEL 400



of which appears on *page* 3-42 *of Rider's Volume III and page* 1234 *of the Rider-Combination Manual.*

Automatic Volume Control

(*Continued from page 5*)

across which the signal voltage develops the d-c. voltage that is used for control purposes. The rectified voltage developed across R3 is fed over to the grid of the 58 tube through the filter network consisting of R4 and C3. It is important to note that the avc load resistor, R3, is returned directly to ground. On the other hand, the cathode of the 55 is 3 volts above ground, so that the net result is a delay voltage of 3 volts on the avc diode; that is, the plate of D1 does not begin to draw current until the peak value of the signal across the i-f. plate is more than 3 volts. However, the detector diode, D2, is returned directly to the cathode, so that no delay voltage is introduced in the audio circuit. This can be seen by the fact that the volume control is returned directly to the cathode.

Automatic Delay

An interesting variation of delayed avc is the variable delay voltage system used in Motorola Golden Voice receivers. That part of the circuit, which is of interest to us here, is shown in Fig. 10. If you examine the illustration, you will note that the diode section of the 6R7 tube is used as the avc rectifier. The resistors, R3 and R4, constitute the load for the rectifier and the resulting control voltage is fed to the controlled tubes through the filter resistor R5. The bias for the triode section of the 6R7 is produced by the voltage drop across R6. Naturally the voltage drop across R6 will depend upon the plate current drawn by the triode section. This in turn is controlled by the bias on the control grid of the tube. Since the control grid is tied in with the avc circuit—you will note that the control grid is connected to R5—it receives the full avc control voltage. It follows that when a strong signal is being received, the bias on the control grid is large, and conversely, when a weak signal is being received, the bias is small. This naturally means that for strong signals the plate current is small, and that for weak signals the plate current is large. Going further, it implies that the voltage drop across R6 will be large or small depending upon the strength of the signal being received.

What is the significance of this and how does it affect the performance of the receiver? To analyze this we need only consider the effect of this varying cathode voltage upon the performance of the avc rectifier. For we have previously seen that when the cathode of the avc rectifier is made positive with respect to its plate, then rectification does not take place (is "delayed") until the signal input is such as to exceed the value of the bias. Thus, for small values of signal input, the control voltage is small, the bias on the triode section is small, the plate current is large, the voltage drop across R6 is large—and the net effect is that the avc rectifier is blocked. In other words, a delay action is secured which operates to release the maximum sensitivity of the receiver for low values of signal input. Now as the signal input is increased, the bias on the triode section increases, its plate current drops, the voltage drop across R6 decreases—with the net result that the avc rectifier starts to function. Actually all these actions are interrelated and the increased bias on the triode section presupposes the rectifier having started to function. Nevertheless, we explain its operation in this manner, because of its comparative simplicity.

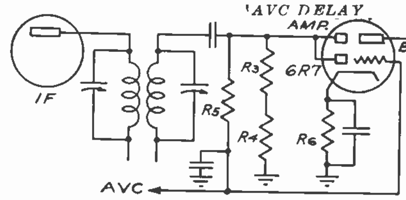


Fig. 10. The diode section of the 6R7 is used as the avc rectifier and the control voltage is fed to the delay amplifier through R5.

We see then that as the signal input is increased, the action of the triode plate current is such as to remove the delay voltage effect, because of the decreased voltage drop across R6. This allows the avc rectifier to function at maximum efficiency so that the full control voltage is available to produce a flat output. We might note at this point that the removal of the delay voltage, as soon as it has performed its function of increasing the weak signal sensitivity of the receiver, is highly desirable from the viewpoint of preventing distortion, as well as from the viewpoint of producing a uniform output characteristic.

There are many other forms of delayed avc which lack of space prevents us from discussing in this article. Although the circuit arrangements will vary widely for these systems, basically the action is similar to that described in the previous paragraphs.

Firestone-Stewart-Warner R-1332

The schematic diagram of this receiver will be found on *S-Warner page* 6-16 *of Rider's Volume VI.* The following data was received after the publication of Volume VI. During all adjustments keep the volume control full on.

I-F. Alignment: Set test oscillator to 456 kc., the i-f. peak of the set, and connect its output between the 6A7 control grid and ground. Adjust the four i-f. trimmers, located on top of the i-f. transformers, to give maximum output deflection. After aligning the trimmers once, recheck the settings.

Dial Calibration:

If set is badly out of calibration, the oscillator shunt trimmer must be adjusted. In order to reach this, the chassis will have to be removed from the case, as follows:

(a) Remove the flexible shafts and dismount the receiver.
(b) Remove the four terminals of the speaker cable from the speaker.
(c) Remove the black antenna lead from the coil and unsolder the coil shield grounding braid.
(d) Remove the blue dial light lead from the socket terminal.
(e) Remove the yellow tone control lead from the tone control switch.
(f) Remove the six slotted chassis fastening screws and slide the chassis from the case.
(g) Reconnect the red and yellow leads of the speaker cable to the speaker.
(h) Insert the tuning shaft in the gang condenser fitting and reconnect the battery lead.
(i) Set the chassis on a flat metal plate and adjust the set as follows:

Connect a 0.00025-mf. condenser in series with the output lead of the test oscillator and the antenna lead lug on the antenna coil and the ground lead of the test oscillator to the chassis. Set the test oscillator to 600 kc. Tune the set to maximum volume and set the dial to read exactly 6.0 (600 kc.) Then set the test oscillator to 1400 kc. and adjust the tuning knob of the set until the pointer indicates 14.0 (1400 kc.) Adjust the oscillator shunt trimmer (on the gang condenser second from the control end) until the output indicator shows maximum out-

(*Please turn to page* 16)

Ohms—*Ohms*—OHMS!

The other day we were going over some schematics and happened to notice the number of ways these drawings from different manufacturers varied in respect to the manner in which the values of resistors were designated. Our curiosity was aroused and we started to track down all the variations we could . . . There were *plenty!*

First let's take a value under 1000—say, 695 ohms. That was written as 695ω, 695Ω, and just plain 695 with no symbol at all. Others wrote out the words OHMS. We'll grant you there is not much chance to get mixed up so far, but—

When we began compiling a list of the ways in which thousands of ohms and megohms were written, we discovered more and more variations. We found those listed in the accompanying work of art and there may be others for all we know. (This hot weather isn't so good for research.)

Now the point of all this is that there is a perfectly good chance for someone to get mixed up. Take, for instance, the third item on the left—.3 MEG. Suppose that the draftsman didn't make the dot sufficiently heavy and when the drawing was reproduced, the dot was almost invisible and so easily overlooked. Result: a 3-megohm resistor gets put in somebody's receiver, where one-tenth the value of that should be.

The question naturally arises, "Has not some standard symbol been chosen for ohms?" The answer is in the

300,000 OHMS	
$300{,}000\omega$	$300M$
$300{,}000\Omega$	$300M\Omega$
.3 MEG.	$300M\omega$
.3℧	$.3M\Omega$

Here are a few of the ways 300,000 ohms were designated on schematic diagrams.

affirmative. *The Institute of Radio Engineers* adopted capital omega (Ω) as the symbol for ohms and M Ω for megohms. However, various authorities do not follow this. For instance, *The Radio Engineering Handbook*, by Henny, uses both small and capital omega to designate ohms and sometimes omits it altogether.

The Bell System Technical Journal follows the form employed in the Bell Laboratories, i.e. lower case omega (ω). Several radio magazines play on the safe side and instead of adding further confusion, either spell out the word "ohms" or else omit it. If a fraction of a megohm or one or more megohms appear on a schematic, the designation is MEG.

Sometimes the common abbreviation "M" is used for thousand and three thousand ohms appears as $3M\omega$ or $3M\Omega$. Here is another chance to get mixed up, because if you will compare the latter notation with the last one in the right-hand column of the illustration, you will see that M Ω also designates megohms!

It would be possible to continue with such examples for quite awhile, but you can easily see for yourself what they are and the trouble that might result. We strongly suggest that some form really be recognized as a standard, and that it be followed by one and all.

•

Lost, Strayed or Stolen

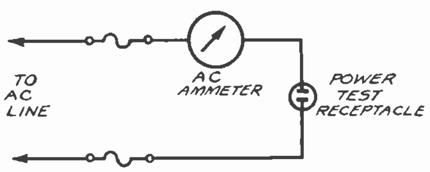
The Servicemen of Vancouver City, up yonder in Canada, do a little gumshoe work along with their regular pastime of fixing receivers. About once a month the city police department issues a list of stolen receivers, which list includes the make of the set, the model number, the number of tubes, and its serial number, if possible. Copies of this list are distributed to the members of the Associated Radio Technicians of B.C. (which was organized in 1928, by the way!) and they keep their eyes open for the "missing" receivers in the course of their rounds. Perhaps the police chief of *your* town might welcome a similar idea.

•

Know Your Power

We have been surprised to find that relatively few servicemen follow the practice of measuring the wattage or power consumption of a receiver as part of the standard test procedure. Quite a few manufacturers supply this data and we believe that service men should use it for more than an indication of how expensive it is to run the receiver in question. It should and often can be used to indicate the presence of a defect which is causing the set to draw an excessive amount of power. Such a defect might be a shorted filter condenser, a ground in the plate supply circuit, defective tubes, shorted power transformer, etc.

Before any other measurement is made it is very desirable that the power consumed by the receiver be checked and compared with the value given by the manufacturer as contained in the Rider Manuals. This can conveniently be done by plugging the receiver into the line through a special receptacle fitted out for this purpose, as shown in the accompanying ing illustration. You will note that



This simple layout will enable you to check the power consumption of a-c. receivers.

nothing is complicated about the layout and what is more important, it does not involve any expensive equipment. All that is necessary is an a-c. ammeter having a range of about 3 amperes. This will take care of sets drawing up to about 330 watts; if equipment is serviced which draws a greater amount of power then, of course, it is only necessary to substitute an ammeter which has a greater full-scale range.

A few remarks about how the power is measured. The most direct way is by means of a wattmeter. Because of the expense involved we believe that the average shop will prefer to use the ammeter method given here rather than go to the expense of purchasing a wattmeter. You will recall that power is equal to the product of voltage and current. Since the line voltage is known, generally about 110 volts, to get the power consumption or wattage, it is only necessary to multiply the current by the line voltage. An example will make this clear: Suppose the line voltage is 110 volts and the receiver under test draws 1.2 amperes. The wattage is then 1.2 multiplied by 110, which is equal to 132 watts. If the receiver draws appreciably more than rated power, then, as was pointed out above, it indicates the presence of a defect and the receiver should be disconnected from the line to prevent possible permanent damage to the power transformer.

Firestone-Stewart-Warner R-1332

(Continued from page 13)

put. Then adjust the other gang condenser trimmer as directed below.

R-F Alignment:

Set test oscillator to 1400 kc. and tune the set for maximum output. Adjust the setting of the test oscillator to the minimum value which will give sufficient output deflection. Adjust the trimmer nearest to the shaft end of the gang condenser to give maximum output indication.

•

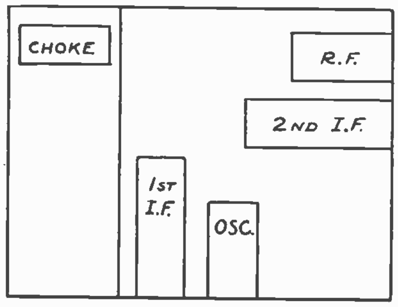
Fairbanks-Morse 346, B-6

The schematic diagram for the chassis used in these two models will be found on *page* 5-12 *in Rider's Volume V*. The bottom view of the chassis is shown in the accompanying illustration. The sections of the gang condenser, starting from the front of the set, are oscillator, r-f., and antenna.

Alignment:

Set the gang condenser to minimum capacity with the dial pointer exactly on 1600 kc. Then turn the pointer to 1200 kc.

With the signal generator at 1200 kc., adjust the oscillator trimmer to maximum output with minimum signal from the generator and with the volume control of the set on full.



Location of essential parts on under side of chassis for aligning.

Adjust antenna and r-f. trimmers in the same way. The gang will then track properly throughout its range if plates have not been tampered with and the intermediate frequency is exactly 177.5 kc. If gang does not track, then adjust the i-f. transformers.

To realign i-f. transformers, connect the output of the signal generator, set to 177.5 kc., to the grid of the 6A7 through a condenser, not larger than 50 mmf. Short oscillator section of the gang condenser and align the first i-f. transformer and then the second. The center screw will peak the grid side and the hex nut takes care of the plate circuit. Repeat the process so you will have maximum sensitivity.

Howling:

If there is a tendency to howl, the gang condenser is binding in some way; it should be free to float on the rubber mounting. Note that when the drive cable is pushed too tightly against the gang condenser, howls will result on all stations.

Remove the tuning control cable from the bushing on the set. Look through the hole in the bushing and see that the condenser shaft is lined up with this hole.

The bakelite tube flexible shaft couplings *must* fit freely over the tuning condenser and volume control shafts.

•

Remler 40

Beginning with serial number 66,746 several changes have been made in the Remler model 40, which is described on *Remler page* 6-3 *of Rider's Volume VI.*

Only one antenna coil is used in the revised chassis, the one marked "Long" (*see schematic on page* 6-3) having been eliminated. Resistor No. 12 in the cathode circuit of the 6A7 tube has also been removed and now the junction of the cathode of this tube and resistor No. 18 is directly connected to the lower end of the volume control in the antenna circuit. A 400-ohm, 1 watt resistor has been substituted for the 450-ohm resistor, No. 14, in the power supply circuit. The resistance of the volume control, No. 16, has been changed from 12,000 ohms to 1000 ohms and the upper connection of the shunt resistor, No. 22, goes now to the movable arm of the volume control instead of the upper end of the resistor element of that unit. The resistance of No. 22 remains the same. The resistance of No. 18 in the cathode circuit of the 6A7 has been increased from 50,000 ohms to 60,000. Resistor No. 21 in the secondary circuit of the second i-f. transformer has been decreased from 1 megohm to 500,000 ohms. Resistor No. 24 has been changed from 90,000 to 100,000 ohms.

The servicing data on Remler page 6-3 applies to this revised model, as well as the earlier chassis.

The Camera Doesn't Lie

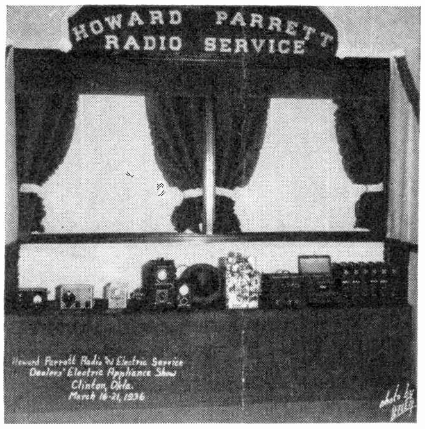
Just as a snowball gathers volume --as a racing car gains momentum, so has the RIDER 100 per cent CLUB increased a hundred fold in membership since the idea was first suggested some months ago.

Servicers everywhere exhibit such pride in their ownership of the RIDER MANUALS that in many cases they are using this ownership as a potent sales argument. Smart Servicers utilize the MANUALS as a visual reason why set owners should patronize that particular servicer.

We show a photograph of the display of "HUNDRED PERCENTER" HOWARD PARRETT of Clinton, Okla., which was shown at the Annual Dealers Electric Appliance Show held in Clinton during the week of March 16-21.

Here is clever merchandising—and the Rider organization is complimented by the inclusion of the MANUALS with the other test equipment. We admit that the MANUALS are quite as necessary to the successful and profitable operation of a service station, but we didn't think that owners of the MANUALS would realize this fact in quite the numbers who have written us.

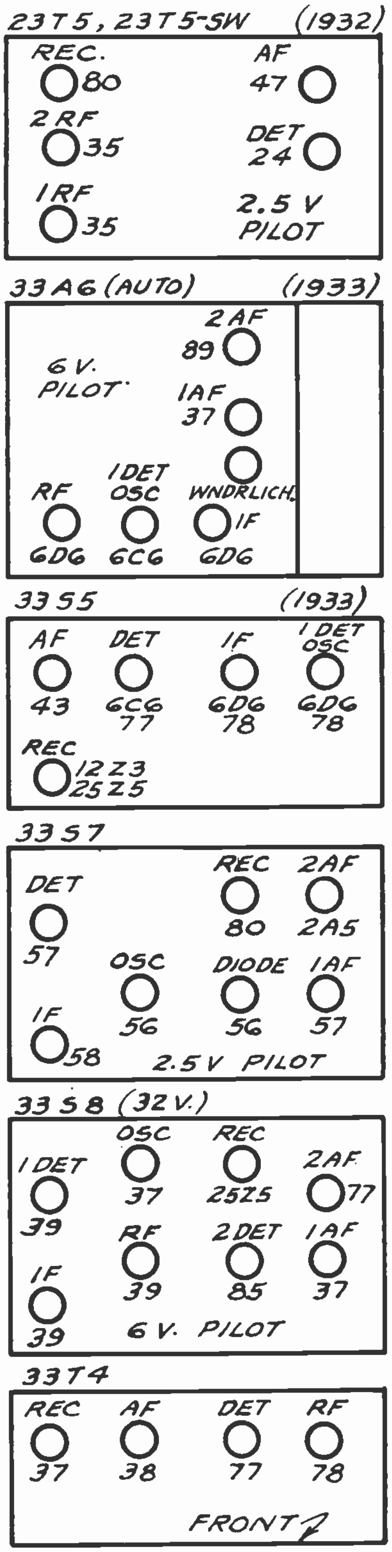
We are burning the midnight oil in an effort to devise practical ways and means to "sell" the RIDER MANUALS to YOUR public. Howard has sent us ONE honey of an idea—perhaps there are some more merchandising ideas which you'd like to share with your fellow servicers—if there are, we'd be grateful for them.



Note the six Rider Manuals on the right end of Mr. Parrett's display. . . . Good merchandising on his part!

Audiola Socket Layouts

The accompanying illustrations show the socket layouts of six Audiola chassis, the schematics for which will



Audiola socket layouts.

be found on the pages in Rider's Manuals indicated opposite the model numbers below:

Model 23T5, 23T5-SW on Audiola *page* 3-6 *in Rider's Volume III and page* 346 *in the Rider-Combination Manual;* 33A6, *page* 4-5; 33S5 and 33S7, *page* 4-7; 33S8, *page* 4-4; and 33T4, *page* 4-7.

Note: the bottom line of each layout is the front of the chassis, as shown on the lowest one.

•

G.E. A-64, A-67

In the schematic diagram for Models A-64 and A-67, on *G.E., page* 6-14 *of Rider's Volume VI,* you will find a connection between the low side of L-6 and the high side of L-8 (oscillator coils). This connection should be deleted. In the parts list for these models, note that the capacity for C-5 (Stock No. RC-210) is listed as 50 mf. This is incorrect; it should be 50 mmf., as is shown on the schematic diagram mentioned above. The parts list will be found on *G.E. page* 6-18.

The electrostatic shield of the 0.05-mf. condenser (C-23) that shunts the bleeder resistor R-7-8-9, sometimes makes contact with the high-voltage a-c. terminal of the 5Z4 rectifier tube socket. This causes a decided a-c. hum, which has none of the characteristics of the a-c. hums usually encountered.

This condenser, C-23, is mounted near the high-voltage terminal of the rectifier socket and vibration in shipment and operation, or pressure accidentally applied when the chassis is being serviced, may cause it to be moved against the terminal. This brings the electrostatic shield (the layer of foil just under the outer layer of wax paper) in contact with the terminal.

Dressing the condenser away from the terminal so as to assure permanent clearance, will eliminate the hum.

•

Not Oscillator Drifting

It has been brought to our attention that the apparent drifting of the oscillator in some Philco receivers is really not drifting at all, but is due to a change in the capacity of some of the i-f. trimmers.

This is caused by some trimmers being near some piece of apparatus that has a fairly great increase in temperature with a consequent melting of the wax that seals the adjusting screw on the trimmers. This melted wax runs down in between the plates of the condenser and so changes the capacity.

5-Meter Bands

We had a very illuminating experience a short time ago. We were experimenting with several all-wave antenae in use with a 5-band receiver. We knew definitely that reception on the 5- and 10-meter band was possible. As a matter of fact, certain police networks, operating two-way communications, were working within this band, yet it was impossible to receive the signals.

After the investigation, it was found that the characteristics of the antenna were such as to make it extremely difficult to receive stations in this band. Just how many other people are in the same boat, we do not know, but we feel reasonably certain that many other owners of such receivers have noted the absence of signals on this band.

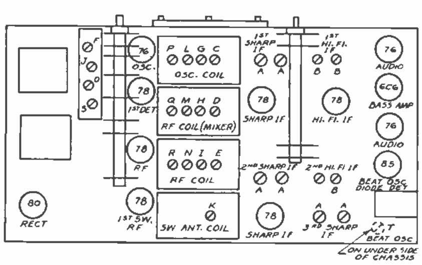
A check-up of the antenna systems installed showed that in those cases where reception was not possible, the erection of the antenna system was not strictly according to Hoyle. A change was instituted, so that the antenna was erected as originally specified in instructions, which very definitely improved reception on this band.

The moral of this story is that antenna systems should be erected as specified—that is, whenever it is possible. Furthermore, we believe that when an antenna system is installed, a thorough check of the receiver on all bands should be made. If this means the expenditure of additional time, it should be allowed for when the original estimate is presented.

•

Howard Grand

The accompanying illustration is the socket layout and shows the locations of the trimmers for the Howard



Locations of trimmers and sockets for Howard Model Grand.

Model Grand, servicing data on which appears on *page 6-15 of Rider's Volume VI* and page 12 of the May, 1936 issue of SUCCESSFUL SERVICING.

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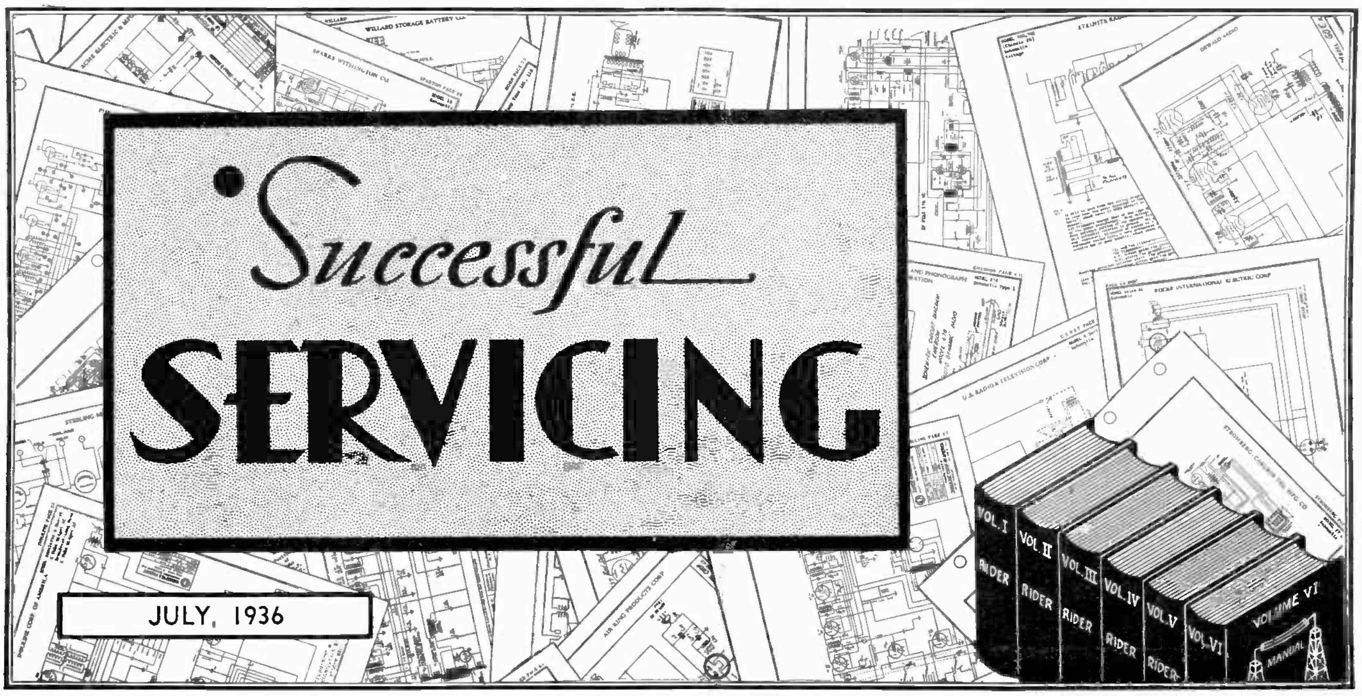


QUIET A. V. C.

A Discussion of Several "Q" Circuits and Their Functioning

By JOHN F. RIDER

ALL of you, we are sure, have at some time come across "Q" circuits in one form or another. Maybe you haven't known them as "Q" circuits, but called them silent tuning circuits, squelch circuits, quiet a.v.c. circuits, muter circuits or noise suppression circuits. Regardless of what name you choose to call them, the action of all these circuits is basically the same. They were introduced in radio receivers some time ago because of frequent complaints that receivers were excessively noisy. They function to prevent excessive noise when tuning between stations and, in general, block the receiver so that there is no output whenever the signal strength of a station is such that the noise background is too high for satisfactory reception.

At the outset we want to "squelch" any idea which you may have that these circuits will suppress or eliminate noise in the usual meaning of the term. "Q" circuits do not eliminate noise, but block the receiver whenever the input is less than a certain value determined by the design of the receiver or by the operator. If the receiver is blocked for the noise, it is also blocked for the signal. Furthermore, these circuits do not take the place of the usual steps which are taken to eliminate man-made static, but supplement these steps. *When everything possible has been done to eliminate the sources of interference, then the "Q" circuit blocks the receiver for signals which are weaker than a value sufficient to insure satisfactory noise-free reception.* Again you should bear in mind that in places where the noise level is high, satisfactory operation of the "Q" circuit means that the receiver will have to be blocked for all but fairly strong signals. Otherwise the receiver will function at the noise levels and an objectionable amount of noise will be heard when tuning between stations.

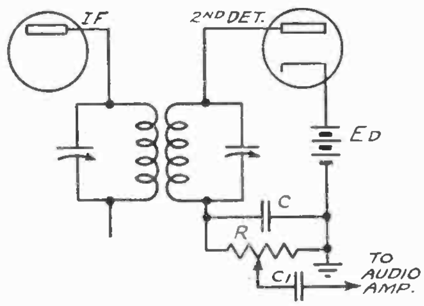


Fig. 1. A simple a.v.c. circuit wherein the second detector is blocked when the input falls below a certain level.

Various Methods Used to Block Receiver

How do these "Q" circuits function? In general, regardless of the type of "Q" circuit which is being examined, you will find that the action depends upon blocking one of the several channels through which the signal passes before it reaches the loudspeaker. Sometimes you will find that it is the i-f. amplifier which is blocked by means of a control voltage automatically produced when the input falls below a certain value. In other circuits, the audio amplifier—generally the first audio stage—is blocked by means of a negative voltage applied to the grid of the first a-f. tube. Sometimes the plate voltage of the first a-f. stage is automatically reduced so as to block the stage and if the tube happens to be of the screen-grid type, then it may be the screen voltage which is lowered to prevent the stage from passing the noise voltage. In still other circuits the action is made to depend upon blocking the second detector by means of a negative voltage in series with the second detector plate. This action renders it impossible for rectification to take place in the second detector and in this way blocks the whole receiver. You can see, then, that blocking the signal at almost any point, as it passes through the successive stages of the receiver, is effective in producing the noise suppression action which we are discussing.

(*Please turn to page 3*)

Zenith 090,90,V-8

Chassis 2012-4J is used in Models 090,90 and V-8. This chassis is more or less similar to Chassis 2012 and 2012-J that was used in Models AH, CH, and RH, which are shown on the following pages in *Rider's Manuals: page 1-23 in the revised edition; *674-E, in the early edition, and page 2717 in the Rider-Combination Manual.* The circuit changes that were made in Chassis 2012 to make the Chassis 2012-4J are shown below and it is suggested that you make a notation in your Index about the similarity that exists between these two chassis.

The antenna circuit has been revised, as may be seen by comparing Fig. 1 with the schematic of Chassis 2012 on one of the pages mentioned above. Instead of a three-gang condenser (Part No. 22-116), a four-gang condenser is used with the fourth section tuning the antenna winding. (The part number of the four-gang condenser is 22-134.) The winding in the antenna circuit, which is tuned by the fourth section of the new condenser, has been added to the antenna coil assembly. Note that the condensers and resistors in this part of the circuit are the same as those shown in the schematic for the early chassis.

The padder condenser assembly (Part Nos. 22-120 and 22-82) has been replaced with a single variable condenser, Part No. 22-129. Also the 8-mf. filter condenser (Part No. 22-121) mounted at the side of the condenser gang has been removed and mounted below the chassis. No mounting base is used, and it carries a new part number, 22-136.

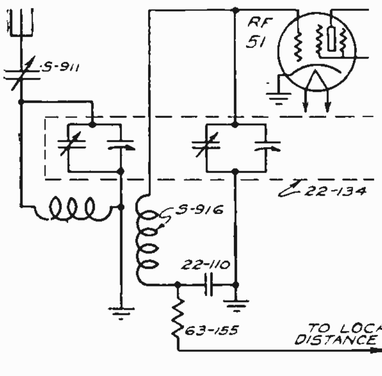


Fig. 1. Antenna circuit of Zenith Chassis 2012-4J shows new connections.

Fig. 2 shows the voltage divider, the a.v.c. tube, and the new local-distance switch. Note that the lead marked "To Local-Distance Switch" in Fig. 1 is connected to that lead in Fig. 2 which carries an arrow in the plate circuit of the 24 tube. Note also that the condensers, Part No. 22-99, in the Chassis 2012 have been eliminated, and that the one in the plate circuit of the 24 tube has been replaced with one having a value of 0.03 mf., Part No. 22-111. The value of the resistor connected between the "Local-Distance Switch" and the lead to the tone control (the one at the right of Fig. 2) has a value of 4.5 megohms, Part No. 63-188. The 0.1-mf. condenser, connected between the movable arm of the volume control and ground, has been eliminated. The part number of this condenser was 22-115.

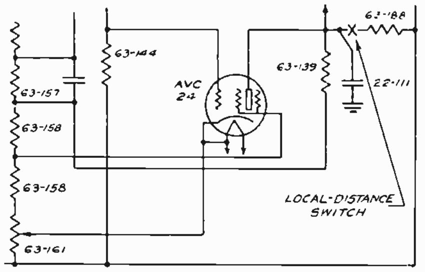


Fig. 2. A "Local-Distance" switch is now included in Zenith Chassis 4012-4J.

In other respects the chassis 2012-4J is the same as chassis 2012.

Majestic Balancing Notes

From time to time requests have been received for the balancing notes on the tuned r-f. Majestic sets that appeared on the market about 1930. So many of these requests have come in that we decided to run these instructions, which cover the following sets:

Chassis No.	*Model No.*	*Rider's Manual Page Revised*	*Early*	*Combination*
70, 70-B	71, 72	1-1, 1-5	*373, *377	1149, 1153
90	91, 92	1-11	*383	1161
90-B	90, 91, 93	1-12	*385	1164
100	101	1-11	*383	1161
100-B	102, 103	1-12	*385	1164
180	181	1-8	*380	1156

1. Supply a 1350-kc. signal to the input of the receiver and tune it to the exact resonant point of this signal with both the main tuning control and the trimmer. Then turn the volume control to maximum.

2. Insert a balancing tube (a 26 or 27-type—depending on type used in set—with the heater open, so that it will not light) in the first r-f. tube socket and adjust the first r-f. balancing trimmer for minimum output.

3. Balance the rest of the r-f. stages in the same way, moving the balancing tube to the respective sockets.

4. Supply a 950-kc. signal to the input of the set and tune it to this frequency.

5. Adjust all gang condenser trimmers for maximum output.

When using the balancing tube be sure that a tube shield covers it when making adjustments, so that the capacity effect of the shield is included.

G. E. A-66 and A-86

Please make a note in your *Index to Rider's Volume VI* that the General Electric receiver, Model A-66, uses the same chassis as Models A-64 and A-67. Also that Model A-86 uses the same chassis as Models A-82 and A-87.

Philco 630, Code 121

Starting with Run No. 4, the 20,000-ohm resistor, No. 50, was changed from 0.5 watt rating to 1 watt. Note that this resistor has a value of 99,000 ohms on the schematic diagram on *page 631 of Rider's Volume VI,* but that at the end of the parts list on *page 6-33* a note states that this was changed to 20,000 ohms during Run No. 2.

The 4,000-ohm resistor, No. 56, has been changed from a 0.5-watt to a 0.25-watt rating.

Effective with Run No. 7, the shadowmeter was changed from Part No. 45-2086 to No. 45-2083 and that the 4,000 ohm resistor, No. 56, has been removed from the circuit.

Philco 640, Code 121

Effective with Run No. 4, replace the first i-f. transformer, Part No. 32-1835, with No. 32-1917 to prevent microphonics. Also remove rubber bumper, Part No. 27-4150 for the same reason.

Effective with Run No. 9, the tuning condenser, No. 31, has been changed from Part No. 31-1556 to 31-1671.

Effective with Run No. 10, the shadowmeter, No. 61, has been changed from Part No. 45-2080 to 45-2083. The 5000-ohm resistor, No. 62, has been removed from the circuit.

The bottom view of the chassis on *page 6-34 of Rider's Volume VI* has a transposition of indicating numbers: No. 47 should be No. 39 and vice versa. In other words the first i-f. transformer which is No. 39 on the schematic, is now indicated by No. 47 and should be No. 39.

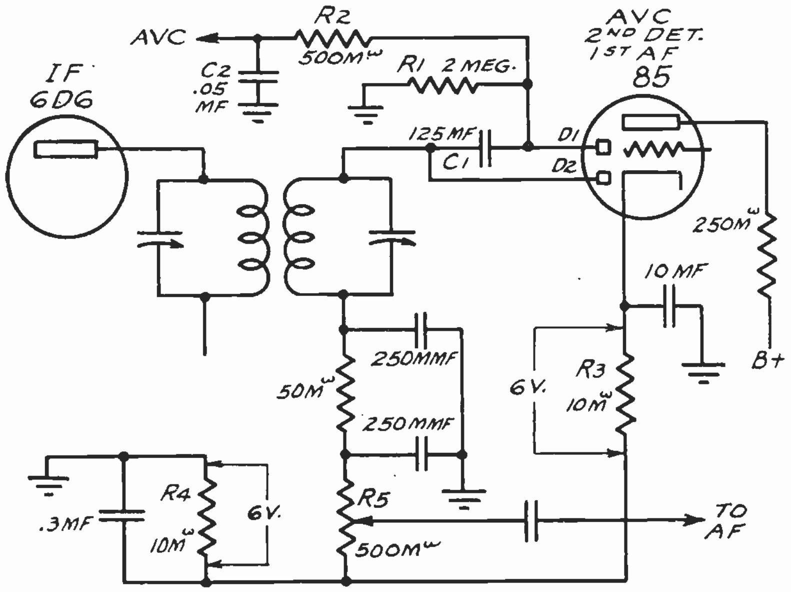


Fig. 2. A noise suppression circuit of the blocked second detector type. Note that the 6-volt drop across R3 provides the blocking action.

Quiet A.V.C.

(Continued from page 1)

Basic Blocked Second Detector "Q" Circuit

Perhaps the simplest type of quiet a.v.c. to comprehend is that type which depends for its action upon the blocking of the second detector whenever the input signal falls below whatever the predetermined value may be. This system is used in a considerable number of receivers and, on the whole, finds its greatest application in automobile receivers.

The basic circuit, which is characteristic of "Q" circuits of the blocked second detector type, is shown in Fig. 1. You will observe that the signal from the last i-f. stage is fed to the second detector which is conventional in all respects with the exception that a delay voltage—designated as E_D—is inserted in series with the cathode. The effect of this delay voltage is to block the second detector and, therefore, the receiver, until the input signal reaches a certain value. In other words, for a given value of delay voltage, the receiver will not function and there will be no audio output until the peak value of the signal across the secondary winding is greater than the delay voltage, E_D. To take a numerical example, if the delay voltage is 5 volts, then there will be no output until the incoming signal is sufficiently great so that more than 5 volts is delivered to the secondary winding of the last i-f. transformer. As you should expect, the larger the value of delay voltage, the stronger will the input signal have to be in order to render the receiver operative. In other words, when the delay voltage E_D is zero, then the second detector functions in the ordinary manner and there is no delay—regardless of how weak the incoming signal is, the second detector will still function. However, as the delay voltage is increased from the zero value, then larger and larger values of minimum input signal are required to overcome the delay voltage. *The voltage E_D is accordingly the factor which permits the choice of the minimum signal level at which the receiver will operate.*

Typical Blocked Second Detector Circuit

You will appreciate, of course, that the circuit shown in Fig. 1 represents only the bare outline of circuits of the general type which we have been discussing and that in practice there are certain variations in the circuit connections in spite of the basic similarity. An example of a typical commercial circuit of this type is shown in Fig. 2. You will note that this circuit uses a duplex-diode triode tube to combine the functions of delayed a.v.c., delayed second detection, and audio amplification. Considering the delayed a.v.c. circuit first, we note that the diode designated as D1 is used as the a.v.c. diode and that the diode load is the resistor R1. The a.v.c. voltage is distributed to the controlled tubes through the filter network composed of R2 and C2. The delay voltage in the a.v.c. circuit is, of course, equal to the voltage drop across the cathode resistors R3 and R4, which in this receiver is equal to about 12 volts. This voltage drop represents the IR drop due to the flow of plate current of the triode section and remains constant regardless of the value of input signal. You will note that a 10-mfd. electrolytic condenser prevents any audio voltage from being developed across the cathode resistors R3 and R4.

As far as the delayed a.v.c. rectifier is concerned we have just seen that the delayed action is secured by returning the a.v.c. diode load, R1, to ground, whereas the cathode of the tube is 12 volts above ground. In the case of the second detector, diode D2, you will note that the load resistor for this tube —the volume control, R5—is returned to the junction of the two cathode resistors, R3 and R4. Since R3 and R4 are each 10,000 ohms, it follows that the plate of D2 is 6 volts negative with respect to the cathode and, as we previously explained, this implies that the receiver will not begin to operate until

Please turn to page 10

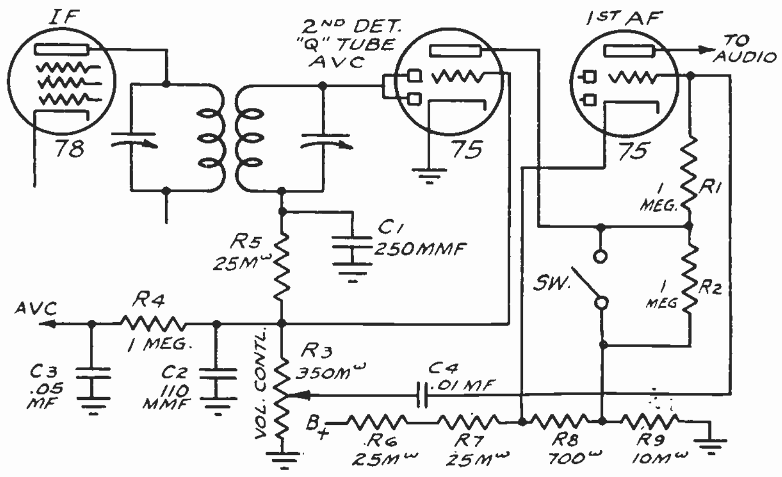
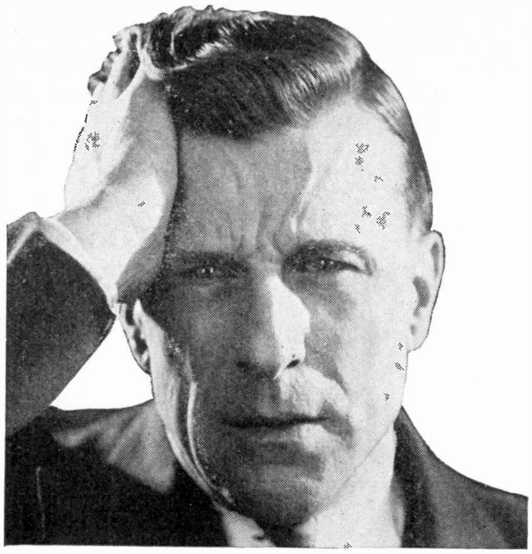


Fig. 3. A "Q" circuit that depends for its action on the blocking of the audio amplifier.



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Electrad Offers 3 Specially Designed Controls for use in Antenna-Cathode Circuits—Complete Table in New Guide Simplifies Selection.

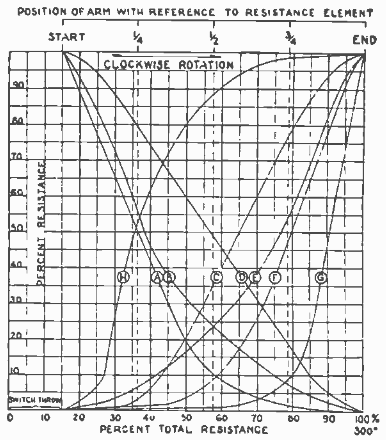
Correct taper is the important thing in an Antenna-Cathode volume control. When the taper is not exactly right, the control either gets noisy and burns out quickly—or the control of volume may be "jerky."

To provide for all receiver requirements, Electrad has designed three standard controls for use in this circuit—No. 240, No. 201 and the heavy-current-carrying No. 875. Selection of the proper control is guided by a complete table of which the following is an excerpt:

Tube	No. of Tubes	Control	Taper	Bias Resistor
27	1	201	C	3500
	2	240	C	1500
	3	875	H	1250

By consulting the complete table it is immediately evident that if three R. F. tubes have their cathodes tied together, and then to one end of the volume control, thru the proper bias resistor, the No. 875 control must be used. Column 4 shows fixed resistance value needed to give proper minimum bias to the tubes in question.

Servicemen who have used these new Electrad controls report complete satisfaction and a tremendous simplification of the job of selecting the right control for this frequently troublesome replacement.



Above chart shows standard control tapers. Curves H and C are recommended for Antenna-Cathode circuits.

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Vol. 2 July, 1936 No. 11

EDUCATION

THIS may sound like so much repetition, but we will hazard criticism on that score. We feel that it is impossible to stress to too great an extent the need for further education in the radio service field. This becomes evident when upon analysis of modern radio receiving equipment, we analyze but a few of the technical features of the modern radio set as against the early receiver. At the present time automatic volume control is a part of practically every superheterodyne receiver. . . . As a matter of fact it has become a regular feature of even automobile radio receivers.

Now how does the serviceman go about checking the performance of an A.V.C. system? It is perfectly possible that some form of A.V.C. action does take place but it is of extreme importance that, when a receiver is serviced, it be definitely established that the A.V.C. system is functioning properly by knowing the change in output from the receiver for certain prescribed changes in input. In other words, if a receiver is rated in such a manner that a 40 db. change in input voltage causes a change in power output of the receiver from .5 to 2½ watts, it is imperative that the serviceman be familiar with the functions of A.V.C. systems sufficiently well so he can establish that such operating conditions do or do not exist. A 40 db. change in the input means a voltage change of 100 times in the input. In other words, if the signal voltage input changes between the two limits, one of which is 100 times as great in voltage as the other, the action of the A.V.C. system will be such as to create a range of output value of which the maximum is five times as great as the minimum.

This is not a standard rating; in some cases a change in input voltage of 100 times will only cause a change in output wattage of two times. Now the serviceman must be familiar with the significance of such actions and with the significance of certain technical statements which are made.

Today the average serviceman can tell if a certain A.V.C. is functioning, but seldom, if ever, can he recognize a defect which will tend to impair the operation so that the proper relation between input and output is not maintained.

Then again the subject of sensitivity is one of importance. There is no doubt about the fact that service notes will make reference to the signal input required to produce a certain definite output across a prescribed load. It is imperative that you be familiar with this, when we recognize that receivers of different types produced by the same manufacturer, possess different values of sensitivity. Further, this sensitivity is often a variable, depending upon the tuning band being used. For example, certain small models or possibly lower priced models of receivers may require an input of 70 microvolts to about 100 microvolts in order to produce an output of 1 watt. Larger or higher priced receivers, produced by the same manufacturer, require from 5 microvolts to possibly 30 microvolts input in order to produce an output of 1 watt. Therefore, it is necessary for the serviceman to appreciate the significance of sensitivity and sensitivity measurements, so he can tell if a receiver is performing in the manner indicative of normal operation.

If all receivers were alike in that the signal input required to produce a standard output were the same, then a simple uniform test would suffice. However, inasmuch as different types of receivers require different values of signal input in order to produce the required output and since the receiver sensitivity varies on the different bands of the same receiver, it is imperative that the required tests be known and understood.

It is not sufficient that certain mechanical operations be performed in making these tests. . . . It is essential that the man who makes the test be perfectly familiar with just what is being done and why the test is made, so he will be able to recognize the existence of a defect, when normal conditions are not observed during the test.

We recognize that to present technical information of the type required to enable testing of sensitivity and A.V.C. action would complicate the service data, but it is still essential that such material be available to the serviceman. No matter how we try to view the servicing picture—admitting that servicing without such tests has been going on for so many years—we cannot see how it is possible for any service organization to classify a modern multi-tube receiver as being satisfactorily serviced without having established various operating conditions.

We admit that the average customer would never recognize that a A.V.C. system which is supposed to change in output from say .5 watt to 1 watt for an input voltage change of 100 times—changes from .5 watt to possibly 2 watts because of the manual audio volume control located in the system and which would no doubt be manipulated by the owner. However, such a set is not working properly and we believe that it is not just or, for that manner, honest to return such a receiver to the customer,—purely on the grounds that the customer would not recognize the valued operation.

JOHN F. RIDER.

CHARLIE CHANCE

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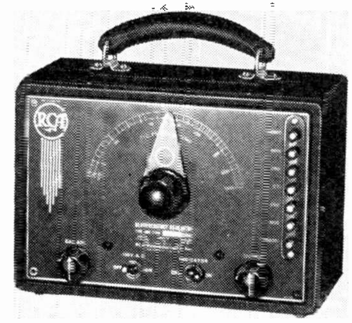

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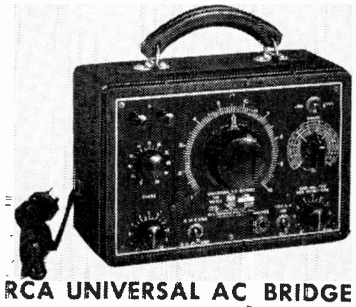

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Rolling REPORTER

RUMOR . . . They do say that the winter of 1936 will see about 300 different types of tubes in the lineup. . . . Right now they count up to about one ninety . . . *that makes 110 to come ! ! !* On account of nobody wants to say anything definite—— television receivers have already been put in the price class of the Chevvy—but a couple of spiritualists seem to think that maybe about **300 bucks** is a closer price. . . . We're sneaking this thru. . . . If it gets into this colyum——it slipped by hawkeye Rowe—Rider's VII may be as big as 1600 pages. . . . **Wow!** . . .6500 plus 1600 makes about 8100 pages and *thats a lota pages*. . . . The price? . . . No ketch. . . . They plugged the keyhole just about that time. . . .Rider is supposed to be chewing the fat with two pubs. in Europe. . . . Howja like to see a "parlais vo" edition of the Cat-Ray book? . . . Oui, *oui! !* . . .

ELIGIBLE FOR THE LIGHTWEIGHT CLASS
Joseph Smith, N. Y. servicer deluxe, just about 5 feet tall and weighting 132 knocked the block off a 170 pound penitentiary graduate. . . . *and that without the wiring diagram!*

A GAG . . . A Scotch servicer went into a Western Union Station and asked how much it would cost to send a 10 word telegram. . . . "50 cents for 10 words", said the clerk, "5 cents for each additional word and no charge for the signature" . . . "Good" said Service Sandy, "I know that I don't look it, but I really am an Indian and my name is **'I won't be home until Friday.'** "

NEWS . . . We hear that the A. F. of L. has issued a charter to a servicemen's group in Seattle and Bremerton in Washington through the I.B.E.W. (*International Brotherhood of Electrical Workers*, to you.) The local is known as No. 741. . . . Also that the A. F. of L. is active in Cleveland. . . . Also Tacoma. . . .
There's gonna be quite a shindig in Spokane, Wash., on **August 6, 7 and 8.** . . . Its the *North Pacific Radio Service men's Convention*. . . . A week later the *Third Annual Washington State Radio Servicemen's Convention* will assemble in Seattle. . . .The dates are **August 14 and 15.** . . . Rider will go to both and also pull a couple of salmon out of Puget Sound.

MR. FARLEY'S DEPT——Cleveland has a Shakespeare. . . . The guy is known as Vangunten. . . . Shak-Van. . . . Okee Doke on ure lettere. . . . Let's have the news about Cleve. . . . Thanx for ur com on VI. . . . *Smith of Appelton, Wisc.* . . . That postcard you enclosed is a grand brain throb. . . . Other servicers might well use the same tactics by telling the world——AND THEIR CUSTOMERS—— that they're equipped 100% with Rider's Manuals and so are all set to take on **ANY SET A-TALL,** for they've got all the dope at their fingertips. . . . Mebbe we'll get cards as per your suggestion. . . . Anyhooooo——thanx. . . . *Andrew Fisher, Crested Butte, Colo.* . . . You'll get S.S. regularly from now on. . . . Try again Andy, may be you'll be able to sell the others. . . . **Your letter would make a swell ad.** . . .*Lagasse, Father and Son, Beverly, Mass.* . . . Sure we remember. . . . Them were the dark days. . . . About S. S., you can have as many of the missing copies as the red head here in the office can find. . . . Sorri you missed some copies. . . . No reason for it. . . . Such things happen now and then. . . . Congrats to you. . . . Servicing can be made to pay and your belief in it and your idea to groom your son for it displays the confidence the business needs. . . . **You can't fail, fella——no matter what may happen to thousands of others.** . . . *Robert Hass, Chicago*. . . . The postman brought your card. . . . Why didn't you put your address on it? . . . Some of the names we got for S. S. at the IRSM show in Chi went astray when the box was erroneously sent to Minneapolis. . . . Maybe your name was in that bunch. . . . No reason why you should not receive S. S. . . . (Notice to all friends of Bob Hass. . . . Tell him about this reference to his card. Thanx.). . . . *D. A. Padgham, Biggar, Sask. Can.* . . . Glad you enjoyed your hour a day. . . . There'll be more soon. . . . *A. E. Ellison, Ilwaco, Wash.* . . . Doc Manual tells the truth. . . . **We're glad that you confirm his comments.** . . . *Harold Brown, Pen Argyl, Pa.* . . . No date yet on Practical Testing Systems . . . the hours a day are taking up all the hours. . . .

MORE FROM FARLEY . . . *Dale Kealy, Chicago*. . . . Thanks for the compliment. . . . We did spend some time developing the Cat-Ray book jacket. . . . and we are very pleased that you like it. . . . Your name has been added to the S. S. mailing list. . . . *C. H. Woodruff, Orange, Calif.* . . . Let's hope that your Rider library will be complete soon and we hope that you'll say the same nice things when you get the rest of our books. . . . *Incidentally, you couldn't spare an orange, could ya, . . . huh?*

THIS IS NO FISH STORY . . . J. F. R. was invited to go fishing a few weeks ago. The locale was a privately owned forest of about 5300 acres and a couple of lakes, privately stocked. . . . They visited the trout pond and the fish were too smart . . . so-o-o, they went to the pickerel pond. . . . Did they catch fish! ! ! ! In four hours they THREW BACK into the lake more than 200—— yes, *you heard me*, TWO HUNDRED—— pickerel, which were less than 13 inches long. . . . If you run into any other **TRUE fish stories while on your vacation send 'em in to**

The Rolling Reporter

Philco 37-84, Code 122

The tube complement of the Model 84, as published on *page 4-34 of Rider's Vol. IV,* has been changed, as may be seen in the voltage table given below. Also circuit changes have been made as follows:

Condenser No. 32 (0.015 mf.) connected across the voice coil is not shown in the new schematic. This condenser was only used in the early production of the old Model 84.

The center tap of the filament winding of the power transformer has been eliminated and the terminals are now numbered:

Terminals	*Circuit*	*Color*
1-2	Primary	White
3-4	Filaments	Black
5-6	Fil. Rect.	Blue
7-9	Rect. Plates	Yellow
8	Center tap 7-9	Yellow with Green Tracer

The part number of the power transformer (60 cycles) remains the same, but if the set is used on 25 cycles, the part number of the power transformer for this frequency is 7422.

The i-f. peak of the receiver has been changed to 470 kc.

Voltage Table:

Tube	Function	Plate	Sc. Grid	Cont. Grid
6J7G	Det-Osc.	245	105	8
6J7G	2nd Det-1st A.F.	40	30	—
6F6G	Output	235	245	—
5Y4G	Rect.	300	—	—

The locations of the tubes remain the same and can be identified by comparing their functions with the socket layout on *page 4-33.*

Note that a change has been made in the locations of two resistors, shown in the bottom view of the chassis on page 4-33. The 1-megohm resistor, No. 18, now occupies the position of No. 12 and this last mentioned resistor (16,000 ohms) is located where No. 18 used to be. Resistor No. 18 is now connected directly to the 4.0-mf. electrolytic condenser, No. 29, and located near it.

The color of the leads to the i-f. transformer are as follows and should be marked on the schematic, *page 4-34:*

Red—Top lead of primary going to No. 11.

White—Bottom lead of primary going to No. 12.

Brown—Top lead of secondary going to Nos. 15 and 16.

Black with White tracer—Tap on secondary.

Green—Bottom of secondary going to No. 17.

Green (With grid cap)—Capacity winding to 2nd detector control grid.

G. E. A-63

If a noisy Model A-63 is found, the trouble may be due to the field coil breaking down to ground. This trouble is not readily apparent, but it should be checked if you come across a very noisy receiver.

•

Resistor Identifications

When must a resistor of 10% tolerance be used and when is it all right to use one that is plus or minus 25%? That is a question that is continually arising and we are glad to be able to tell you how two manufacturers specify tolerances. We are indebted to J. N. Golten, Service Manager of Stewart Warner, for the following method used for identifying the *carbon resistors* in their receivers:

When a resistor is given a round number, such as 20,000 ohms, it indicates that the limits are + or — 10%. If the value on the schematic is given as 21,000 ohms, for instance, (the figure is *one higher* than the round number, 20,000), then the limits are + or — 20%. If the figure should be shown as 19,000 ohms (*one less* than the round number 20,000), then the limits are + or — 25%. (*This data does not apply to wire-wound resistors,* for which more exact values are sometimes indicated.)

On some of the resistors used in the new General Electric receivers, a silver or gold dot or ring has been added in addition to the standard RMA resistor color code. These added markings indicate the tolerance, which are as follows: Silver marking ± 5%; no marking ± 10%; and gold marking ± 20%.

It would be a step in the right direction if such specifications could be standardized and we would be glad to get any suggestions. However, in the meantime we would like to know how you and *you* identify your resistors—and condensers.

•

Unity Power Factor

In the squib "Know Your Power" on page 14 of the June issue of SUCCESSFUL SERVICING mention was omitted of the fact that the power factor was assumed to be equal to one. This assumption is permissible since under normal operating conditions the power factor is not appreciably less than unity and furthermore maintains this value until very heavily overloaded.

Quiet A.V.C.

(*Continued from page* 3)

the signal voltage across the last i-f. transformer is greater than 6 volts. You should note that it is the voltage drop across R3 which determines the magnitude of the second-detector delay voltage and so determines the minimum signal at which the receiver will begin to function.

To summarize the action which takes place in this receiver as regards the operation of the a.v.c. and second detector systems, we see that there is no audio output at all until the input signal corresponds to a 6-volt level at the second detector and that the a.v.c. does not begin to act until the signal level at the second detector is 12 volts. In between the squelch signal level and the threshold voltage there is thus no a.v.c. action.

Blocked Audio Type of "Q" Circuit

Another type of "Q" circuit which we mentioned in the early part of this article is that which depends for its action upon the blocking of the audio amplifier, rather than the second detector, whenever the input signal falls below a certain value. In general, circuits of this type depend upon the application of a control voltage to reduce the voltage amplification in the first audio stage to a point where no signal reaches the speaker. The element to which this control voltage is applied may be either the plate, the screen grid or the control grid, depending of course upon the circuit design.

The circuit shown in Fig. 3 is representative of the manner in which blocked audio "Q" circuits function. This is the quiet a.v.c. circuit used in the Philco Model 810 PA receiver. You will note that the diode section of the first 75 tube is used as the second detector and also as the a.v.c. tube. The a.v.c. voltage is fed to the controlled tubes through the filter consisting of R4 and C3, while the negative voltage which is applied to the grid of the triode section of the 75, is taken directly from the high side of the second detector load, R3. The plate of this triode section, which serves as the "Q" tube, is connected to a positive point on the voltage divider through a 1.0-megohm resistor, R2. The diode section in the second 75 tube, you will note, is not used. The triode section of this tube is the first audio stage, which is automatically controlled.

(*Please turn to page* 12)

Grunow 580, 581

The voltage data for Chassis 5-G, used in the two models 580 and 581, has just been received together with some changes in the circuit, which will be found on *pages 6-9 of Rider's Volume VI.*

The 0.05-mf. condenser between the plate of the 75 and the control grid of the 42 has been changed to 0.02 mf., Part No. 34435. There are two 500,000-ohm resistors in series between the control grid of the 42 tube and terminal No. 2. The upper one—that nearer the junction of the tone control and the grid of the 42—has been reduced in value to 200,000 ohms, Part No. 23538.

Voltage Data:

Tube	Plate	Screen	Cont. Grid	Grid No. 2	Suppr.
6A7	245	85	4.5	190	—
6D6	230	80	—	—	2.5
75	90	—	—	—	—
42	230	250	—	—	—

There is a negative voltage of 14 volts between terminal No. 2 and ground.

•

Philco 650

The tuning condenser, No. 31 on the schematic on *page 6-37 of Rider's Volume VI*, has been changed from Part No. 31-1556 to 31-1671, effective with Run No. 13.

Effective with Run No. 15 for Code 121 and Run No. 13 for Code 122, the shadowmeter has been changed from Parts No. 45-2086 and 45-2082 to 45-2083 and the 5000-ohm resistor, No. 58, Part No. 6096 has been eliminated.

In the bottom view of the chassis on *page 6-39*, the indicating numbers 39 and 47 should be interchanged.

Effective with Run No. 12, the tone control, No. 56, has been changed from Part No. 30-4351 to 30-4379. Also the 110-mmf. condenser, No. 62, has been removed from the circuit.

Effective with the following runs on the respective codes: No. 8 on Code 123; No. 12 on Code 121; No. 9 on Code 122; and No. 11 on Code 151, the following changes were made to reduce the hum:

Schematic No.	Value	Old Part No.	New Part No.
45	1000 ohms	5837	33-1028
58	5000 ohms	5310	6096
76	15,000 ohms	6208	33-1177
64	70,000 ohms	5385	33-1115

•

We glory not in never failing, but in rising every time we fall.
—Confucius.

Quiet A.V.C.

(*Continued from page* 10)

From the connection of the cathode of the second 75 tube to the voltage divider at the junction of R7 and R8, it is clear that an initial bias is placed on the first audio tube equal to the voltage drop along R8. The plate of the first audio tube is coupled to the output tubes in the conventional manner.

To examine the noise suppression action which is present, it is necessary to consider the bias on the first a-f. tube under varying conditions of input signal. When the input signal is high, then it follows that the voltage developed across the detector load, R3, will also be high. Furthermore, with this high negative voltage applied to the grid of the 75 tube, the plate current of the "Q" tube will be very small. This in turn means that practically no voltage drop will be across R2, with the result that the bias on the first a-f. tube will not be increased, but will be equal to the normal value established by the voltage drop across R8.

So much for the operation with medium and strong values of input signal. As the input signal falls to weak values, the bias on the "Q" tube is also decreased so that the plate current of the "Q" tube increases. This in turn results in an appreciable voltage drop across the 1-megohm resistor, R2. The direction of current flow being into the plate of the tube, the bias on the first a-f. tube will be increased to the extent of the drop along R2. Since the 75 first audio tube is of the high mu type, the circuit design is such that the increased bias is sufficient to cut off the plate current of the first a-f. tube and to reduce the amplification to zero. This naturally blocks the receiver and produces an effective noise suppression action.

With the "Q" switch closed so as to short R2, there is no additional bias impressed upon the grid of the first a-f. tube under conditions of low input signal, so that the "Q" circuit is inoperative and the receiver then functions at maximum sensitivity with no noise suppression action.

There are many other variations of this basic type of "Q" circuit which depends for its operation upon cutting off the first a-f. stage for low values of input signal. However, we feel that the explanation of a typical system coupled with the similarity in operation of these circuits will suffice to enable the comprehension of other circuits without the necessity for further elaboration.

Blocked I-F. Amplifier Noise Suppression

There is another type of noise suppression which depends for its operation upon the blocking of the i-f. amplifier during those periods when the signal input falls below a certain value. Whereas in the previous system which was just discussed, the action took the form of a control voltage applied to the first a-f. stage, in the system which is about to be described the control voltage is applied to the i-f. tube in order to secure the desired noise suppression action.

The circuit shown in Fig. 4 is a partial schematic of the RCA Model R-78 showing the essential parts of the a.v.c. and noise suppression circuit. If you refer to the illustration you will note that there are two i-f. amplifier stages, one of which is used to amplify the voltage which feeds the a.v.c. rectifier. The reasons for the use of this arrangement are discussed at length in the book on A.V.C. in the "An Hour a Day with Rider" series.

You will note that each of the two diodes in the type 55 tube are used for separate purposes. The diode designated as D1 is the a.v.c. rectifier and receives its voltage from the primary winding through the small coupling condenser C4. The a.v.c. voltage is fed to the controlled tubes from the voltage divider composed of R5, R6 and R7. The second diode, D2, is connected to the secondary winding of the i-f. transformer and the load for this diode is the resistor R4, which is bypassed by means of the condenser C3. You should observe that this resistor is returned directly to the cathode, whereas the a.v.c. load is returned to ground. From the connection of the a.v.c. diode load to ground it follows that the magnitude of the a.v.c. delay voltage is equal to the voltage at the cathode of the 55. This is also the voltage at the cathode of the signal i-f. amplifier stage, since the cathode of the 58 is tied in with the cathode of the 55. The plate of the triode section of the 55 is connected to B+ through the switch designated as the "Q" switch.

So much for the important circuit connections. Let us now analyze the operation of the circuit.

As the figure shows, when no signal voltage is impressed on the receiver, no voltage is produced across the load of the noise suppression diode D2. Since the triode section receives its bias from the voltage across R4, it follows that under conditions of zero or very small input signal, the triode section operates at zero bias. Under this condition the plate current of the triode is very large and approximately equal to 10 ma. Since this plate current flows through the cathode resistor R1, *which is common to both the signal channel i-f. amplifier and the a.v.c. tube,* this 10-ma. plate current will develop a positive voltage on the cathode of the i-f. tube. Since the resistance of R1 is 4500 ohms, the voltage drop across R1 is 45 volts and this voltage is sufficient to reduce the amplification of the i-f. stage to a point where no signal voltage will reach the second detector.

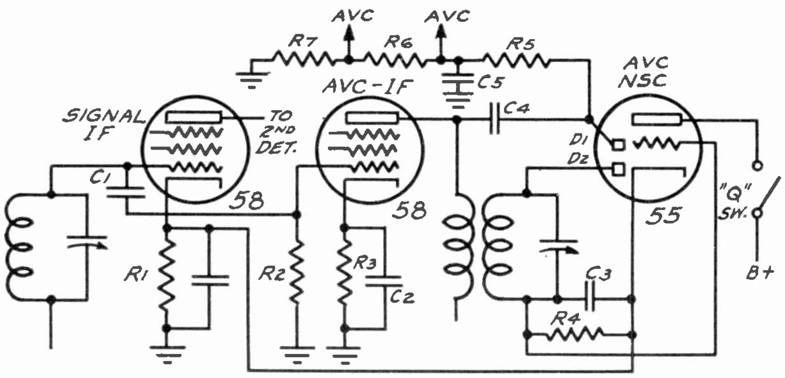

Fig. 4. A noise suppression circuit which operates to block the i-f. amplifier. This is accomplished by the automatic control of the drop across R1 as explained in the text.

Under conditions of larger signal input the increased bias, which is developed across R4 as a result of the increased signal, acts to reduce the plate current of the triode section and hence to reduce the bias on the signal channel i-f. stage. *In this way the sensitivity of the i-f. amplifier is restored under conditions of larger input signal and the receiver functions in the usual manner.*

(*Please turn to page* 14)

Quiet A.V.C.

(*Continued from page* 13)

Although we have already discussed three basically different types of a.v.c. we have by no means covered all the types of noise suppression circuits in use. Among the interesting variations to be found is a system in which the noise suppression is due to the shunting of a variable capacity across the second detector load resistance. This capacity takes the form of a vacuum tube which is automatically controlled by the a.v.c. voltage. These systems and many others are fully described in "An Hour a Day With Rider On A.V.C."

CHANGE OF ADDRESS

We want you to get *Successful Servicing* every month, but you have to do your part. This morning our attention was called to a postal from someone in Albany who wanted his copies sent in the future to Stop some number (we couldn't read the figures) "Schdy Rd., Albany, N. Y." *No name was signed nor was his old address given, so we have no way of identifying the man.* That's just an example of many that come to this office, so—if YOU should want your address changed on our list, please PRINT your name—your OLD address, and the new one to which you want *Successful Servicing* sent. Thanks.

G. E. A70, A75

Low sensitivity in models A70 and A75 may be caused by accidental application of plate potential to the electrostatic shield of the second i-f. plate by-pass capacitor (C-28).

This condition exists when the second i-f. plate by-pass capacitor (C-28), either due to vibration or to an accidental pressure, is forced into contact with the plate lug of the second i-f. transformer nearest the 6K7 i-f. tube. Its effect is an approximate decrease in sensitivity of 30% which may be partially compensated by unscrewing the plate coil trimmer screw as far as it will go. However, before attempting to align the i-f. stage be sure that the capacitor is entirely free from this lug. When this set is aligned at the factory this condition does not exist and the mere removing of this capacitor from actual contact will automatically return the i-f. to perfect alignment.

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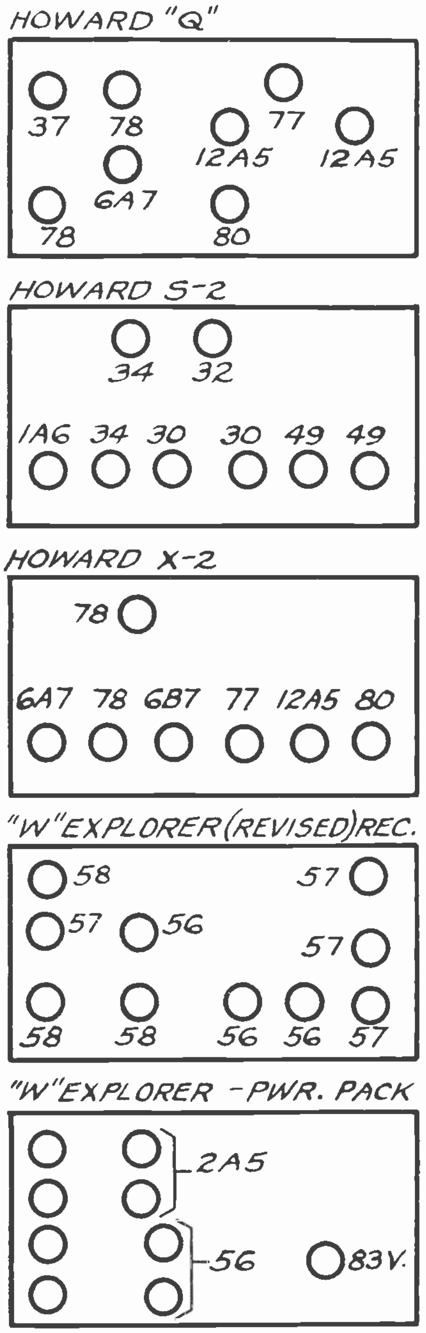
It is our actual work which determines our value.—Geo. Bancroft.

Howard Socket Layouts

Herewith will be found five socket layouts for Howard receivers, the sche-



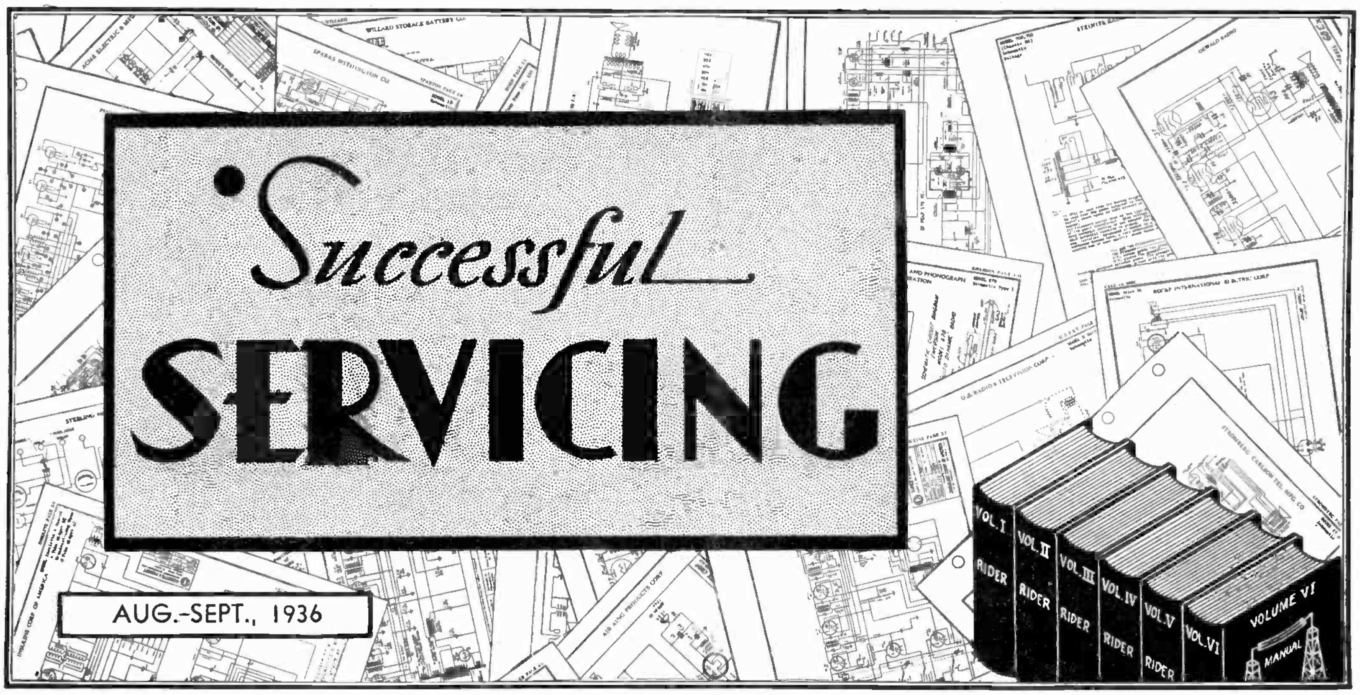
matics of which appear on the following pages in Rider's Manuals:

Model	*Page*
"Q"	4-3
S-2	4-1
X-2	4-5
"W" Explorer (Revised)	6-13

The last layout—that of the power-pack of the "W" Explorer—applies to both the early and the revised models. See pages 5-6 and 6-13.

•

Those who think must govern those that toil.—Goldsmith.



REFLEX CIRCUIT CONSIDERATIONS

Importance of Circuit Constants in Reflex Circuits

By JOHN F. RIDER

AT a time when automatic frequency control, automatic selectivity control, tone compensation circuits, degeneration in audio amplifiers, and other new developments are in the center of the stage, it would seem rather unusual to bring up reflex circuits. If you recall, reflex circuits dropped out of the picture a number of years back, as tubes became relatively inexpensve. With the price of tubes down to a reasonable level and with advances in design, it became possible for engineers to use a greater number of tubes and so obtain improved sensitivity and stability without recourse to reflexing. However, the popularity of the automobile receiver and the midget compact receiver introduced new problems, in that economy of space and power drain became important. It was these considerations which led to the use of reflexing in some automobile and midget receivers. This alone would not justify our discussion if it were not for the intrinsic interest of reflex circuits and the direct application of basic electrical principles which they illustrate.

For the benefit of those who have forgotten the nature of reflex circuits, we will take the liberty of describing in general terms the operation of a reflex amplifier. In this type of stage the circuit elements are arranged so that one tube can serve both as an r-f. amplifier and as an a-f. amplifier at the same time, or, if so desired, the circuit values can be chosen so that the stage can function as an r-f. and i-f. amplifier. More generally, though, reflexing is accomplished at the intermediate and audio frequencies. You can readily appreciate that to construct such a stage which will first amplify the signal at the intermediate frequency and which will then take the signal and amplify it after it has been rectified and converted into an audio frequency, requires a very special choice of circuit constants. For not only must the circuit elements present the proper load at both audio and intermediate frequencies, but filters must also be inserted to separate the two frequencies so as to prevent feed-back.

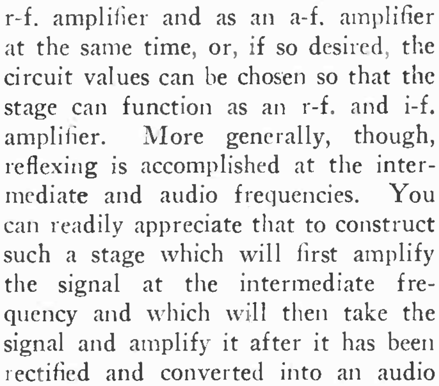


Fig. 1. A conventional i-f. stage coupled to a diode detector.

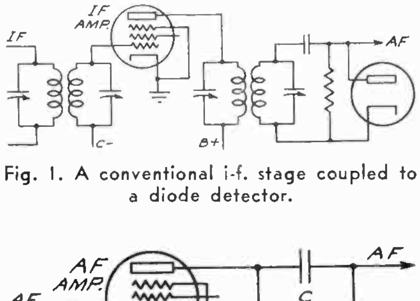


Fig. 2. A tube of the same type as that in Fig. 1, is here used as an a-f. amplifier.

It is interesting to trace the development of the reflex circuit by considering first an i-f. stage and a typical resistance-coupled a-f. stage. The combination of these two circuits—using but one tube—yields the desired reflex action. In Fig. 1, we show a conventional i-f. stage which is coupled to a diode used as a detector. In Fig. 2, we show the same tube used as an audio amplifier. The problem, then, is to combine these two circuits so that the resultant circuit can function as an i-f. and a-f. amplifier at the same time.

This is not so difficult as it might appear at first glance. If you will refer to Fig. 3, you will note that the circuits have been combined in a very simple way. The i-f. loads have been placed next to the grid and the plate. These are followed by the a-f. load resistors, each of which is bypassed as far as the intermediate frequency is concerned.

The composite signal voltage on the grid of a reflex stage is shown in Fig.

(*Please turn to page* 3)

Silvertone 1590, 1592

Several changes have been made in the chassis used in this model, the schematic of which appears on *page 3-8 in Rider's Volume III and page 2094 of the Rider-Combination Manual.*

The first detector has been changed from a 57 type to a 58, which improves the volume control action. The second i-f. transformer has been replaced with one whose secondary is tuned by a condenser mounted under the chassis. Some of the receivers have a hole in the chassis end plate to make this condenser accessible. In other sets, it is necessary to remove the end plate.

The cathode circuit of the 58 (first detector) has been changed. The cathode formerly went to ground through a 2000-ohm resistor. This resistor has been increased to 5000 ohms, and, in addition, a 0.1-mf. condenser has been inserted between the cathode and this resistor. Also a 5000-ohm resistor has been connected between the cathode and the junction of the 150-ohm and 50,000-ohm resistors. The 0.001-mf. condenser, which formerly was connected between the cathode of the oscillator tube and the oscillator coil, has its connections changed. One side still is connected to the 0.1-mf. condenser and the oscillator coil, but the other side goes directly to the junction of the cathode and suppressor of the 58 first detector tube.

The 20,000-ohm resistor connected between the screen of the first detector and the high-voltage supply (the filament of the 80 rectifier) has been changed to 30,000 ohms.

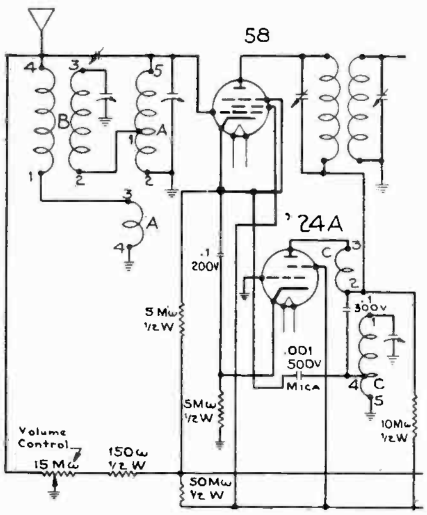


Fig. 1. The first detector and oscillator circuits of the revised Silvertone model 1590 and 1592.

In Fig. 1 is shown the first detector and oscillator circuits in which are located some of the changes mentioned above. Also note the numbering of the various coils, which correspond to the numbering on the schematics of the coils as shown in Fig. 2. In most cases

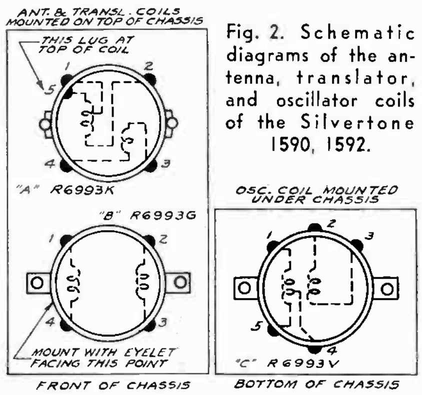


Fig. 2. Schematic diagrams of the antenna, translator, and oscillator coils of the Silvertone 1590, 1592.

it is clear in the schematic diagram (Fig. 1) where the various connections from the coils go, but where there is any doubt, the following notations may be of aid:

Coil "A":

> Lug No. 2 is connected to the center terminal of the volume control.
>
> Lug No. 5 is connected to the stator, middle variable tuning condenser unit, and the grid clip of the first detector.

Coil "B":

> Lug No. 3 is connected to the stator, No. 1 (shaft end) of the variable tuning condenser unit.

Coil "C":

> Lug No 5 is connected to the frame of the variable tuning condenser.

•

Silvertone 1584 and 1640

If any trouble is experienced with the 0.003-mf. condenser connected across the primary of the power transformer, breaking down, it has probably been due to a surge built across the transformer primary when the line switch is opened (set turned off).

To correct this difficulty, an 800-volt condenser is replacing the one of 600-volt rating used heretofore. This new condenser (Part No. R-6461, 800 V.) is connected between the line side of the on-off switch and the receiver chassis. Although these condensers may be marked 500 volts, they are really 800 volts and can be identified by the daub of yellow paint.

Philco 660

In the sketch showing the locations of the trimmers, see *page 6-40 in Rider's Volume VI,* condenser No. 29 is labelled as "standard" and it should be "police." Condenser No. 27 is labelled "police" and it should be "standard." Also reverse the indicating numbers 27 and 29.

The 2000-ohm resistor, No. 47, shunting the shadowmeter, has been removed.

Effective with run No. 5, condenser No. 19 (0.05 mf.) Part No. 30-4123 is replaced with 0.1 mf., Part No. 30-4170.

•

Kolster K-60

In the resistance test data appearing on *page 2-4 of Rider's Volume II and on page 1455 of the Rider-Combination Manual,* the resistance from the plate of the 47 tube to chassis is given as 850 ohms. This reading should be 7300 ohms. Please make this correction in your Manual. Thanks.

•

G.E. A-70, A-75

In the earlier models of the A-70 and A-75's it will be noted that the diode plate lead (green rubber covered) is soldered to one of the lugs of the second i-f. transformer. If for any reason it is necessary to remove or replace this transformer or wire, it is important that the wire be dressed as far as possible toward the front of the chassis to obtain full sensitivity. Sets carrying later serial numbers have this lead tied to the center tap of the coil inside the can. However, it is still necessary to keep it toward the front of the chassis to prevent a feed-back between the plate dropping resistor between the first and second i-f transformers, and the lead itself.

For schematic, see *G. E. page 6-19, Rider's Volume VI.*

•

Crosley 161 and 8B1

We are advised by the manufacturer that only a comparatively few of this model were made and that it is practically the same as Crosley Model 160, the servicing data on which will be found on *page 3-32 of Rider's Volume III and on page 756 of the Rider-Combination Manual.*

Model 8B1 is practically the same as Model 143. See *page 4-7 of Rider's Volume IV* for servicing data.

Reflex Circuit Considerations

(*Continued from page* 1)

6. The modulated wave is shown in Fig. 4, while Fig. 5 shows the a-f. signal produced in the second detector. The resultant signal voltage, which appears in the reflex stage (Fig. 6), is naturally the combination of the two voltages in Figs. 4 and 5.

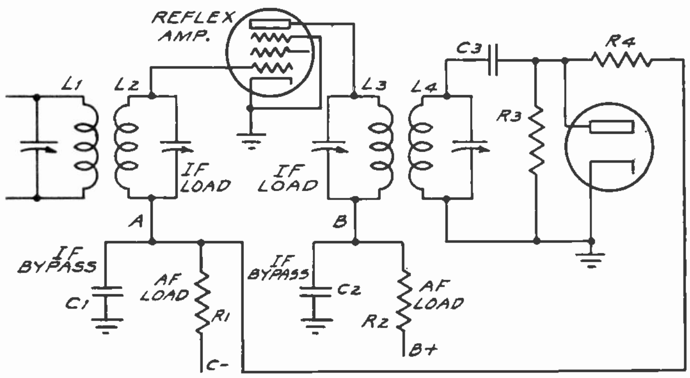
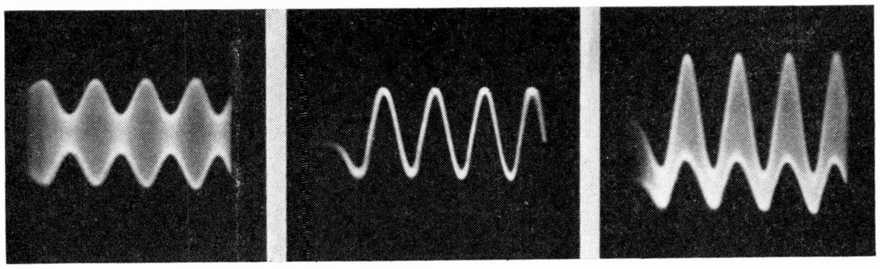


Fig. 3, left. The same tube here amplifies both i-f. and a-f. Figs. 4, 5, 6, below, are oscillograms of modulated signal, detector output, and a combination of the two.

Oscillograms by Successful Servicing Laboratory.



Operation of the Circuit

With the diagram of Fig. 3 before you, it is an easy matter to trace the path of the signal through the amplifier. The current flow through L1, the primary winding of the input i-f. transformer, induces a signal voltage in the secondary winding, L2. The resulting i-f. current, which flows in the grid circuit, is bypassed through C1, so that, effectively, point A is at ground i-f. potential. As far as the intermediate frequency is concerned, you can look upon R1 as a filter resistor through which the C-bias voltage is fed to the grid. The amplified i-f. voltage appears across L3 and is bypassed to ground through C2. Here again the i-f. current flows through C2, and R2 functions as a filter resistor. Point B is consequently likewise at ground i-f. potential. Continuing the tracing of the signal path, we note that the signal voltage is induced in the secondary winding L4 and fed over to a diode which functions as the second detector. The resulting audio voltage, which appears across R3, is taken off through an i-f. filter R4, which is introduced to prevent the i-f. signal from being fed back to the grid of the reflex tube. The a-f. voltage is fed back to the grid and appears in the grid circuit across the a-f. load resistor R1.

At this point we want to digress a bit to show that the i-f. tube circuits will not interfere with the operation of the tube as an a-f. amplifier. For since the tuned circuits are resonated at, say, 460 kc., it is quite obvious that their impedances will be comparatively small for frequencies which are as far removed from their resonant frequencies as are the audio frequencies. In other words, the audio frequencies find a ready path to the grid and plate through the inductive branches consisting of L2 and L3 respectively. The inductance of these branches is of the order of millihenrys, so that the impedance offered to even the highest audio frequencies will be measured in hundreds of ohms and correspondingly less for the lower audio frequencies.

We have just showed that the audio signal voltage is developed across R1 and that L2 does not prevent the audio voltage from reaching the grid. It is also true that C1, which is used to bypass R1 at the intermediate frequency, has a negligible effect at the audio frequencies. This is true be-

(*Please turn to page* 6)

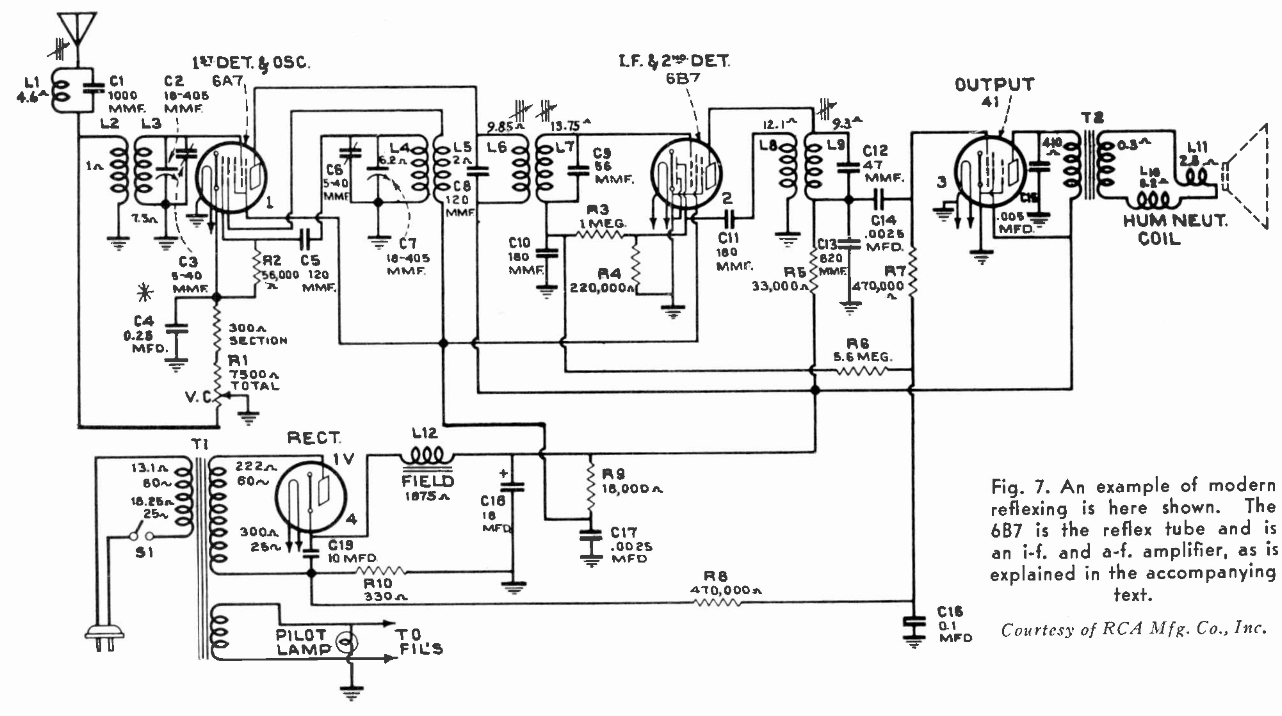


Fig. 7. An example of modern reflexing is here shown. The 6B7 is the reflex tube and is an i-f. and a-f. amplifier, as is explained in the accompanying text.

Courtesy of RCA Mfg. Co., Inc.

Stromberg-Carlson Alignment

The model numbers of the receivers to which the following alignment instructions apply are shown below, together with the page numbers on which the respective schematic diagrams may be found in *Rider's Manual, Vol. VI.*

Model 58 .... Page 6-1
Model 62, 63............. Page 6-5
Model 82............... Page 6-17
Model 83............... Page 6-21

This data also applies to Models 61 and 84. The usual servicing data covering these two receivers will be published in Rider's Volume VII.

Two dummy antennas are necessary. For most practical cases a 250-mmf. condenser connected in series with the high side of the signal generator can be used for the standard broadcast band. A suitable dummy antenna for the short-wave bands may consist of a small non-inductive carbon resistor of 400 ohms value; this latter dummy antenna replaces the former when making short-wave adjustments.

The locations of the various trimmers of the sets mentioned above will be found in the servicing data in Rider's Volume VI. *The i-f peak of each receiver is 465 kc.*

Always align either the r-f. or i-f. circuits (on those sets which are equipped with high-fidelity circuits and controls) with the high-fidelity control set at maximum counter-clockwise position (normal fidelity), unless the alignment is being checked at the high-fidelity setting as specified in the following instructions:

(The use of a cathode-ray oscillograph is recommended for alignment purposes by the manufacturer, although the instructions can be followed when a meter or glow type indicator is used. These instructions are published for the first time in any radio publication. We're proud to say it's a "scoop"!

Before proceeding with the alignment, connect the "high" terminal of the output indicator to the output of the demodulator circuit.

In Models 58 and 61, this connection should be made at the junction of R-15, R-18, and C-33.

In Models 62 and 63, this conneciton should be made at the junction of R-10, L-29, and C-37.

In Models 82 and 83, this connection should be made at the junction of R-12, L-29, and C-46.

In Model 84, this connection should be made at the junction of R-14, L-30, and C-47.

Connect the chassis to the other terminal of the indicator. Connect a 0.001-mf. condenser in series with the high side of the signal generator and the control grid of the 6K7 i-f. amplifier tube. Connect the other terminal of the signal generator to the chassis. Set the range switch of the set to the "A" band position and tune the set to highest frequency setting shown on the dial for this band. Tune the signal generator to 465 kc., the i-f. peak, and keep its output as low as consistent with proper output indications on either the oscillograph or meter.

Adjust the trimmers across the secondary and primary windings of the second i-f. transformer, in the order given, until maximum deflection is obtained on the output indicator.

Feed a frequency modulated signal to the same grid as stated above and adjust the trimmers for maximum output.

Change the input lead from the grid of the 6K7 tube to the control grid of the 6A8 modulator tube. Adjust the trimmers of the primary and secondary coils of the first i-f. transformer, adjusting the latter first for maximum output. Check the alignment of the second transformer and then recheck that of the first.

Check the alignment of the i-f. circuits with the fidelity control set at the maximum high fidelity position (maximum clockwise).

R-f. Circuits Alignment:

Have the On-Off switch set to "Off." (This switch is located in the rear of those chassis which have a "Q" circuit). On receivers equipped with a high-fidelity control, make sure that this is set for normal fidelity (maximum counter-clockwise). See that the tone control is at normal and that the volume control is set at maximum (maximum clockwise).

"A" Band Alignment:

Set range switch on chassis to "A" position. Set the receiver and the signal generator to the particular high-frequency setting called for in the table below, for this band, of the receiver being aligned. Adjust the shunt aligning condensers of the oscillator, r-f. amplifier, and antenna transformers in the order given until maximum output is obtained.

Set the receiver and signal generator to the particular low frequency called for in the table, and align only the oscillator by means of the oscillator series padder. *Align only the oscillator at this frequency.*

Recheck the adjustments of the shunt, trimmers of the oscillator, r-f. amplifier and antenna transformers.

"B" Band Alignment:

Operate the range switch on the chassis to the "B" position and align the oscillator, r-f. amplifier, and antenna transformers in the same manner as was done in the "A" band, using the frequencies listed in the table below under the "B" band.

"C" and "D" Bands Alignment:

Operate the range switch to the "C" band and follow the same procedure as in the "B" band. After this is completed, then change to the "D" band and follow the same procedure, using in each case the frequencies as set forth in the table below for the respective bands.

Models 58 and 61:

Band	*High-Frequency Aligning Point*	*Aligning Frequency for Oscillator Series Padder*
"A"	1400 kc.	600 kc.
"B"	3000 kc.	No Aligner
"C"	16 mc.	No Aligner

Align the bands in the following order: "C," "B" and then "A."

Models 62 and 63:

Band	*High-Frequency Aligning Point*	*Aligning Frequency for Oscillator Series Padder*
"A"	1500 kc.	600 kc.
"B"	5000 kc.	1800 kc.
"C"	16 mc.	No Aligner

Align the bands in the following order: "A," "B," and then "C."

Models 82, 83, and 84:

Band	*High-Frequency Aligning Point*	*Aligning Frequency for Oscillator Series Padder*
"A"	1500 kc.	600 kc.
"B"	4000 kc.	1500 kc.
"C"	10 mc.	4 mc.
"D"	19.8 mc.	No Aligner

Align the bands in the following order: "A," "B," "C," and "D."

•

Bosch 239

Please make a note that Model 239 is similar electrically to the Bosch models 236 and 237, the servicing data on which are found on *page 3-11 in Rider's Volume III and on page 2531 in the Rider-Combination Manual.* This Model 239 was used in a table installation and the only difference between it and the other models mentioned is that the antenna and ground leads were braided together with the power supply cord in Model 239.

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Howard Grand

Please make a notation that the power unit shown on *Howard page 6-16 of Rider's Volume VI* is for Series 2 of this model, as well as Series 1.

Successful
SERVICING

Reg. U. S. Pat. Off.

Dedicated to financial and technical advancement of the radio service man.

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A NEW POLICY

NO DOUBT some of you have wondered why you did not receive the August issue of SUCCESSFUL SERVICING during the month of August. The reason for it is that we have changed our publishing policy and in the future, SUCCESSFUL SERVICING will appear nine times a year. During the months of April and May, June and July, August and September, combination issues will be published; during the other six months of the year, namely, October, November, December, January, February and March, issues will be published monthly.

Our reason for taking this step is that we have built up quite a large circulation — approximately 20,000 copies per month, and the expense of printing and mailing is quite substantial. In view of the fact that we believe in the months to come this circulation may amount to between 25,000 and 30,000, we feel that by combining issues during the late spring, summer, and early fall, we will be effecting a saving during those months which represent the lull in radio servicing activity.

This is the combined August and September issue, and beginning with October, the regular monthly mailing will be made until April, 1937.

•

Our Second Birthday

THIS issue marks the second anniversary of the initial appearance of SUCCESSFUL SERVICING.

We have tried to give you servicing data in the form of changes in sets which have been covered in the six volumes of Rider's Manuals, so that you might have *all* the information that is available. We trust that you have found these changes of assistance to you.

It has been our intention to present articles covering subjects that will give you a clearer insight into your work . . . so that you will understand the different circuits of complicated receivers. These will be continued in the future and if you have any specific subject in which you are interested, let us know about it.

We have enjoyed publishing SUCCESSFUL SERVICING and we deeply appreciate your cooperation. . . . Remember, it is *your* magazine and if you have something to get off your chest—drop us a line about it.

•

Wanted—A Systematic Method

WITHOUT any idea of despoiling any one of their rugged individualism, we still feel that the time has come for the development of a routine method of radio servicing—at least as far as the analysis of a defect is concerned. . . . In making this statement, we recognize that the application of any one routine method requires that the operator possess the needed technical background. . . . In order to get the ball rolling, we shall assume the possession of such a background.

Just what this routine method of servicing will be, we do not know—but we do know that unless it is developed, the majority of the men operating in the field will soon be floundering in a maze of wires, tubes, coils, condensers and resistors. . . . Today there is no routine method—not even a semblance of a systematic method of operation or progress. . . . It is not our idea to lay down the law that each and every job must be handled in exactly the same routine—because we know that to be impractical. . . . What we think the service industry needs is a system of analysis which will lead to certain positive or negative reactions and which will point to the application of a procedure based upon the reactions obtained. . . .

There may be in use today a dozen different methods of approach or attack. . . . All of these may be considered equally effective by the persons using them—yet we feel certain that one of these methods is superior to the other eleven—or that a combination of the dozen systems will evolve a thirteenth mode of progress, which is universally applicable and is most effective.

There is a definite need for such a system, if the servicing industry is going to cope with its technical problems. . . . Such a system would have been valuable in the past—but the fact that progress has been made by the servicing industry during the years that have gone—despite the absence of an established routine—is not proof that similar success will prevail in the future. . . . As a matter of fact, we are reasonably certain that the contrary will be true.

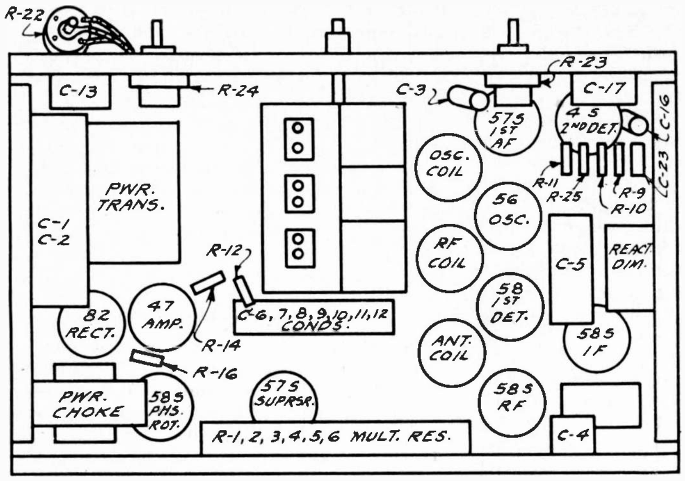
Cut and try or hit and miss methods are out of the question in the future. . . . Such systems were applicable in the past because receivers were simple. . . . The past three years have witnessed an influx of highly complicated receiving systems and that which has gone is nothing to that which is coming. . . . Now is the time to start thinking about such a system. . . . Its absence in the past should be forgotten and all of the attention should be focused upon its urgent need in the future.

Numerous charts listing symptoms of various kinds and the probable reasons have been published during the past ten years. . . . . All of these charts were just so many stepping stones to that which is desired. . . . A definite routine involving the use of equipment and with a means of definite reactions to point the way to the next step, is the common need. . . . Maybe it will require special apparatus. . . . If so, the equipment will be developed for and purchased by every serious-minded service man, who realizes the need for operating in a modern fashion.

Naturally the development of such a routine is not the work of a night,—a week or a month. . . . It needs the cooperation of many men and much work—but what matter the amount of work if it is for the common good? . . . No doubt there are many men with fixed ideas who cannot or possibly will not see any change from their already established routine. . . . If their routine is the best—then let it be adopted. . . . If not, then in time they will be convinced that they should change. . . . Remember progress begins with the minority. . . . The majority fall in line later. . . .

JOHN F. RIDER

Charlie Chance



BOTTOM OF CHASSIS

The lower view of the Majestic chassis 300 and 300-A. Note the locations of the various coils, which will give you the positions of the trimmers.

Majestic Chassis 300 and 300-A

Models 303, 304, and 307 contain these chassis and the service data on them appear on *pages 3-18, 3-19, and 3-20 in Rider's Volume III and on pages 1210, 1211, and 1212 in the Rider-Combination Manual.* Chassis 300 is equipped with twin speakers and chassis 300-A has a single speaker. The accompanying sketch shows the bottom view of the chassis with the various parts designated by the number shown on the schematic.

Reflex Circuit Considerations

(*Continued from page* 3)

cause C1 is chosen so that its capacity is high enough to bypass satisfactorily 460 kc. (the intermediate frequency), yet small enough so as not to bypass the higher audio frequencies around the a-f. load. As a result of the audio voltage applied to the grid, an amplified audio signal appears across R2—inasmuch as L3 offers a negligible impedance and C2 is too small to bypass the audio voltage. The audio voltage developed across R2 is fed to the output stage, so that we have completed tracing the path of the signal through the reflex stage. We have seen that the signal passes through the same stage twice, first as the intermediate frequency and then, after rectification, as the audio signal. It is thus clear that the tube operates simultaneously, both as an a-f. and as an i-f. amplifier.

Reflexing in the RCA Model 4T

Up to the present point we have gone over the general operation of reflex circuits. It will be instructive to see how these principles are applied in a modern receiver. An interesting layout is that used in the RCA Model 4T receiver, see Fig. 7.

You will observe that the i-f. signal developed in the first detector is fed into the 6B7 through an iron core i-f. transformer. After amplification in the tube, the signal passes through the tuned primary winding, L9-C12, and is bypassed to ground through C13. R5 functions as a filter resistor for the i.f. The voltage induced in the secondary winding L8 is fed over to one of the diode plates through C11, the capacity of which is 180 mmf. The load for this diode is the 220,000-ohm resistor R4. The a-f. voltage developed across R4 is applied to the grid of the same tube through the resistor R3, which is 1 megohm. As previously mentioned, this resistor, in combination with C10, acts as a filter to prevent the feedback of i-f. to the grid. This a-f. voltage, which is applied through R3, develops an audio voltage across the 5.6-megohm resistor R6, which is directly in the grid circuit of the tube. As a result, the audio voltage excites the grid of the 6B7 and an amplified audio signal appears in the plate circuit of the pentode across the a-f. load resistor R5. This voltage is fed over to the grid of the 41 through the .0025-mf. condenser C14. We repeat that the transformer windings, do not affect the operation of the stage, since L7 and L8 offer a very small impedance to the audio frequencies.

Closer examination of the circuit shows that automatic control of the 6B7 pentode section is embodied in the circuit design. This is effected by means of the d-c. voltage which the carrier develops across the diode load R4. Approximately five-sixths of this voltage is utilized for a.v.c., as you can see by examining the circuit. With no input signal, the bias for the pentode section is 16 volts—this is also equal to the voltage at the grid of the 41. The unusually high bias on the 6B7 grid is due to the fact that the peak signal swing, over which the tube must be capable of operating, is equal to the combined value of both the i-f. and a-f. signals. The antenna and C-bias control R1, in combination with the a.v.c. action in the reflex circuit, provides a very effective control over the volume output.

Can You Align a Superhet?

The answer to that question will be: "Sure, I can . . . I do it every day" and then we'd like to hear some of the answers to this: *"Can you explain what each aligning operation does to the circuit as a whole?"* We'd be willing to bet that some of those answers would be weird and wonderful. Honestly now—could *you* give a clear, concise answer?

Why should you? Just this—you more than likely can follow the manufacturer's alignment instructions with ease and return the set to your customer in better shape than it was when it came into your shop, but suppose you run up against a snag—suppose the set just won't be put into proper alignment — something wrong some place—and you've got to locate it. You have to know the WHY of the circuit in order to ferret out the trouble.

And that's why John Rider has written **"An Hour A Day with Rider on Resonance and Alignment"**—It contains an easy-to-read explanation of just what you want to know about alignment, but don't take our word for it—here's what Zeh Bouck, the Service Editor of "Radio News," says about it: "To the serviceman who will admit that he is a little hazy on some aspects of inductive and capacitative reactance in relation to resonance, or perhaps on some of the finer points in the actual practice of tuning and alignment, this book provides an excellent, self-teaching text. To the serviceman satisfied with his technical knowledge and practical expertness, we still recommend this little volume as a refreshing course. In either case, you will find the hour spent with this book highly interesting—and should you experience the least difficulty in assimilating its contents, don't blame the book, it is merely *prima facie* evidence that you need it!"

Dere R. R.—

Are you haveing a good time out ther in the stix on yur vacation? Gee, I wish I was with you. and are you lucky youre not here in Newyork honest its been so hot that *a guy fried a negg on the sidewalk.* I saw the picture of him doing it in the paper but it didnt say if the guy ate the egg after he cooked it. Poor reporting that I calls it. And that awful hot day WOR had a micaphone downstairs on the st. and one of the anounsirs was asking the Bway suckers what they thot of the heat and he asked me but i only **started to tell him** when he shoved me away from the mike and said that that kindof language wasnt allowed on the air. Say did the Redhead tell you that she got a nawful dose of sunburn down at some beach the other day and she cant get in here cause she cant stand nothing on her back. I wouldnt think that would bother her much, would you, cause *she dont never wear much there anyhow does she?*

Well, the Boss was all set to fly out and talk to those servicers conventions in Seattle and Spokane, but at the last minute he couldnt get away. The Saturday he was to speak to the gang in Spokane, I comes back to the office about half past one after my baseball mitt that I forgot. When I opened the door I hears the Boss talking fast and furious—And gentlemen, "he was saying, "let me tell you that if you dont charge enough youre going to end up behind the 8 ball". I thinks he has a gang in his office and I starts to sneak by. I looks in as I passes and *he was all alone!* **And still talking.** I stretches up on my toes and looks over the pile of books he has on his desk and there he is, talking into a funny looking telephone. Then he says something about you servicemen in Spokane and I tumbles—**he was making a speech over the phone.** Boy I like to died right then. And whats more, *he did the same thing again the next Saturday night and talked to the gang in Seattle.*

Did you hear about the **I.R.S.M. New York Radio Trade Show** thats going to be at the Hotel Pennsylvania the *18th, 19th and 20th of September.* They aint going to have it up on the roof this year like they did before. Its going to be on the mezaneen which *you* oughto like.. **You wont have such a long trip to the bar.**

Hey lissen heres one i cant figure out that I herd somebody telling Jack when I was in the lab. moving some stuff for him. This guy tells Jack hes got a swell dog. It does everything he tells it to and the pooch can even read. Yes sir, says this gent, *he can read.* Why the other nite when i got home there he was poring over the Rolling Reporters colyum. They both laughed but i dont see anvthing funny.

If you get down around Paducah in the blue grass part of these United States will you please look up *W.C.Moore* and tell him that J.F.R. says theres going to be a gang of United Motors sets in *Volume VII* along with all the others and that he thinks Moores idea about model numbers is swell.

The other day a tall gent wanders in and asked me about some books that he had ordered sent to his shop. I wouldnt know anything about that so I shooed him out to where the gang does the shipping. I heard someone say Why those books were shipped three weeks ago and he says well I guess I must have passed them on the way. I wondered where this guy lived.... Bet its China or someplace foreign like that I thinks... And do you know, I was right! This guy was *Robert Stewart* from Shanghai. I hears him talking to the editor and he was telling him how the servicemen in China have an awful job fixing the sets there on account of they get sets from the U. S., England, France, Germany, Italy, Japan and China to work on and THEY CANT GET ANY SERVICE DOPE TO WORK WITH *NOT EVEN A SCHEMATIC!!!* Can you tie that??? Of course they have the dope on the U. S. sets, but thats all. **If you hear any servicers beefing about the tough time they have, give them an earful about what theyd be up against if they was working in Shanghai.**

Are you going to be back here by the 20th of September? I saw a letter come in the other day from the *New Haven Radio Servicemen's Assoc.* and it said that Conn. was going to have a state get-together at **Rustic Inn, Guilford** on that day. They want to have every servicer in the state there, so maybe you might push that chariot of yours up the Post Rd. and take part in the swimming and dancing theyre going to have. (You *might* even get some news.) If you are going, let J. Guetens know. Hes in West Haven at 6 Hall st. **Hows to take me on your handlebars?**

Do you know *Vanguntcn,* sectry. of the I.R.S.M. in Cleveland? (Since the strawberry blond has been out Ive been haveing your mail wished on me and soon I'll be the perfect private sec.) Well, anyhow, Vanguntcn wants you to stop in and tell the gang hello at their meetings held the first Mon. and 3rd Wed. of each month (sounds like the opera?) at 8 p. m. in the Hanna Bldg. He says everybodys welcome.

Might you get out as far as Holbrook in Ariz? If you do, look up *D. A. Dargie* and thank him personally for his letter about resistance markings. He aint the only one that wishes they was standard, from all i can here around the place here.

And while youre out in that neck of the woods, go on out to *Orange, Cal.* and see *C. H. Woodruff.* Remember how you cracked wise in the last issue and asked him could he spare an orange? Well, he sent you **SIXTEEN!!!!** Theyll keep all right till you get back for *theyre already squeezed* **and in two cans**—eight in each can... it says so right on the label. Thank him pretty, for lookit all the work hes saving you when you want to build a gin rickety or whatever it is that **you weaken with gin.**

Yours truly,
Aloysius Winenwiski
Head Officeboy

RIDER'S VOLUME VII

History is busy repeating itself! Once more the tempo is speeding up in the office....**Volume VII is being made up for the printer!!** ***And what a Manual it will be!!!***

When Volume VI was put to bed last fall, we heaved a sigh of relief, stretched our weary bones, and then wrote all the manufacturers that we were starting in on Volume VII....Ever since that day *we have been gathering in servicing data from receiver manufacturers all over America...* finding out what chassis were used with what model numbers....getting socket layouts from this one....i-f. peaks from that ....in other words, ***searching for every bit of information that will help you in your job.***

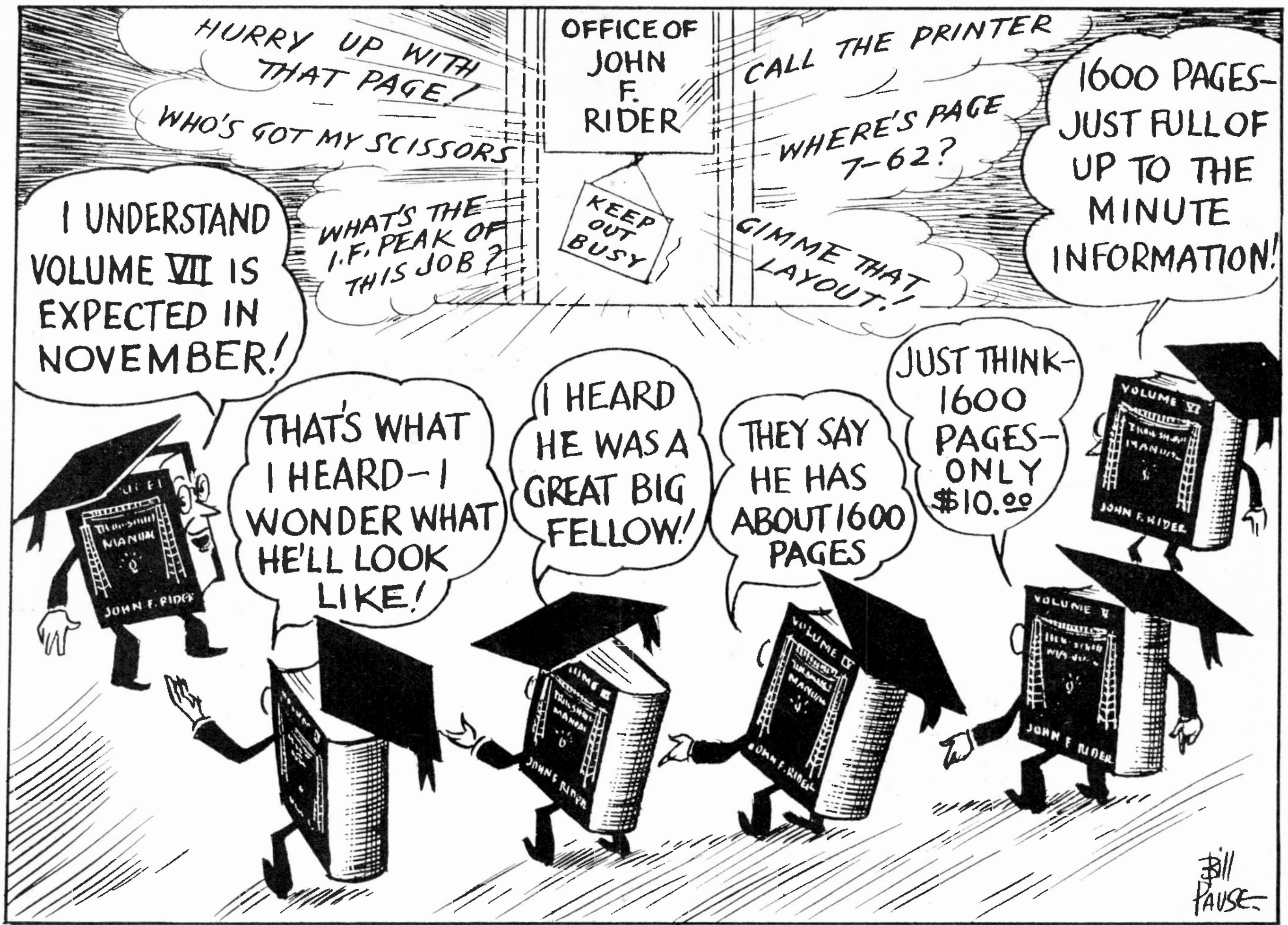
Several months ago we began to sort out all this material—and never before has so much servicing data poured into our hands ....and never before have we seen such *complete* servicing data. Then came the question—how were we going to put out such a mass of information? We couldn't cut *this*—and *that* just ***had*** to go in—and so the number of pages increased....and grew and GREW!....The suggestion was made—Publish it in two binders and call it "Volume VII—Part 1 and Part 2." We would have been forced to charge too much—that was out! Then we decided that a 2000-page Manual would do it—all in one binder. . . . This was considered for awhile and then, to make a long story short, we found that we could squeeze 2000 pages of material into 1600 pages and advance the sale price of the Manual by only a small amount.

And that's the final word—**1600 PAGES IN VOLUME VII!**

What a Manual this will be!!....All the large manufacturers....as many of the smaller as we can find....Practically all modern receivers announced up to the fifteenth of October....Data on sets you have asked us for and material on some sets that you thought impossible to get. . . . Private brands—mail order houses—etc. . . . More servicing information that will cover more manufacturers and trade names than we have ever published before....We know that the serviceman today must have at his finger tips servicing data on as many different manufacturers as possible, for who knows what will come to the bench tomorrow? . . . . So we can promise you that **Volume VII will be more comprehensive in its scope than any other Manual hitherto published,** helping you more than ever—to do a real job.

Sets have been getting more and more complicated these last two or three years—not only electrically, but mechanically. You know that—and we know that, too—and something further: if you are going to do a *profitable* job on any of these tough sets, you must do it as quickly as you can—so—you must have *all* the service data you need. ***And you're going to get it in Rider's Manuals.***

Another thing—*and is it important!*—is the index to the seven Rider Manuals. When you want something, you want it *fast* and so to help you more than ever before, **we have revised the index, introducing an elaborate system of cross indexing that will gladden your heart. . . .** If a chassis is used in several models, then those models are listed separately and referred back to the lowest model number the chassis carries. The chassis—where its number is given—is listed with the several models and this number, too, is cross indexed. We have spent hours and hours making these changes with just one thought in mind: *to make it easier for you to find anything in anyone of Rider's seven Manuals.*



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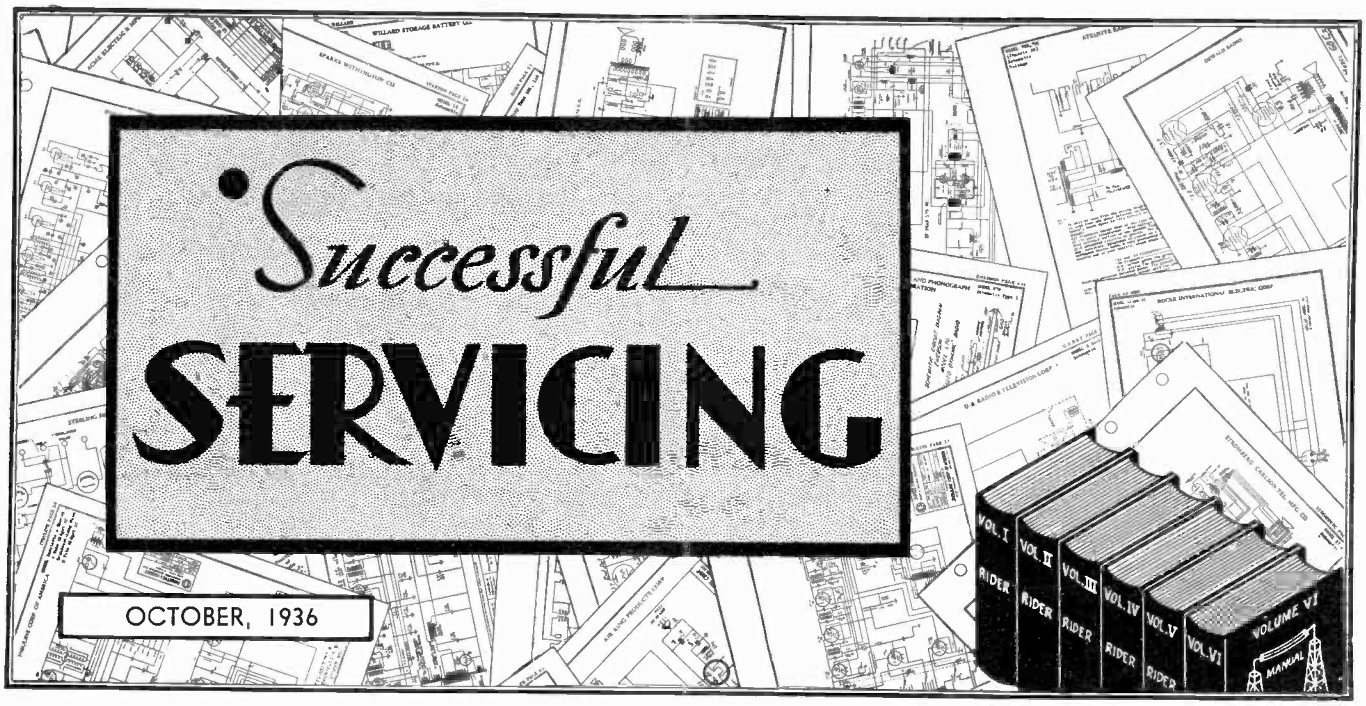


AUTOMATIC FREQUENCY CONTROL

A Brief Explanation of the Functioning of the Basic Elements

BY JOHN F. RIDER

This article is not intended as a complete exposition of a.f.c. The subject is lengthy and would require many times the maximum amount of space available in the eight pages of this issue. However, in view of the fact that this subject is of the moment, we feel that a few words concerning the system will not be amiss.—Editor.

BASICALLY, the a.f.c. mechanism corrects inaccuracies in manual tuning and insures perfect tuning regardless of small errors in the setting of the gang tuning condenser. We might also mention here, that the action which corrects manual errors in tuning also corrects that highly undesirable state known as oscillator drift—a condition which can be extremely annoying when receiving short-wave signals. . . . And strange as it may seem, a.f.c. likewise is an important factor in preventing distortion, because inaccurate tuning is productive of a distorted output.

Without desiring to go into extensive detail showing how inaccurate tuning causes distortion, we show two oscillograms in Figs. 1 and 2 illustrating the result of non-uniform amplification of the higher and lower side bands of a modulated carrier—the direct consequence of inaccurate tuning. The audio output when the receiver is correctly tuned is shown in Fig. 1. In contrast to the undistorted signal previously mentioned, we show the distorted audio output due to incorrect tuning of the receiver in Fig. 2. These two oscillograms indicate the demodulator output signal. The point of inaccurate tuning is located ahead of the intermediate-frequency amplifier. So much for a general picture of what a.f.c. accomplishes.

It is quite natural that at this time you would be tempted to ask: "How does a.f.c. operate?" Before we can proceed very far, there are certain preliminary details which must be clearly understood. In the first place, what is "perfect" tuning? Inasmuch as the majority of the modern radio receivers are superheterodynes, our comments will pertain to receivers of this type. In such receivers, tuning can be considered completed when the oscillator frequency differs from the receiver signal carrier frequency (usually higher) by an amount equal to the i-f. peak. We do not concern ourselves with the r-f. and detector tuning circuits, because they do not play an equally important role with respect to the effects of slightly incorrect tuning This, of course, does not mean that the r-f. and detector tuning circuits should be inaccurately tuned. It is assumed that these circuits are tuned as accurately as can be. The idea we want to leave with you is that the accuracy with which a superheterodyne receiver is tuned to a signal depends, to the greatest extent, upon the accurate tuning of the heterodyning oscillator and that any variation of the oscillator frequency from its correct value for any one setting means inaccurate tuning with its attendant audio distortion, reduced output, and increased noise background.

With the above in mind, you can readily comprehend that automatic frequency control must do one thing—namely, to keep the oscillator frequency at its correct value. The accomplishment of this automatic regulation of the oscillator frequency—for that is what it is—requires the introduction of two new units or circuit elements. One of these is called the *discriminator* and the other the *oscillator control* unit.

In order to give you an idea of how these units fit into a complete receiver layout, the block diagram is shown in Fig. 3. The discriminator and oscillator control elements are shown in heavy lines. While it is true that there are many different systems of

(Please turn to page 3)

Packard Bell 34

If this set should need to be readjusted, the procedure is as follows: Set dial to about 1700 kc. and connect the output of a signal generator, set at the same frequency, to the antenna. Adjust the trimmer condensers of the r-f. and detector stages for maximum output. All adjustments at 1000 kc. and 600 kc. are made by bending the outside rotor plates of the variable condenser tuning the r-f. stage. The schematic diagram of this receiver will be found on *page 6–4 of Rider's Volume VI.*

•

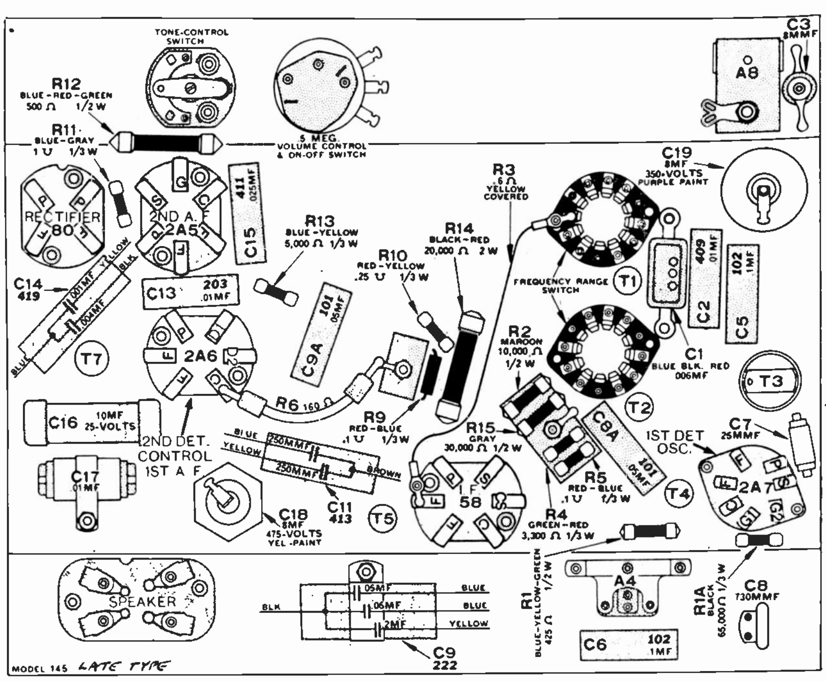
Crosley 815

We have received word from the manufacturer that no servicing data has ever been issued for the 815, but if you get one in the shop look up Model 8B3, on *page 6–10 in Volume VI of Rider's Manuals.* We are advised that the 8B3 is practically the same as the 815.

•

Atwater Kent 145, 325

The schematic diagram shown on *page 5–7 of Rider's Volume V* is for the early model but the note at the bottom of the diagram covers the changes that were made in the late model. The elimination of the condenser, C4, in the frequency-changing switch in the late models necessitated a rearrangement of the parts. The chassis layout for the late model is shown in the accompanying illustration.



The bottom view of the chassis used in A-K. Models 145 and 325 of the late type

Silvertone 1640

Several changes have been made in this model, the schematic of which was published on *page 3-12 of Volume III of Rider's Manuals and on page 2098 of the Rider-Combination Manual.* Other changes were noted in the March, 1936 issue of SUCCESSFUL SERVICING, on page 8.

The 0.003-mf. condenser in the tone control circuit has been changed to 0.001-mf., Part No. R6952.

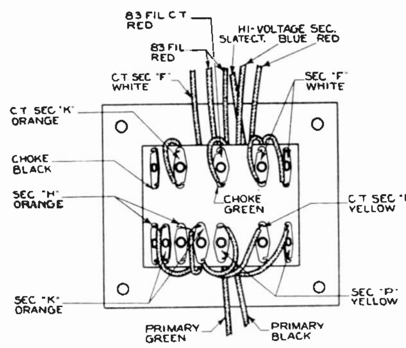
The 100,000-ohm resistor and the 0.1-mf. condenser, which were in the lead to the midpoint of the driver tubes' gridleak, are eliminated. This midpoint of the gridleaks, while still going to the top of the speaker field in the schematic, is also grounded through a 0.5-mf. condenser, Part No. R6451.

The 0.02-mf. condenser in the primary circuit of the power transformer (at the on-off switch in the schematic) has been changed to 0.003 mf., Part No.R6461.

Use is now made of a grounded electrostatic shield between primary and secondaries of the 25-cycle power transformer *only.* Some of the 60-cycle transformers have shields built into them, but they should be left disconnected.

The 8.0-mf. electrolytic filter condenser has been replaced with one having a value of 14.0 mf., rating of 440 volts, Part No. R7236. If replacement is needed, the 14-mf. unit should be used, even though the set orginally had the one of lower value.

A power transformer, Part No. R7286B is now used, having a separate filament winding, with a 20-ohm adjustable center-tap resistor (Part No. R7189) across it for one of the 46 driver tubes. The resistor center-tap adjustment can be reached with a screwdriver through a hole in the rear of the chassis near the speaker socket. *The adjustment is quite critical and must be turned carefully to the point where the hum disappears.* Connections for this new transformer are shown in the accompanying illustration. The R7286A transformer should



Connections to the new power transformer used in the Silvertone 1640

be used as replacement, if the receiver does not have the adjustable center-tap hum-eliminating resistor.

The volume control has been changed to Part No. 6401C. The new control is mounted at a different angle to minimize hum pickup. This new volume control should be used in case of replacement. It probably will be necessary to bend the resistor mounting board slightly (behind the volume control) to prevent it from touching the control. If the volume control does not reduce the volume to zero level, the second i-f. and detector grid leads are too close under the chassis. The i-f. grid lead from the coupling choke and the detector grid lead from the tuning condenser should be bent as far apart as possible.

•

Stromberg-Carlson 55, 56

The i-f. peak of these models, the schematic of which appears on *page 4-10 of Rider's Volume IV,* is 175 kc. Please make a notation of this on the above-mentioned schematic.

•

It is our actual work which determines our value.—Geo. Bancroft.

Automatic Volume Control

(Continued from page 1)

a.f.c., the basic arrangement shown in Fig. 3 is still applicable regardless of the actual circuit structure used in any one particular discriminator or oscillator control unit. As a matter of fact,

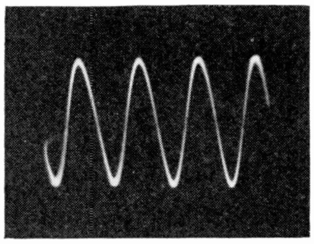


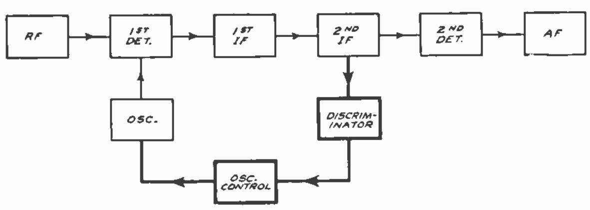
Fig. 1. The a-f. output of a set that is correctly tuned to a carrier

the block diagram, as a whole, remains unchanged for electro-mechanical as well as electrical systems of a.f.c.

The Discriminator

With Fig. 3 as the basis, let us examine the functions of the two unique components. Suppose that we start with the discriminator . . . What is the function of the unit, and why is is connected between the i-f. stage that feeds the second detector, or de-

Fig. 3. The block diagram on the right shows how the discriminator and oscillator control tubes are incorporated in a superheterodyne receiver to obtain a.f.c. action



modulator, and the oscillator control section? The answer to this question is not clouded in a veil of mystery if you keep in mind the one important requirement of superheterodyne operation: *the i-f. signal passing from the intermediate-frequency amplifier must be of the proper frequency.* The purpose of the discriminator is to identify if the signal passing through the i-f. amplifier is of the correct frequency, is higher than the required peak, or lower than the required peak. In other words, the discriminator can be looked upon as the indicator of the a.f.c. system, in that it functions to tell, electrically, when the oscillator in the receiver is in perfect tune and when it is not. . . .

To present a full explanation of how this is done is beyond the realm of this article because of space limitations. If you can, try to imagine or visualize the development of a control voltage which is of positive or negative polarity depending upon whether or not the intermediate-frequency signal—which is naturally related to the oscillator frequency—is too high or too low. If the receiver is in perfect tune, no control voltage is developed.

What has been described is not the only function of the discriminator. It has still another. Not only does it establish if the oscillator frequency is incorrect, but its circuit is such that the amount of the control voltage developed depends upon the deviation of the oscillator frequency from the correct value.

The following may help in comprehending this subject. If the oscillator frequency is correct, there is no control voltage. . . . If the oscillator frequency is 2 kc. high, then in a typical case the discriminator might develop a control voltage of 1 volt minus. If the frequency of the oscillator is 4 kc. high, a corresponding larger control voltage, say 2 volts minus, would be developed. (The relationship is not necessarily as linear as stated here.) Now, if the oscillator frequency is 2 or 4 kc. low, then the discriminator would develop control voltages of one or two volts positive. . . . So much for what the discriminator does.

The voltages mentioned above as a rule are developed in a 6H6 double diode rectifier system, which, with its associated elements, comprises the discriminator. The input to the diode plates is a split tuned system that is balanced when the signal comes through at exactly the correct intermediate frequency. If the input signal is incorrect in either direction, then the diode circuit becomes unbalanced, with the result that one diode develops more voltage than the other, so that a net control voltage of the proper polarity is produced.

The Oscillator Control

As far as the operation of the oscillator control circuit is concerned the action which takes place is difficult to describe in a limited space. However, we will try. In brief, the control tube is so arranged that it acts like an inductance in shunt with the tuned oscillator system. The value of this apparent inductance is regulated by the mutual conductance, therefore by the grid bias. If a negative control voltage is developed in the discriminator tube and applied to the control tube, it makes this tube appear with respect to the oscillator tuned circuit, as a larger inductance and the fre-

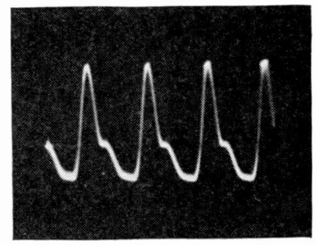


Fig. 2. When a set is incorrectly tuned, the a-f. output assumes this appearance

quency of the oscillator is lowered. On the other hand, if a positive control voltage is developed in the discriminator tube, a positive bias is applied to the control tube, making it appear as a smaller inductance, with respect to the oscillator tube circuit, and the frequency of the oscillator will be higher.

In this way, the a.f.c. bias regulates the apparent inductance shunted across the tube circuit and is automatically able to control and maintain the frequency of the oscillator. During this process, the normal a.v.c. action still operates.

•

DOUBLE-SPREAD PAGES IN VOL. VII

How often do you look at something and never see it? Well, maybe you're not that kind of a fellow, but take our word for it, quite a few of your fellow-servicemen are.

Here's why—

Every so often a letter comes in asking why certain pages in Volume VI index are missing from the Volume itself. When a check-up is made—the pages thought to be missing were double-spread pages. *And these are in the front of Volume VI—not in their proper sequence in the body of the Manual.* A paper strip bands these together and on this is printed: "These are the double-spread pages. Please insert them in place. Thank you."

So . . . Please see that these large pages are inserted in their proper places in *your* Volume VI and remember that **the double-spread pages of Volume VII will also be in front.** Kindly spread the word . . . Thanks.

•

The true University of these days is a collection of books.
—Carlyle.

Grunow Chassis 5B

On *page 6–3 of Rider's Volume VI* the parts list showed that the same loud speaker was used for all four model numbers using this chassis. This has been changed. For models 501 and 550, the speaker parts are the same as those listed on the page in Volume VI, but in models 520 and 530, the output transformer part number is 34420 and that of the complete speaker is 34498.

•

Atwater Kent 317

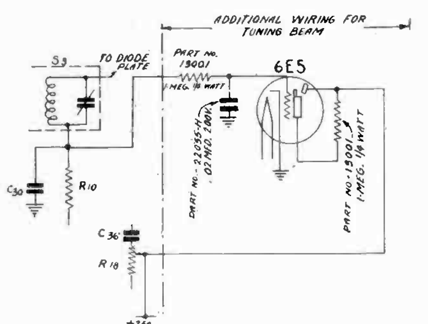
A couple of changes have been made in the early type of this model, the schematic of which was shown on *page 6–17 of Rider's Volume VI.* The value of R5 has been cut from 2 to 1 megohm (color, brown, black and green). The wattage rating is the same.

The other change is in the circuit of the 6H6 tube. Formerly both the plates P1 and P2 were connected. This connection is now opened. P1 now goes to the intersection of C8, R4 and R5. P2 is connected by the same green wire to the upper side of the secondary of the i-f. transformer, as it was before.

•

Pilot 243, C243, 245, C245

These numbers are used for models in which are incorporated the same chassis as were used in models 213 and 215, see *page 6–21 of Rider's Volume VI.* The change is the addition of a 6E5 tube connected in the circuit as shown in the accompanying partial schematic.



How the 6E5 tube is connected in the Pilot models mentioned in the text

To the left of the dot-dash line in the schematic are the points in the 213 or 215 circuit where the 6E5 is connected. On the right are the circuit elements used in conjunction with the tube.

To replace the tube in models 243 and 245, it is only necessary to remove the four corner bolts which hold the loud speaker. This gives access to the socket. On models C243 and C245, the 6E5 socket is held by a bracket, which can be removed when it becomes necessary to replace the tube.

•

Attention Associations!

We are extremely anxious to compile an up-to-date tabulation of the various independent and affiliated radio service associations . . . We are anxious to establish the names and addresses of the associations and the corresponding secretaries . . . The extent of the membership does not matter. We are just as interested in the independent local association with all of its members in the same town, as we are in state-wide groups with national affiliations . . .

When you communicate the name of the state-wide association or national association—PLEASE identify the names of the local associations or chapters.

We assure you that this compilation is of importance and is not intended for any sales promotion scheme . . . We are certain that it will be to the general welfare of the entire servicing industry.

Thanks for your cooperation . . . Address your replies to John F. Rider, 1440 Broadway, New York, N. Y. A post card will do . . .

Silvertone 1570, 1574

The paper form on which the windings of the output transformer were wound in these models, apparently contained some chemical that caused electrolysis in the layer of wire next to this form. This trouble has been eliminated by winding the coils on a bakelite form or else putting a layer of empire cloth between the form and the winding. Also the windings are now preheated and a sealing compound is used.

If any of these models come in to you for repair, it is suggested that you replace the old transformer with one of the new type, Part No. R-6790-A and R-4337-F.

Atwater Kent 856

Please note the following changes in the schematic on *A–K. page 6–45 in Rider's Volume VI.*

The resistance of R3 remains the same, but the wattage rating has been changed from one-half to one-third watt (color, brown, black and orange).

A condenser, designated as C15A, has been added. It is connected from the junction of the plate lead from the 6F5 (1st a-f. tube) with C–16, C–17, and R–13 to ground. It has a value of 120 mmf. (color, brown, red, and brown).

The connection between the plates, P1 and P2, of the 6H6, 2nd detector, has been opened. P2 now is connected to the junction of R5, the blue lead from the left-hand 0.05-mf. condenser in C9, and the black lead from point 9 on the antenna coil. The other plate goes to the same point as it did formerly on the i-f. transformer. (If you should happen to see a revised schematic of this receiver, note that the plate designations, P1 and P2, have been reversed. We use in the above explanation of the change, the designations as they appear in *Rider's Volume VI,* so that there will be no confusion.)

The value of R5 has been changed from 1 megohm to 0.5 megohm, same wattage rating (color, black and purple). The value of R6 has also been changed from 1 megohm to 0.5 megohm, 1/3 watt (color, green, black, and yellow).

•

Pilot X-43, X-45

The chassis which is used in these models has the same schematic as that shown on *page 6–2* of *Rider's Volume VI.* The range of the X–45 (export model) is 1680–545 kc. and 380–140 kc.

The following Long-wave Alignment data should be added on *Pilot page 6–2x*: Procedure in the X–45 is similar to the Broadcast section. Align at 375 kc. and adjust the padder at 160 kc.

Should it be necessary to remove the band switch assembly, it is advisable to realign the receiver after reinstalling.

A Good Buy! •

Serviceman: That's what I need!
Salesman: It's the one and only book on cathode-ray oscillographs.

Successful SERVICING
Reg. U. S. Pat. Off.

Dedicated to financial and technical advancement of the radio service man.

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John F. Rider..........Editor
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OSCILLOGRAMS

It has been said that we are too prone, or perhaps too liberal, in the use of oscillograms to illustrate the stories or articles which appear in these issues. It has also been said that we were favoring the use of equipment, which because of its cost, will not come into use for quite some time. It might be well if we also made some comments concerning our ideas with respect to the use of oscillograms.

Frankly, we seek whenever possible to show oscillograms in connection with various articles. The primary reason is that we believe the words of Confucious when he said that "A picture is worth 10,000 words." An oscillogram makes it possible for every man who reads to see more than just the written word. It is difficult enough as it is to visualize electrical phenomena and to comprehend electrical phenomena when an oscillogram is shown. It is very much more difficult to comprehend what is taking place when a synthetic drawing is made and it is most difficult of all to comprehend when the illustration is lacking.

It is our belief that the presentation of oscillograms should be a commonplace practice and should replace the numerous pen-and-ink drawings whenever possible. *The educational value of an oscillogram is tremendous.* Not only does it lend authenticity to what is being said, but it inculcates in the mind of the individual who is reading and seeing the thought, that those mysterious things which represent radio and electricity are not so mysterious after all—because their manifestations can be photographed.

No doubt it is too much to hope, but we do, and sincerely so, that some day—and the day will come—when cathode-ray oscillograms will find their function in radio service shops as educational instruments, in addition to serving a purpose as a testing instrument. Also, that the photography of cathode-ray images will become a commonplace act and that the pen and ink drawing of a waveform will become as extinct as the "Dodo."

So, if we are accused of using too many oscillograms, we plead "guilty" and we go on record that it is our intention to continue doing so, because we believe that the cathode-ray oscillogram represents progress from the educational angle as well as the technical angle, and no one can stop the progress.

•

INITIATIVE

This may appear like a publicity plug, but really it isn't. There is a man in New York by the name of Rhine, whom we have had the pleasure of knowing for a number of years. The man has seen lean years as well as fat years—financially speaking, of course—and we believe that the latter still prevails. Be that as it may, we must say one thing: the man has shown initiative and perseverance throughout all the years. Radio service and public address system installation have been his means of acquiring the shekels. Today we learn of an activity of his which, in our mind, justifies duplication in every major center within the boundaries of the United States. Perhaps, some of you who read these lines may have similar contacts, but from what information we have gleaned during our trips around the country, we know that such a service is generally lacking.

Mr. Rhine has a tie-up with WOR and for all we know, with some of the other major stations in New York City. The Bamburger station forwards to him all of its reception complaints, received from radio receiver owners. No charge is made for the inspection, but the letter from the station advises the receiver owner that if the inspection indicates that the fault is inherent in the receiver and the receiver requires repairs or adjustment, the representative will submit an estimate.

Simple, isn't it?—And equally effective. For according to this radio service shop, *between 40 and 50% of the calls result in service work.* Operating systematically, the calls are routed so that a man may spend a day, or even two, in a suburban community and during that period he handles all the calls which have come in from that community. These calls have resulted in not only the sale of service, but in the sale of sets, tubes, and what have you.

The idea is not new, but evidence of initiative and perseverance to make such contacts is.

•

WPA IN RADIO

Word comes from the Works Progress Administration of a project just initiated in Newark, New Jersey. The project has for its purpose the conducting of a survey to locate causes of electrical disturbances interfering with radio reception.

While it is true that the project is definitely tied in with the Newark and Essex County Police Departments in order to locate the sources of electrical disturbances, which interfere with police radio reception in those counties, there is no doubt about the fact that the radio receiver owners in that community—and perhaps within 25 or 50 miles—will enjoy reception more than heretofore. And incidentally, about 45 men and 1 woman have found employment in this project.

JOHN F. RIDER

•

Did You Know That

Iodine, which you rush after when you skin your finger instead of a piece of wire, is now being used in the active material of some storage battery plates.

If you wanted to buy the equivalent amount of electricity that is contained in the average lightning flash, it would cost you about 29 cents.

In some cases shocks of an earthquake have been known to *travel around the earth twice.*

The latest figures announced by the Chinese Government show that nearly 70,000 radio receivers have been registered in that country.

No word in the English language ends with the letter Q.

A bird whose native land is South America has a pair of claws on its wings. It is called the **Hoatzin.**

Oysters have a main heart and two others that are supplementary. *The three beat at different rates.*

Scientists at Cornell University have developed a cabbage that is *odorless when it is being cooked.*

The *lining of the stomach of dolphins* makes excellent shoes for women and children, according to Russian scientists.

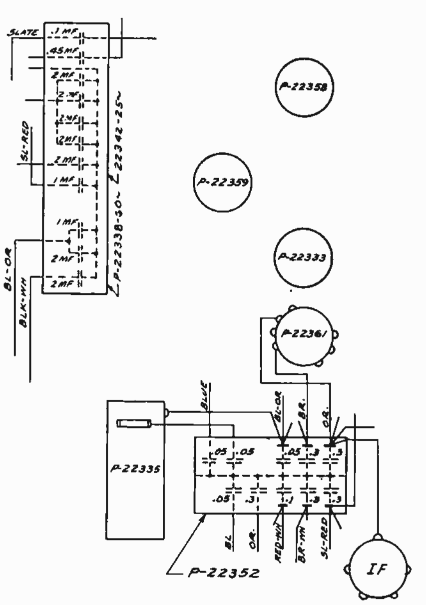
Grunow Suffixes

Here's something to remember when a set comes in to your shop carrying an extra letter after the chassis designation. Suppose the chassis number is 7B. That means the power supply is designed for operation on 115 volts, 60 cycles. If an X follows the chassis number, then the set is for 115-volt, 25–50 cycle operation. If the letter after the chassis number is W, it is for 115-volt, 50–60 cycle operation. The letter Z indicates that it is for 110, 135, or 250 volts, 50–60 cycle operation. Why not put this in your index to *Rider's Manuals* at the head of the Grunow section?

•

Stromberg-Carlson 29

The chassis wiring diagram of this model, which appears on *page 2-15 of Rider's revised Volume II; page 614-R of the early edition; and page 2401 of the Rider-Combination Manual,* is not clear in one or two places. So that no doubt will be in your mind when checking over two of the condenser banks, we are showing herewith enlarged drawings of the bank having eleven condensers, in the upper right-hand side of the diagram, and the nine-condenser bank that is shown in about the middle of the page. You can identify their positions on the wiring diagram by the apparatus in the vicinity and by the color and position of the leads. Notice that the top of the sketch shown here goes to the right-hand side of the diagram in your Manual.



Condenser banks of Stromberg Model 29

VOLUME VII INDEX

Thanks for your suggestions . . . As this issue of SUCCESSFUL SERVICING goes to press, we have about finished the 100-page index to our New Rider Manual, Volume VII. We were astounded at the amount of money and labor which was spent in this index, covering all seven Rider Manuals.

It is quite natural that the men who purchase these Manuals will, as they have occasion to use them year in and year out, find that the certain inconveniences are absent. We consider ourselves fortunate in that our customers are sufficiently interested to communicate their ideas and desires to us. These suggestions were seriously taken—and the result is the magnificent index which will accompany Volume VII.

Time and again you may find it necessary to identify a receiver when you do not know the model number but have established the chassis number. In previous editions of the Manual Index, the chassis number was always associated with the model number and oftentimes its presence in the index was completely missed. *That cannot occur any more.*

About $1,000—to be exact $998—was spent in the revision of the index, which means resetting of type matter already standing so as to cross-index chassis and model numbers. **Each and every chassis number shown in the seven Rider Manuals is separately listed in numerical sequence or alphabetical sequence, in addition to the regular listing of the receiver model number.**

Another problem has been solved at considerable expense to us. We deem all this expense worthwhile just so long as it serves its purpose by making the index more perfect and enables easier identification of the receiver data contained in the Manuals. We are referring specifically to manufacturers who have identified certain of their models by certain model numbers, but never released any data concerning these models. Investigation during the past year disclosed that in many cases these specific models were identical in circuit arrangements to other models, but did not bear such identifying data. *We have been successful in securing the required information from the manufacturers and this material is also identified in the Volume VII index.*

Stewart-Warner 56

This model receiver employed the chassis 105 or 105-A, the schematic of which was published on *page 3-3 of Rider's Volume III and page 2349 of the Rider-Combination Manual.* The letter "A" after a Stewart-Warner chassis number means that the receiver is for use on 110 volts, 60 cycles a.c.

•

Grounds ! ! !

A bulletin has just been received in which it is stated that in every case where trouble was experienced from ignition interference in auto radio sets, it was corrected by improving the ground connections at the following points:

(1) Set mounting bolts.
(2) Junction box grounded to the cowl, not to the instrument panel.
(3) Dome light filter grounded to the cowl—not to the instrument panel.
(4) Grounding the junction box to the frame of the car, not to the running board when using under-car antenna.
(5) Grounding rear edges of the hood, when using roof antenna.
(6) Ground the steering column, if necessary, especially in Chrysler cars and in cars where the distributor suppressor is omitted.

Is a word or two to the wise sufficient?

Galvin Mfg. Co.

•

A Good Layout

The illustration on page 7 shows one of the nicest layouts we've ever seen. "A place for everything—and everything in its place" seems to be the motto of T. P. Robinson, the proprietor of this service shop in Dallas, Texas.

Evidently Mr. Robinson is a Rider enthusiast. . . . Not only is he a 100%er (see the *SIX Rider Manuals* right smack in the center of his cabinet?) but tucked away on the left we can spot the jackets of "The Cathode-Ray Tube at Work" and "Servicing Superheterodynes".

By the way, Mr. Robinson, you'll have to do a bit of shelf enlarging next month when you get Rider's Volume VII. ***It's 33 1/3% BIGGER THAN VOLUME VI! !***

PERSONALITIES . . . Seen in town the past month. "Ten Gallon Hat" Campion—"Shorty" Charlie Dolfuss—"Horsey" Bill Hendrickson—"Southern Drawl" Taylor and his aide-de-camps—"Smokey City" Olsen—"Erie Canal" Segar . . . If you see any of them—say 'hello' for us . . . Willya —thx.

THAT MAN . . . He's in again. Shak VanGunten of Cleve. The servicers had a piknik recently and played ball with the Akron gang. Clev. 13—The Rubber Town 0 . . . But don't be harsh. You wouldn't do better after 7 half barrels of beer—18 cases of belch water, and 10 gals of tonsil sooth . . . *Just a bunch of sissies!* . . . By the way, Cleve's goin' to have its **4th Annual Trade Show on Nov. 1st.** J. F. R.'s planning to be there . . . Said that he had a swell time last year. Wants to repeat.

RUMOR . . . The three leading magazines serving the service industry are fighting for dominance. . . . That means they'll publish the best material they can get . . . ***Hooray for the servicing industry*** . . . It's true alright. Rider is working on a special book giving step by step instruction on the alignment of *every Philco receiver ever made*—about **8,000,000** of them. Will contain trimmer locations and alignment instructions. Dame Rumor has it that union men employed in all fields are asked to cooperate by calling only union radio servicemen . . .

MR. FARLEY'S DEPARTMENT— J. E. Bliven. New London. Thanks for your comments . . . You've no doubt received the list you wanted. There'll be some more in the near future. **Mrs. C. H. Woodruff. Orange, Calif.** Lot's of luck to you and the Mr. . . Ur letter was swell and we hope that you'll always feel the same way. . . . **Jack O'Brien. N. Y.** Any relation to the guy from Philli? So you're a 100 percenter. That's swell and I hope that you'll like Volume VII . . . We've put all we had into the 1600 pages. . . . We don't want to play the part of "life savers"—but we hope that you can always use the dope in SUCCESSFUL SERVICING. . . . If you're in REAL trouble give us a blast on the phone. . . . **That guy Vangunten!&%"** . . . More than likely Nov. 1st. Surely Nov. 2nd. **W. D. Wiborg. Fort Worth, Texas.** See the special comment below. **R. Douglas Clerk, Westmont. P. Q. Canada.** Your check okay. As a 100 percenter you'll hear some good news in November—at no cost to you. Ain't that sumpin'? . . . **Wm. T. Florence Jr. Washington, Ga.** . . . Thanx. You too will hear some good news next month. For that matter all the men will who have *all* the Rider Manuals. . . . **G. Grover, San Diego, Cal.** . . . Glad you like our monthly paper. Hope you continue doing so. **Again that Vangunten** . . . What's a "Bag A Jeep?" . . . **J. C. Gibson. Chicksaw, Ala.** . . . Swell . . . We thot you'd like the double page spreads . . . Your idea about hunting through the manual is good. . . You'll find a lot of things we just can't talk about because of some of the manufacturers do a great deal of business with the mail order houses. . . . **John A. Gardner. Sibley, Iowa** . . . You're rendering a service to us and we appreciate it. You'll find the Gamble sets in Volume VII. . . . **Porter V. Noe. E. Hartford, Conn.** . . . Thats a grand list. You're certainly a customer and we hope you'll continue thinking as favorably as you do now. We'll never do anything to kill your confidence. . . .

Service Procedure . . . Howabout some comments concerning the editorial by J. F. R. about the need for a systematic method of servicing? We have received numerous suggestions to run a forum . . . How about it????

The Rolling Reporter

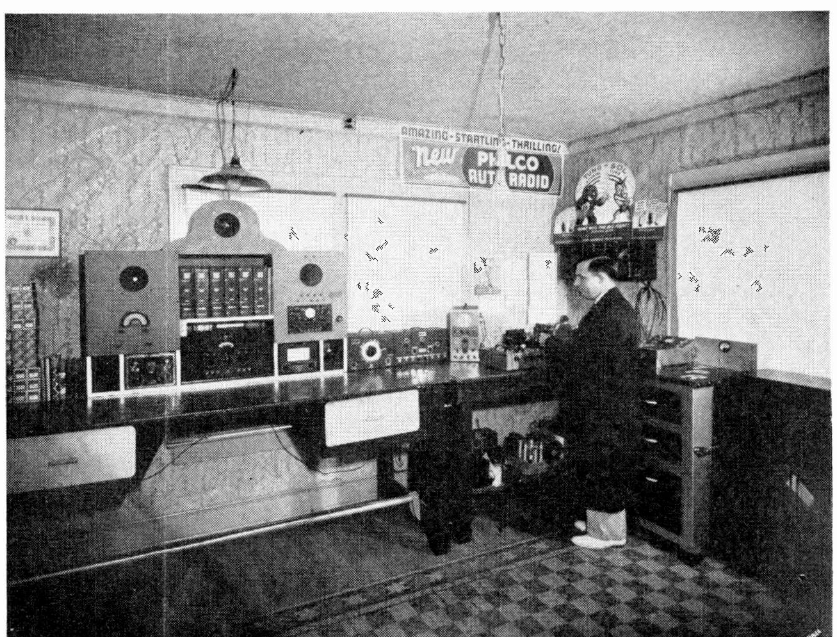
THE A.V.C. BOOK IS OUT

The third of the "An Hour a Day with Rider" series of books, entitled **"Automatic Volume Control,"** has now made its appearance and is available at all jobbers. Shipments have been made during the past week and your order, placed with the jobber, now can be filled. Those of you who have not as yet seen a copy of this book should make it your business to visit your favorite jobber and examine the contents of the 96 pages contained in this volume.

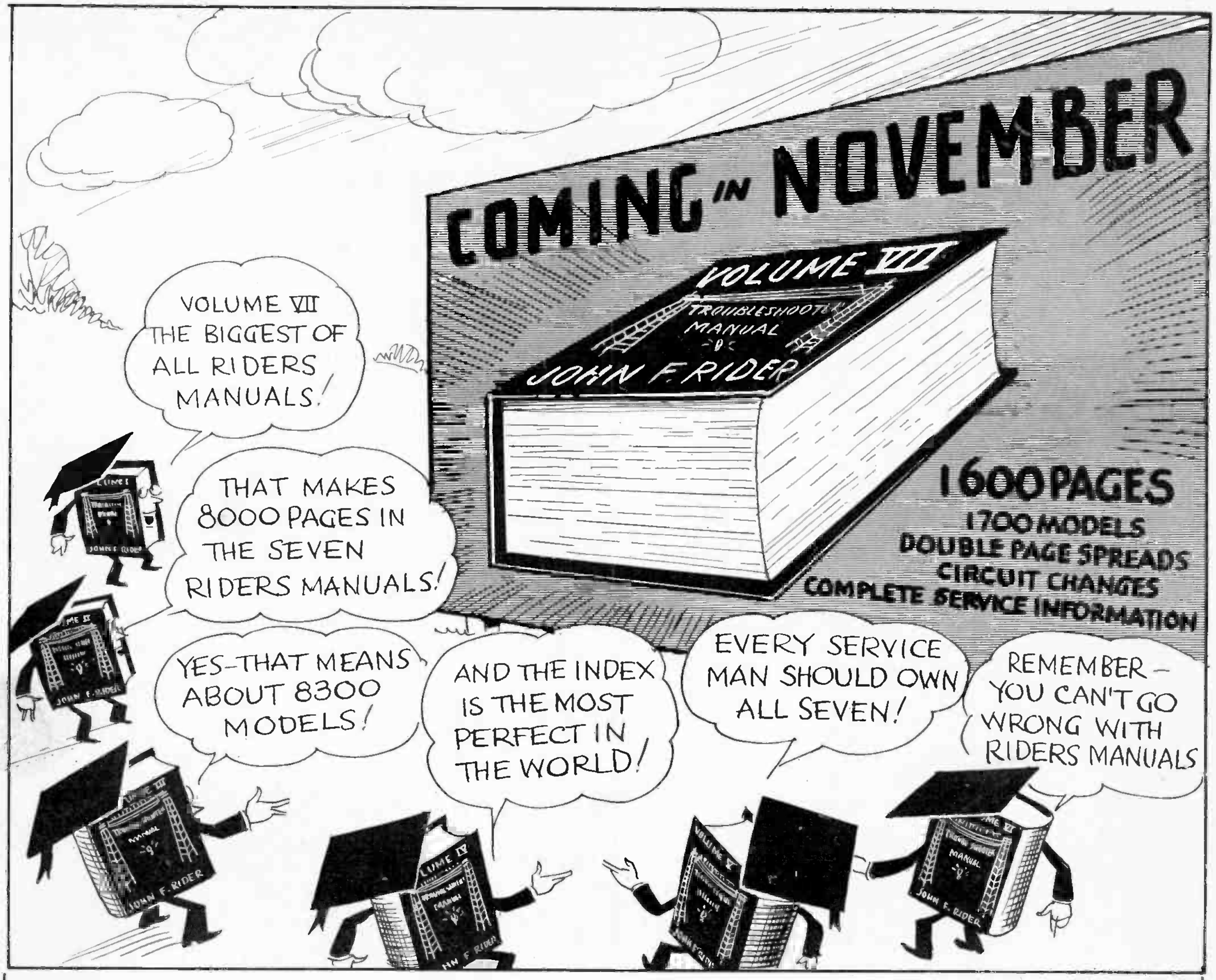
There are 65 diagrams and illustrations of various kinds. Each of these diagrams is accompanied by a detailed caption which makes it very easy to correlate the figures with the actual text.

We don't know how much or how little you may know about automatic volume control in its various forms, but we feel reasonably certain that if you start reading the text in this volume—*you will gather facts of infinite importance in your daily routine.* The reason for the delay in the actual publication of the Automatic Volume Control book was the repeated revisions of the text, so that the finished volume would embrace the systems used in old and new receivers, thereby giving coverage of modern design details—and the desire to word the volume in such a manner that the material presented would be most easily understood. **After all, the merit of a book is not in the abundance of words, but in the information conveyed by what is printed upon the pages.** The book contains six chapters with the following main headings: 1. General Review. 2. Control Factors. 3. The Simple A.V.C. System. 4. Delayed A.V.C. Systems. 5. Noise Suppression or Quiet A.V.C. Systems. 6. Trouble Shooting in Various Types of A.V.C. Systems.

The contents of these chapters cover the subject of Automatic Volume Control from A to Z. ***If you ever hope to get anything from the money you spend—this is your opportunity to get your money's worth!***



The "Good Layout" of T. P. Robinson in Dallas, Texas. (See story, page 6)



YOU GOTTA HAVE 'EM ALL!

You may be a gambler and willing to bet on almost anything that comes along, but . . . if you're a smart serviceman there's one thing you won't take a chance on . . . and that's being without a single RIDER MANUAL. Because you cannot tell what set John Q. Public will ask you to service next, you just can't gamble with success by being shy even one or two RIDER MANUALS. The very next job you get in the shop may be in one of the Manuals you "haven't gotten around to buying" . . . Why gamble?

Look at it from this way too: "Word of mouth" advertising is the best . . . but it works both ways . . . The influence of just one dissatisfied customer can do your business untold harm . . . Don't have dissatisfied customers . . . Make sure that every job is done well . . . The best assurance you have for a good job is to KNOW what's in the set before you start working on it—and you have full information to guide you.

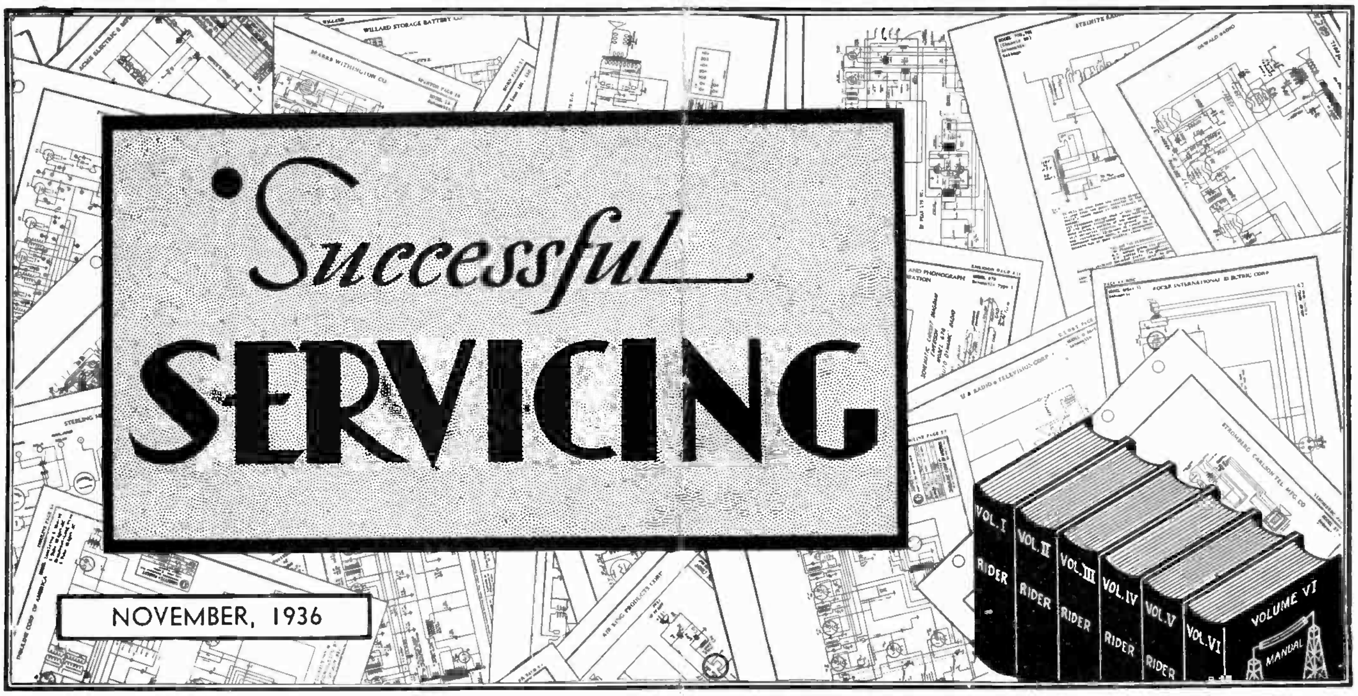
Just remember this: It takes many jobs to make up for one failure . . . If you don't have every bit of available data, you're gambling on public satisfaction and confidence. If possible, every job that goes through your shop MUST BE PROFITABLE. One way to insure this is to have ALL THE DATA RIGHT WHERE YOU NEED IT. And you'll always find what you need in RIDER'S MANUALS, so—BUY TODAY WHATEVER RIDER MANUALS YOU'RE MISSING.

Volume VI	$7.50	Volume III	$7.50
Volume V	$7.50	Volume II	$6.50
Volume IV	$7.50	Volume I	$7.50

VOLUME VII . . . 1600 PAGES . . . $10.00

Out November 19th

RIDER MANUALS BUILD PUBLIC CONFIDENCE



PHOTOGRAPHING OSCILLOGRAPH IMAGES

How Cathode-Ray Patterns Can Be Permanently Recorded

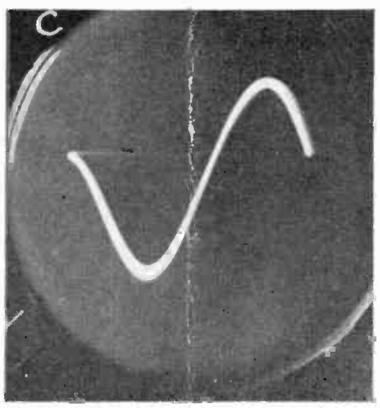
By JOHN F. RIDER

FROM time to time we receive requests for information as to the technique to be used in photographing cathode-ray images. While we realize that you will seldom have occasion to photograph the trace which appears on the screen of the cathode-ray tube, at the same time we feel that you will be interested in knowing how we take the oscillograms appearing in our publications. Those of you who are photographically minded, we feel sure, will want to try your hand at making permanent records of important oscillograms.

Perhaps the first consideration which comes up is the camera. What type of camera is best adapted for securing good photographs? One of the primary factors is the lens with which the camera is equipped. It should be a fast lens—any speed less than f/6.3 is certainly undesirable, in that it increases the time of exposure to too great an extent. If available, an f/4.5 lens is entirely satisfactory. We should mention here that the factor which makes long exposures undesirable is that the trace has a tendency to jump about when high amplification is used. With long exposures this results in a blurred pattern. The use of a fast lens minimizes this difficulty by shortening the exposure time.

The size of the camera is not at all critical. However, from an economy viewpoint, we have found that the 2-1/4″ x 3-1/4″ size is about the best. Smaller sizes do not yield a large enough oscillogram without enlargement, while larger film sizes add unnecessarily to the cost.

It is desirable that the camera be equipped with double extension bellows so that the image on the film will be practically the same size as the trace on the screen. This requires that the bellows be long enough to extend about twice the focal length of the lens. It is possible to use a camera which does not have double extension bellows, but under these conditions the picture size will be correspondingly smaller.



By partially darkening the room, undesirable reflections from the tube surface (see corners above) can be avoided and a greater contrast obtained

Cameras of the type shown in the accompanying illustration fulfill the requirements mentioned above. They can be obtained with an f/4.5 lens and are equipped with film pack adapter and ground glass screen for focusing. The ground glass screen is quite essential for securing a clear pattern, since there is little depth of focus with the lens wide open. The camera should be equipped with a shutter which provides speeds as slow as 1 second, as well as bulb and time. These qualifications are met in both the Compur and Ibsor shutters. In addition it is desirable, though not essential, that the camera have adjustments for both horizontal and vertical lens movement.

As regards the type of film, we have used Agfa Superplenachrome and Kodak Verichrome with good results. Supersensitive panchromatic film does not offer any advantages over the films just mentioned, since sensitivity in the red region of the spectrum is of no value.

(Please turn to page 3)

Delco 628

In some districts difficulty has been experienced in obtaining satisfactory reception on weak signals. First of all check over to see that the receiver is otherwise in normal operating condition, paying especial attention to the second i-f. coil.

It should be noted that a set with excessive noise suppression appears unusually quiet between stations, except for bursts of static which might be strong enough to break through the noise suppression circuit. Also, difficulty is experienced in the reception of weak stations and when using the signal generator on the receiver, the signal seems to break in suddenly when the output control is turned away from the zero position.

After assuming that the noise suppression is at fault, a simple wiring change will be found to rectify this trouble.

Locate a black lead protruding from the bottom of the second i-f. coil. This lead connects to the inside end lug of the five-lug terminal strip located on the side of the vibrator shield partition. Disconnect this lead from the terminal strip and connect it directly to the 85 tube cathode.

A certain amount of discretion must be used in making this change as undoubtedly it will improve reception in remote districts, but will also result in complaints of noisy reception if the change is made in cases where the set is to be used in cities where local interference is severe.

•

Howard HA-6

In some cases of the early production of this model the wax holding the iron core of the i-f. transformers melted, causing the iron to collect at the bottom of the coil. A loss of sensitivity resulted. This trouble has been corrected in the later production.

Note that the same chassis is used in the Silvertone 4400.

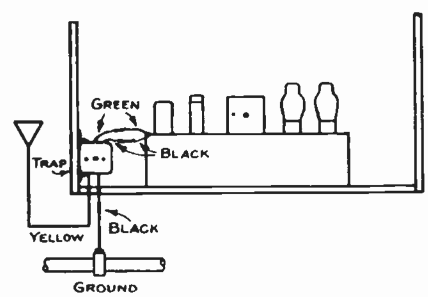
•

Silvertone Wave-Trap

A wave-trap has been designed for use with the following receivers when they are used near ship transmitters, airports, or air beacon stations, which cause code interference: 1989, 4408, 4420, 4520, 4409, 4413, 4442, 4443, 4522, 4523, 4542, 4543. The part number of this wave-trap is 101311-4256.

Installation:

The trap should be mounted, by means of two wood screws, at any convenient place on the chassis shelf or cabinet, where it will be near the an-



Installation of wave-trap in various Silvertone chassis

tenna terminal of the set. Connect the yellow lead of the wave-trap to the antenna downlead and splice the green wire of the wave-trap to the green antenna lead of the receiver. Cut off any excess wire from the trap and from the chassis antenna lead, so that the green lead from the wave-trap to the chassis is as short as possible. The yellow lead from the wave-trap should be run so that it is as far as possible from the green lead. Splice one of the black leads from the wave-trap to the black ground lead of the receiver. Connect the other black lead to the ground that is used for the installation. See accompanying illustration.

Adjustment:

The trap is pre-tuned to the intermediate frequency of the set, so that normally no further adjustment should be needed. However, if interference still be experienced, tune the receiver to approximately between 550 and 600 kc. Then adjust the wave-trap until the interference is eliminated, by means of the trimmer screw at the bottom of the container. The addition of the trap will reduce the sensitivity of the receiver around 600 kc. by about 50%. It would be wise to advise the set owner of this fact before installing this trap.

•

Majestic 90, 91, 93

The voltage table shown on the following pages in Rider's Volume I applies to the Chassis 90-B, to which the above model numbers apply: *page 1-12 in the Revised edition; page *385 in the Early edition, and page 1164 in the Rider — Combination Manual.* Please note that a change should be made in the readings for the detector tube. They should be

Plate	230
Grid	25
Cathode	25
Plate	0.8 ma.

•

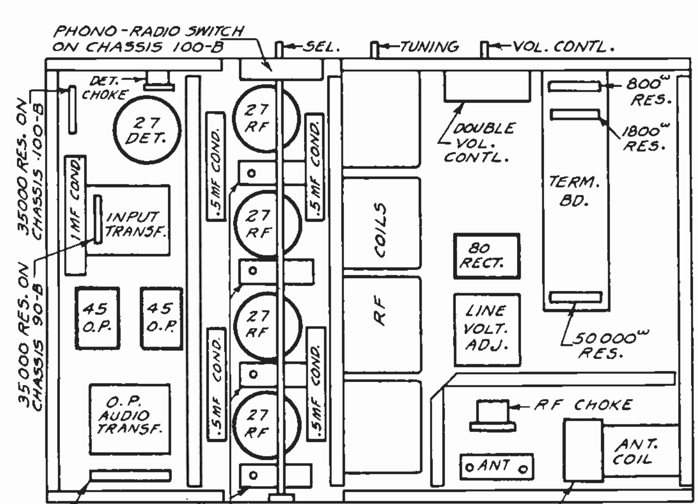
Majestic 102, 103

The schematic for Chassis 100-B, which is incorporated in the above models, will be found on *page 1-12 in Rider's revised Volume I; page *385 in the early edition, and on page 1164 in the Rider Combination Manual.*

The chassis layout for this chassis is shown herewith and it should be noted that this is the same as the layout for Chassis 90-B with the two exceptions noted on the sketch, i.e., the different position of the 35,000-ohm resistor on the left and the addition of the phono-radio switch in Chassis 100-B.

The voltage readings for Models 102 and 103, given below, were taken with the set tuned to 550 kc. and the volume control at maximum.

Tube		Plate	Grid	Cath.	Pl.	Ma.
G-27	.... 1st R.F.	130	8	8	5.5	
G-27	.... 2nd R.F.	130	8	8	5.5	
G-27	.... 3rd R.F.	130	8	8	5.5	
G-27	.... 4th R.F.	130	9	9	5.0	
G-27	.... Det.	230	25	25	0.8	
G-45	.... O.P.	250	50	..	32.	



Chassis layout for Majestic Chassis 90-B and 100-B. Note the different positions of the 35,000-ohm resistor and the addition of the phono-radio switch for Chassis 100-B

Photographing Images

(*Continued from page 1*)

In focusing the camera it is best to use a ground glass screen. If the camera does not have one, then it is, of course, necessary to use the calibrated scale on the camera bed.

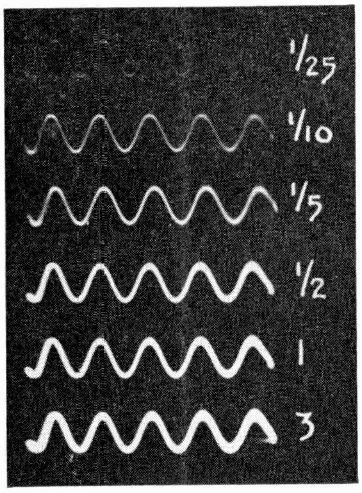
The exposure time depends on a number of factors. You should keep in mind that the greater the intensity of the trace, the smaller will be the time required to secure an adequate exposure. The intensity of the trace depends, among other things, upon the area over which the trace is spread. Practically, this means that if the trace is a complicated one extending over a large area of the screen, then the exposure will have to be longer than in the case of a simple pattern—say, a short straight line.

As a basis for estimating the exposure time, you can take an average exposure of 1/2 second at f/4.5. Some patterns will require less exposure than others and experience will be of value in indicating the correct exposure for any given pattern. Incidentally, it need hardly be pointed out that conventional exposure meters are of no value in this case.

The trace can be photographed under ordinary light conditions, that is, without darkening the room. However, if the maximum contrast in the oscillogram is desired, then it is better to draw the shades and partially darken the room. This will also prevent reflections from the surface of the cathode-ray tube screen.

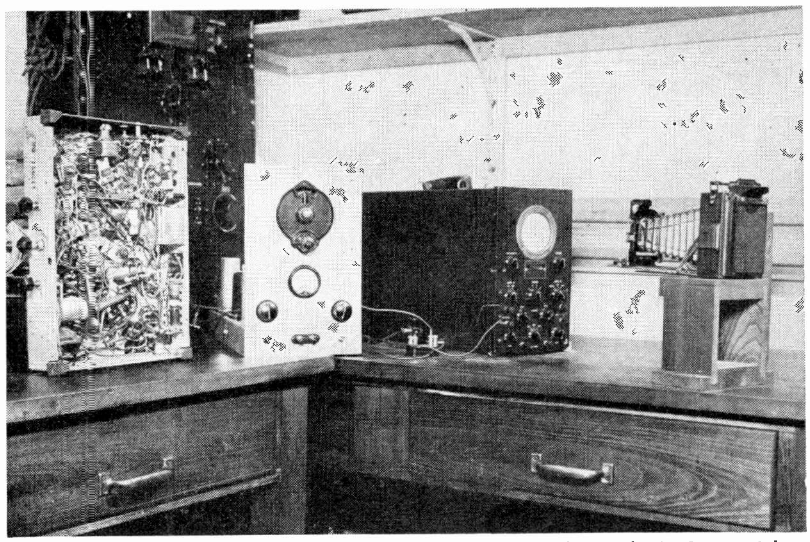
If you have had no previous experience in taking cathode-ray oscillograms, we recommend that you make a trial exposure run on a single film.

A trial exposure run of this type is shown in the accompanying illustration. You will observe that six exposures, at speeds ranging from 1/25 second to 3 seconds, are shown on the same film. These were made by sliding the lens vertically a short distance after each exposure. The effects of over- and under-exposure are strikingly evident. Note that the effect of too little exposure—1/25 second—is to lose the trace, while over-exposure—3 seconds—tends to broaden the trace considerably. This trial run would indicate an exposure of 1/5 second to be satisfactory.



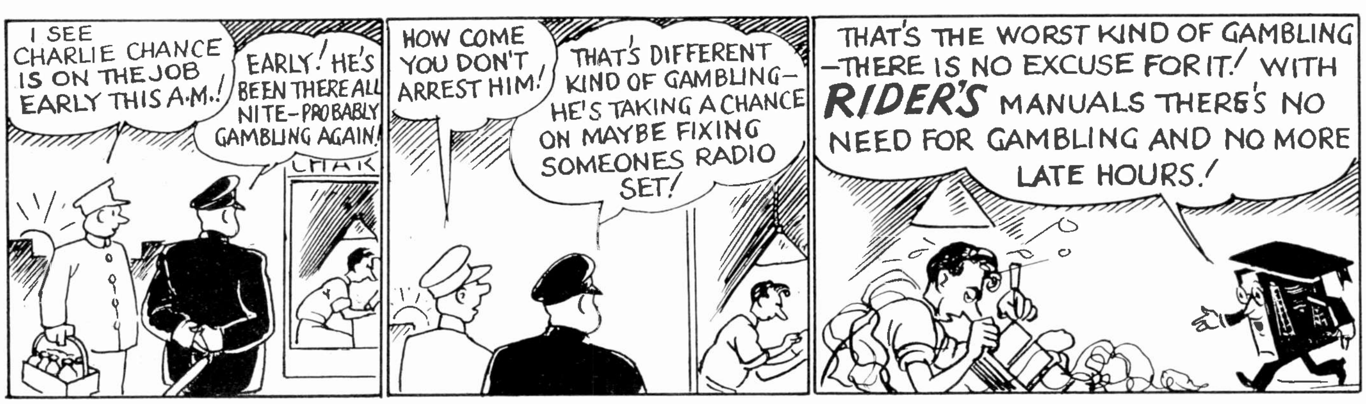
The results of different exposures of the same sine wave with constant image intensity

An accompanying illustration shows the convenient setup in a corner of the *Successful Servicing Laboratory.* The camera, which is of the plate type, 2-1/4" x 3-1/4", double extension bellows, Zeiss Tessar f/4.5 lens in Compur shutter, is rigidly mounted on a small stand attached to the table. The cathode-ray oscillograph, you will observe, is directly in front of the camera at a distance of about 10 inches (twice the focal length). Two strips of wood (not visable in the photograph) serve as guides so that the oscillograph can be readily moved into place without the necessity for refocusing each time the oscillograph is moved. The instrument directly on the left of the oscillograph is an audio oscillator which is being used to check the a-f. amplifier of the receiver on the extreme left.



The arrangement for photographing oscillograms in the author's Successful Servicing Laboratory

CHARLIE CHANCE—*The Gambling Man*



VOLUME VII NOW READY

After twelve months of never-ending search for servicing data and three months of intensive editorial work, the "copy" for Volume VII went to the printer. Now we have the completed result of our toil here on our desk. And we can rightfully say—with justifiable pride, we think—**that Volume VII is the greatest collection of servicing material ever put between two covers!**

What are some of the factors that make for a good manual? First, *it should have coverage* . . . servicing data on the products of as many manufacturers as possible should be included. ***Look at the list below!*** Second, *as many receivers as possible* of these manufacturers should be covered. Third, *an adequate number of pages* should be alloted to each manufacturer, so that every bit of servicing data can be included and be easily located and read. The servicing data should be *authentic* . . . and, last but far from least, a good index should be a part of the manual. ***The Volume VII Index has 98 pages!***

So there you are. We don't ask you to take our word for anything. . . . Go to your jobber. He has Volume VII. . . . Look it over—look at the number of double-page spreads—examine the Atwater-Kent data available in Rider Manual Vol. VII *and nowhere else*—the amount of data YOU NEED on the latest receivers and on those old ones for which you have been asking. . . . Again we say—look over its 1606 pages and we'll bet you say with us, **"It's the best yet!"**

Manufacturer	Number of Models	Number of Pages
ABC Labs	1	1
Acratest	4	4
Air King	35	10
Allied	19	12
Amer. Found. Blind	3	2
Amrad	5	8
Ansley	4	4
Ariel	1	1
Atwater-Kent	44	66
Automatic	7	4
Autocrat	4	2
Brunswick	3	1
Belmont	17	26
Buckingham	2	1
Cadillac	2	3
Capehart	6	6
Case	8	16
Champion	16	10
Climax	27	16
Continental	9	16
Corona	2	2
Crosley	49	78
Detrola	20	12
DeWald	21	12
Electrad	1	1
Emerson	70	40
Fada	21	20
Fairbanks-Morse	16	24
Espey	1	1
Federated	13	6
Firestone	3	4
Galvin	4	12
Gamble	65	92
Garod	20	20
Gates	6	1
Gen. Elec. Co.	22	42
Gen. Household	22	42
Gilfillan	5	4
Goodyear	2	4
Hallicrafters	2	6
Halson	10	10
Hammarlund	1	7
Hetro	30	4
Horn	15	8
Howard	19	24
Intern'l	14	10
Interocean	3	2
Kennedy	1	1
Jackson Bell	7	6
Kodel	6	2
Lafayette	26	16
Laurehk	2	1
Macy	3	2
Majestic	10	4
Midwest	4	6
Mission Bell	3	2
Monarch	1	1
Mont. Ward	17	28
Noblitt-Sparks	18	32
Operadio	5	4
Pacific	10	10
Packard Bell	7	4
Patterson	1	3
Peter Pan	9	2
Philco	57	152
Pilot	18	16
RCA	66	170
Radio Circular	2	2
Radio Mfg. Eng.	1	1
Radio Prods.	6	10
Radolek	9	10
RK Labs	1	1
Remler	13	8
Republic	2	2
Sargent	10	1
Sears	166	70
Sentinel	13	22
Shelley	4	2
Simplex	17	2
Sparks Withington	30	26
Stewart Warner	81	22
Stromberg	29	26
Supreme	4	4
Tatro	10	6
TCA	6	4
Trav-ler	11	4
Triplett	6	4
Troy	24	4
Triangle	2	2
Turner	1	1
United Bosch	34	48
United Motors	19	46
Universal Battery	9	2
Van Dyke	1	1
Warwick	9	4
Wells Gardner	14	34
Western Auto	4	6
Westinghouse Elec.	3	8
Westinghouse Int'l	5	4
Wilcox Gay	10	6
Wurlitzer	1	1
Zenith	51	32
Zephyr	4	2

Stromberg-Carlson 125

The following instructions should be strictly followed in case it becomes necessary for you to change the dial lamps in the above mentioned set, servicing data for which appear on *pages 7-16 to 7-18 of Rider's Volume VII.*

With the rear of the set facing you, remove the 6K7 and 6A8 metal tubes and the 43 and 25Z5 glass tubes from their sockets.

With the right hand passed to the right of the i-f. transformer, remove the nearest pilot light from the bracket. Pull the lamp to the right side of the i-f. transformer, where the bulb can be removed.

Insert the left hand to the left of the #26121 i-f. transformer and lift lamp socket from the bracket. The bulb can now be removed from the socket, by supporting the socket with the right hand inserted over the gang condenser.

To remove the bulb from the socket, DO NOT place thumb or finger directly under the bulb. Support the ends of the black insulator wings between the first and second fingers of the right hand. Push in on the bulb and turn slightly to the left and release pressure—grasp bulb and pull out.

•

Silvertone 1802A, 1803A, 1807

Refer to the schematic *page 5-31 of Rider's Volume V.* The 0.001-mf. condenser in the plate circuit of the 2A6, second detector, is no longer grounded. One side is still connected to the plate, as it was in the schematic mentioned above, but the other side now is connected to the cathode of the 2A6.

•

Silvertone 1945

The original production of this model was supplied with 1.5-ampere fuses. Sometimes trouble was experienced with these fuses blowing out, due to the initial charging current of the electrolytic condensers This occurred only when the receiver had not been used for a considerable time, so that the electrolytic condensers momentarily drew large forming current when the set was first turned on.

Later production of this model was supplied with a 2-ampere fuse and if you come across any of these models with the smaller fuse, substitute the 2-ampere type.

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Life is not so short but that there is always time for courtesy.—Emerson.

Successful
SERVICING
Reg. U. S. Pat. Off.

Dedicated to financial and technical advancement of the radio service man.

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ALIGNMENT DATA

An improvement is being effected in the presentation of alignment data. Some of the receiver manufacturers have introduced this material in tabular form. The presentation appears as a step-by-step tabulation identifying the connection of the test signal generator, the setting of the receiver dial, the frequency of the signal generator, the position of the band switch (if there is one), identification of trimmer, and the nature of the output indication. Up to this writing this tabular form is given for output meter type of alignment, but the same system is applicable to oscillographic type of alignment.

Upon critical analysis, this type of presentation affords certain definite advantages over the usual complete sentence, paragraph type, particularly when certain circuit trimmers, interlocked or associated with each other, require more than one adjustment. Not only is the reading material much less, but if the actual work is done in conjunction with the perusal of the alignment data, operation can be carried out at a much faster rate.

Such a change represents progress in a number of directions. As a matter of fact, it also represents economy in typesetting when the original service manual is prepared by the manufacturer. That which originally consumed two or three normal pages, can be rearranged within a single page or less and afford greater ease of operation. There is one requirement, however, which must be fulfilled in connection with this mode of presentation and that is the identification of the trimmers . . . These must be shown in a separate illustration. But this is no problem, because it is now customary to illustrate trimmer locations. . . . In connection with these illustrations of trimmers, a good idea is to show the adjustment frequency for each of the trimmers adjacent to them.

•

Shielded Rooms

This is not an "I told you so" comment, but we have received an announcement from a manufacturer offering shielded test rooms for sale. This is the first and we believe there will be more of them. . . . There is a vital necessity for such equipment. . . . No one can deny that the sensitivity of receivers offered for sale today is much greater than ever before and some suitable means must be available for proper testing. . . . The abundant use of home appliances and other forms of equipment pregnant with noise, makes it more and more difficult to test these highly sensitive sets properly. . . .

The greater the sensitivity of a receiver, the greater the likelihood of trouble from man-made static during the process of testing. . . . The wide-awake serviceman is going to install a shielded test room. . . . If he does not have space—he is going to find the space somehow. . . .

•

Sensitivity Tests

It is indeed gratifying to note that more and more receiver manufacturers are providing sensitivity data as a part of their service manuals covering their receivers. This practice should be encouraged because it provides each and every serviceman with a means of determining if the sensitivity of the receiver is what it should be.

The sensitivity of the different bands in a multi-waveband receiver varies quite markedly and a single test upon one band is not sufficient. . . . Often it is impossible to make even the simplest "air" test on the short-wave bands, because the location is not ideal for such work or because the time of the day is not correct for the reception of some of the foreign stations. . . . Knowing the required sensitivity of receivers on the different wavebands and having a properly calibrated signal generator, the service station is freed from the limitation of receiving conditions and time of day.

•

Changes in Chassis

It now is becoming common practice among radio receiver manufacturers to supply data concerning the changes made upon the various receivers during production. . . . In some instances these changes are simple and in other cases, they are complex,—but whatever the change, it is imperative that you, as a service man, realize that such a change has been made. . . . Because of this, we stress the point that you should pay close attention to all notices which discuss or describe changes made in the circuits used in receivers. You will find that the simplest of variations between circuit data you may have and the altered receiver in your possession will cause myriad complications. . . . Pay strict attention to all changes and keep a permanent record of them.

John F. Rider.

•

Did You Know That

Glycerine is practically indispensable in the manufacture of cigarettes, because it absorbs and retains moisture, thus preventing your favorite brand from drying out.

One **soft drink** manufacturer in this country uses more than a *million pounds of glycerine* annually in the preparation of the extract. In dilute solutions, it adds smoothness.

Wiping off the leaves of indoor plants occasionally with a cloth dipped in glycerine will make them *glossy and keep them from drying out so quickly.*

A few drops of glycerine added to the ingredients of **cakes** or **cookies** will keep them fresh longer, because the original moisture is retained.

The bulk of the world's supply of glycerine is produced in the making of **soap,** where it is set free during the chemical treatment of the fats and oils.

•

Automatic Volume Control

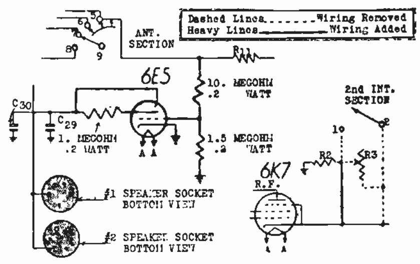
This is the third volume in the series "An Hour a Day with Rider." In its 100 pages it covers the subject more completely than any other treatise known to this reviewer. The text and diagrams are designed with a view to simplifying the involved circuits for the service man. As with all the books in this series, mathematics is used only when no other form of explanation will do. It is a necessary addition to the library of every service man and experimenter.

A review from "The New York Sun," October 31, 1936.

•

Wells-Gardner 2CM-3A Series

When the 6E5 cathode-ray tube is used in conjunction with the 2CM Series receiver, the set becomes a 3A series by the addition of the extra tube, which is a resonance indicator and is connected in the circuit as shown in



Wiring changes in Wells-Gardner 2CM for addition of 6E5 tube

the accompanying illustration. Refer also to the schematic shown on *page 7-4 of Rider's Volume VII.*

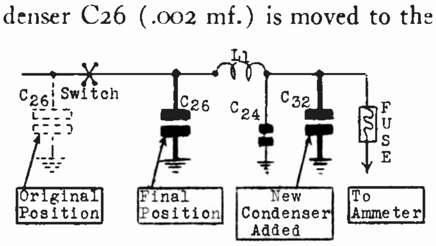
The 6E5 tube may be removed as follows: Pull off the cable assembly socket and swing the upper part of the tube bracket away from the console panel. Then loosen the thumb screw until the tube can be removed. To re-insert the tube, reverse the above instructions.

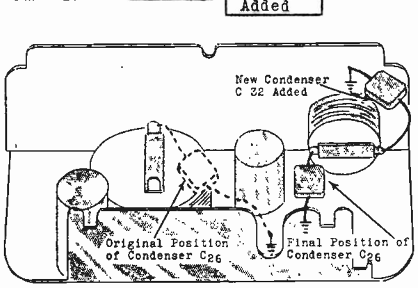
Silvertone 1825, 1828

A change has been made in the antenna circuit of this chassis, the schematic of which appears on *page 5-39 of Rider's Volume V.* The switch, connected across the 100,000-ohm resistor in the antenna primary circuit, has been eliminated.

Wells-Gardner 6R

A change and an addition in the "A" line filter circuit has been made in this receiver, the schematic of which will be found on *page 7-27 in Rider's Volume VII.* Referring to Fig. 1, condenser C26 (.002 mf.) is moved to the





Schematic, Fig. 1, shows changes in Wells-Gardner 6R to eliminate motor noise. Fig. 2, below, shows new parts positions

opposite side of the switch as indicated. A new condenser C32—.002 mf. is added as shown. The actual points at which these condensers are connected are shown in Fig. 2.

Receivers of this series having this change incorporated can be identified by a green paint mark on the battery lead. There will also be a letter "C" stamped on the chassis.

The above mentioned changes are not required for most car installations and are made only to take care of extreme cases of motor noise.

It will be necessary in many Ford V8 installations to take the steps described above. If motor noise persists after the regular procedure has been followed, make this change in the "A" line circuit in Ford V8s or any other cars.

If motor noise still persists, it may be radiated through the openings in the chassis case on the tuning condenser side. Remove the chassis from the case and solder a piece of tin plate on the inside of the case over the openings on the tuning condenser side to completely cover these openings.

Wells-Gardner 2DL Series

We have been advised by the manufacturer that if an a-c. hum develops in this model the following should be checked:

Be sure that the volume control lugs are not grounded on the flat portion of the metal chassis wall which supports the rubber mounting foot.

The bottom plate under the chassis must be under the r-f. end of the chassis and away from the filter choke. If it is in the center or left side (from back of the set), move it towards the right side about one-half inch from the mounting bolt holes.

If you will consult the schematic diagram on *page 7-7 of Rider's Volume VII,* it will be seen that a 5Z4MG rectifier tube is employed. This is a metal-glass tube and that type only should be used. Do not substitute a 5Z4 (metal tube), as this will not operate satisfactorily at the voltages used in this model.

Silvertone 1855, 1856

These receivers use two types of chassis, differing slightly in their circuit. One type has a 4-ohm resistor in series with the tube heaters only, these chassis being stamped 196X, or 259. Other chassis have this 4-ohm resistor in series with the vibrator, as well as the tube heaters. (See schematic *page 5-45 in Rider's Volume V*) These chassis have the marking followed by a suffix letter, as 196XA or 259A.

The model 1855 uses a 196X or 259 chassis. The model 1856 uses a 196XA or 259A chassis.

Two types of vibrators are available for replacement purposes and the proper one should be used as follows:

With either the 196X or 259 chassis (model 1855), use vibrator with the part number R11228 that is identified by a dot of red paint.

With either the 196XA or 259A chassis (model 1856) use vibrator with the part number R11207, that is identified by a dot of green paint.

About Oscillograms

Successful Servicing:

I do not very often go to the trouble of writing to a publication but after reading your article headed "Oscillograms" on page five of the October issue of SUCCESSFUL SERVICING, I cannot help but express my feelings.

I am certainly pleased to know of your stand in regard to the use of oscillograms and must say that although I have been interested and followed radio for twenty-two years, the oscillograms that I saw even before I saw an oscillograph, told me more in a given space of time than anything ever used in explaining electrical phenomena. I also find it much easier to explain a great many things about radio set functions to the servicemen in the field when using these oscillograms.

The use of oscillogaphs is growing very rapidly in this territory and most of the engineers and servicemen who make use of the oscillograph soon find it a great time-saver, not only because of its usefulness as a service instrument, but because he better understands what takes place in the circuit under observation, even though he may not use the oscillograph for his regular service work. After once learning what actually takes place in the circuit, I believe that the oscillograph is the most outstanding development in the indicating instrument field since the development of the meter.

(Signed) Henry W. Rissi,
Rissi Bros., Inc., Detroit, Mich.

N.Y. POW-WOW

"The Radio Technician" in the Pacific Northwest called J.F.R. *the champion long-distance talker* and boon to the A.T. and T. . . . Well another record was established on November 9th, when the boss talked on a **seven city tieup in New York State.** . . . The speech went over the singing wires from the home office, (1440 b'way to you)—to Albany, Buffalo, Rochester, Syracuse, Elmira, Ithaca and Binghamton. . . . All the towns were tied in on the same wire and the phone company installed a loud speaker in each point where the men were assembled. . . . About 600 in all were in on the con-fab. . . . Unfortunately a mistake was made in the final arrangements and some of the cities had a phone installed so that they could talk back to N.Y., but the phone company did not tie them in.

The subject of the talk was well liked in six of the seven cities. One town did not agree and a pow-wow with the boss leads us to believe that these men misconstrued what was said. . . . However—*you know you can't please everyone.* . . . Right!

WE HEAR

That a *miniature* cat-ray tube has been announced by RCA. . . . It's in a 6L7 metal shell and is identified as the RCA-913. Operates on comparatively low voltages and works out swell as a modulation indicator. . . . Mayhap it'll be assembled into a miniature oscillograph job for those with thin pocketbooks. . . . Let's hope so. . . . **The S.S lab is going to get one of these tubes and publish some data in the future.**

FOG

Nature in one of her perverse moods—perhaps a *hangover from Hallowe'en* the night before—did her best to keep the boss from attending the **Trade Show in Cleveland on November 1st.** And she did succeed for awhile! . . . J.F.R. was sky-hopping out there and just after dark, on the west side of the Alleghanies, they ran into a regular "pea-souper." The pilot sat the ship down at an emergency landing field at Kylertown, Pa., about 14.8 miles the other side of the back of beyond. The field mgr. told Rider that there wasn't a chance of getting to Cleve. by 9:30, scheduled time for the talk to the gathered servicers. So that he wouldn't disappoint his audience, the boss went to the manager's farm-house,—got the long-distance "op" busy and *arranged to give his talk via Mr. Bell's invention.* The gang in Cleve. had an awful job getting an amplifier and speaker rigged up in the hall and J.F.R. had an equally tough time trying to convince the local operator in Kylertown that she should persuade the other ***eight parties on the line*** to the farm-house to lay off chinning for about an hour. Apparently the voice-with-the-smile was successful, for when R finally got the go-ahead signal the line was clear and remained that way for the hour or so that he talked. Afterwards he and the other fog-bound Marco Polos rode the foggy back country roads to Altoona and caught a rattler for Cleveland. On Monday he talked to the gang again—this time wherever they found him. Well, you can't keep a good man down. . . . *P.S.* J.F.R. flew back to N.Y. that night and was the *only* passenger.

FROM FARLEY'S HELPERS

R. Martinez Bernat, Mayaguez, Porto Rico. . . . Thanks for them kind words about S.S. . . . The size is about as big as we can make it. . . . About A.F.C., there will be a book in the "An Hour a Day with Rider" series. . . . **Joseph Rioux, Enr'g., Trois-Pistoles, Quebec, Canad.** . . . Thanx again. . . . Sorry that we cannot supply the Number 1 issue. The Nov. and Dec. copies have been mailed to you. . . . WHO CAN SUPPLY OUR FRIEND Rioux with a Number 1 issue of S.S.? . . . we mean the very first issue published, Sept., 1934. . . . We're glad that u find the Cat-Ray book's okay. . . . **Vangunten of Cleve** (*not a Knight of old*) says that J.F.R. and a dame and a pilot stopped off for a drink at Kylertown and could'nt find the plane again. . . . (Wise guy, huh! . . . or are ya just plain jealous? . . . He reports on the successful I.R.S.M. show in Cleveland . . . Swell all around . . . he asks if anybody heard Rider and Hathaway put on the Winchell-Bernie act? . . . Somebody's Sales Mgr. took a train from Cleveland *for Chi and woke up in Buffalo.* . . . I wonder who and I wonder **why?**—to the tune of Sweet Adeline. . . . **More news.** . . . Somebody made a date with his own wife and thought it was the girl in the next room. . . . *What a convention!!* . . . Another question . . . Who bought the dinners for the dozen blondes on the make? . . . ***Write the answer with invisible ink.*** . . . **Red Kendall** and **Lee Evans** busted into the hotel switchboard to make the connection from the outside line to the auditorium for the Rider gab—and caught mucho hell from the hutel and local A.T. and T. . . .

H. J. Surbey, RD 8, North Canton, Ohio . . . Okay——you're a 100%er. . . . Your Q about cameras has been answered by mail and more data in this issue. . . . See pages 1 and 3. . . . **Wilkinson of Fulton, N. Y.** . . . About oscillograms . . . You agree with us and we're glad. . . . Lots of fellows don't use the oscillograph—but like urself—they will. . . . That's a grand idea about the sweep frequency. . . . We'll show it in the future, whenever suitable. . . . Okay on the "olde Tymer" . . . yea, bo—you pressed the key and all the lights went out.. . . .

The Rolling Reporter

Emerson L117, L122, L133, L135, L141

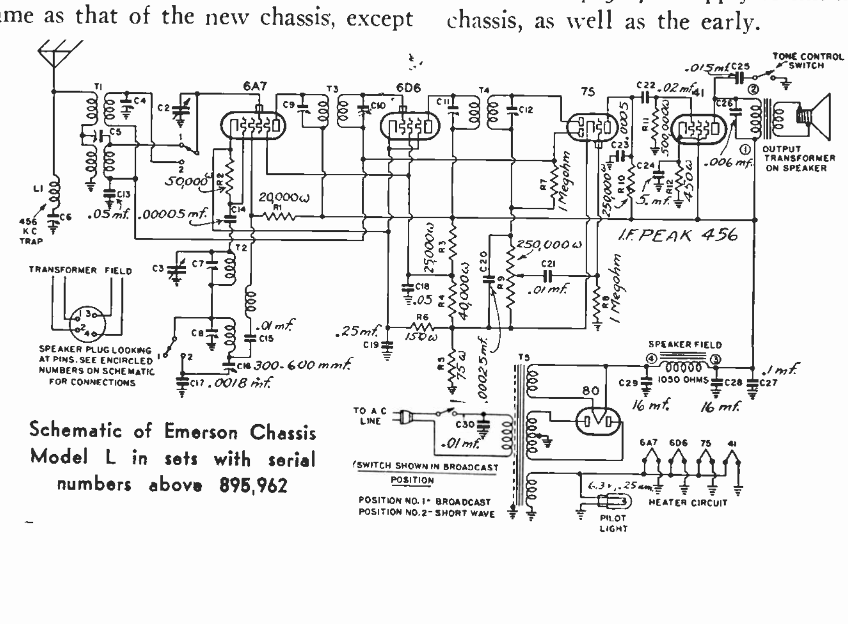
The schematic on *page 7-27 of Rider's Volume VII* applies only to sets bearing serial numbers *under* 895,-962. Since the publication of Volume VII we have been advised by the manufacturer that changes have been made in this chassis, Model L, and in order that you may have the latest data, we are showing herewith the schematic of the chassis that is used in those sets with serial numbers *above* 895,962. Also please note that a sixth model number has been added to the above list: L150.

In this late chassis a 75 second detector has been substituted for the 85 tube. The voltage table, given with the rest of the servicing data on *page 7-28 of Rider's Volume VII,* is the same as that of the new chassis, except for the readings of the 75 tube, which are:

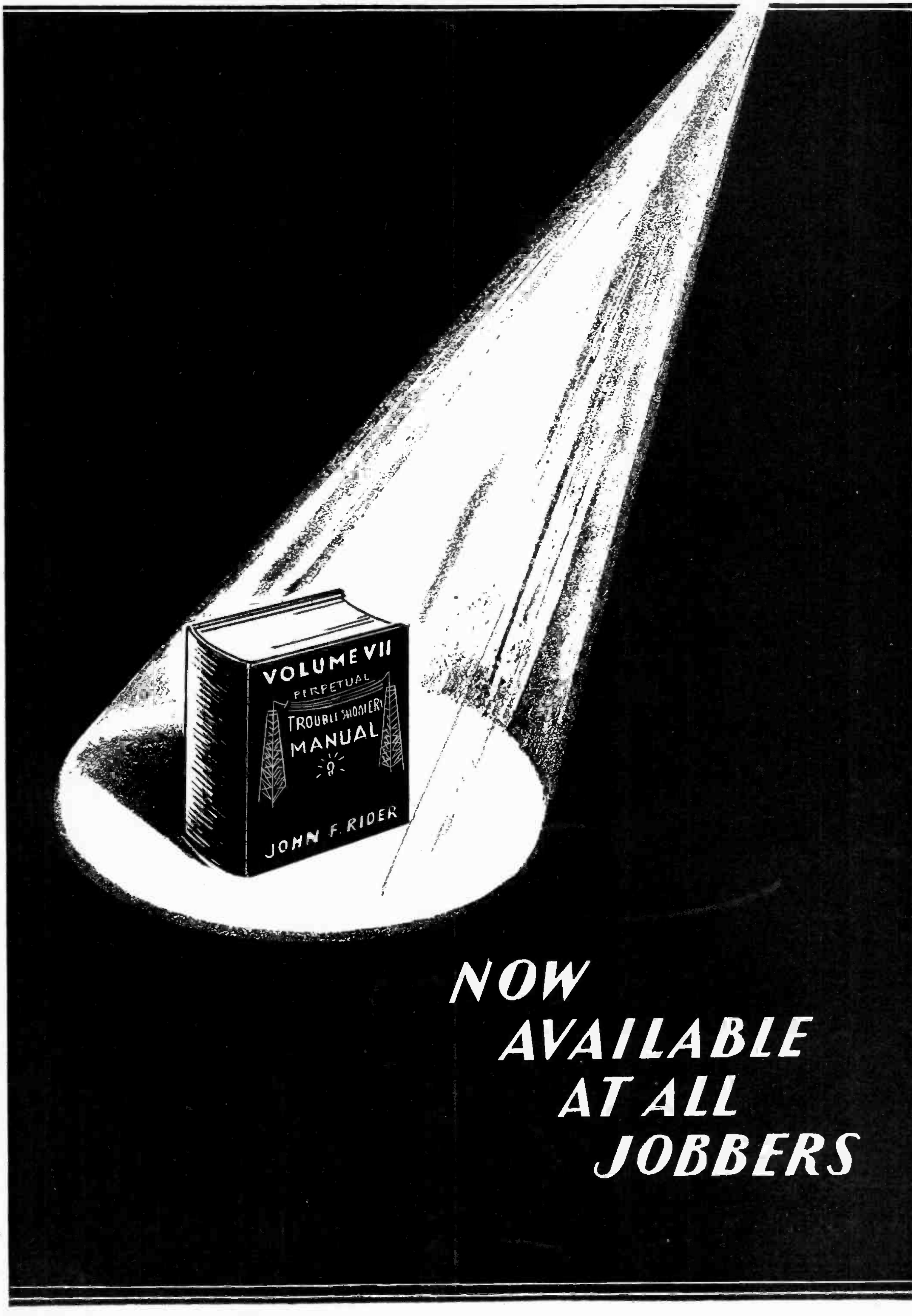
Plate	120
Screen	—
Cathode	1.8
Filament	6.3

Note that in Model L150 the electrolytic condensers, C28 and C29, have values of 12 mf. and 8 mf. respectively, and have a voltage rating of 450. Also note that in sets having serial numbers below 961,900 the two primaries of the antenna coil, T1, were in parallel from antenna to ground, and a 0.00005-mf. mica condenser was in series with the antenna lead and the short-wave primary. Also, C17 was an 0.00135-mf. mica condenser.

The General Notes and Adjustments on *Emerson page 7-28* apply to this new chassis, as well as the early.



Schematic of Emerson Chassis Model L in sets with serial numbers above 895,962


VOLUME VII
PERPETUAL
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MANUAL
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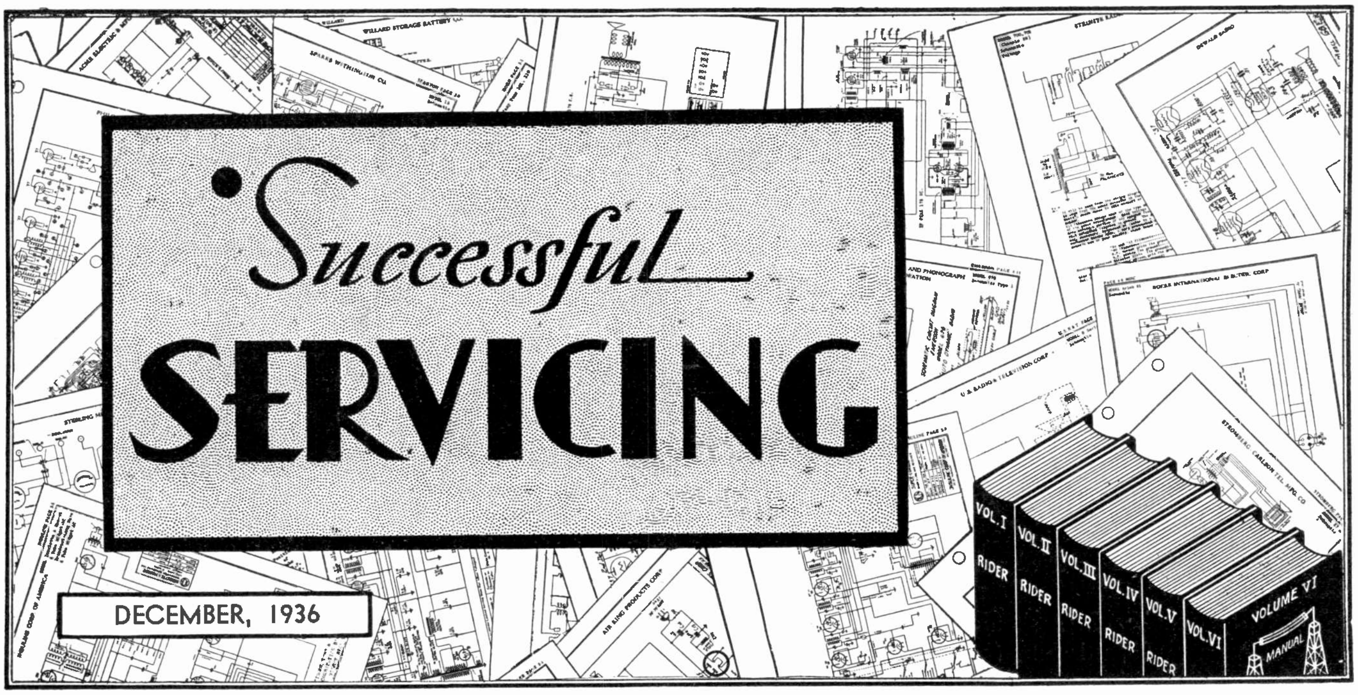
AT ALL
JOBBERS



A PLEA FOR MORE EDUCATION

A More Thorough Understanding of Radio Technique is Necessary

BY JOHN F. RIDER

THERE is an old adage which says "Coming events cast their shadows before them." Certain shadows have appeared upon the panorama of the servicing industry and we hazard the repetitive nature of this subject.

Recognizing the possibility of criticism which may be hurled at us by some servicemen and accepting the thanks of those who will benefit by heeding the warning, we again state that the servicing industry in general must make every effort to acquaint itself with the more advanced details relating to receiver design—particularly with the technical features of the receivers produced during the last two years. If this means going back to school—or buying books or subscribing to advanced correspondence courses—then whichever is the preference must be done.

It is not our intention to be an alarmist. . . . Instead we are simply stating a necessity which is daily increasing in magnitude. . . . Not a single day passes without a communication of some type, verbal or written, in which the essence is the fact that servicemen are finding it more and more difficult to cope with the receivers which come into the shop.

The condition is not local to any one community, but is prevalent throughout the United States and no doubt Canada as well. . . . Perhaps some of the men who read these lines will feel that what we say is just so much greater effort to sell our books and that we are using what is generally classed as "fear copy" to do so. . . . In truth this is not the case, and there is no use sugar coating a pill. . . . A spade might just as well be called a spade. . . . If the service men of this nation are not sufficiently well prepared (from the technical knowledge angle) to service some of these receivers—the facts might just as well be stated. . . .

After all is said and done there must be some reason for the fact that receiver jobbers in different cities are on the hunt for servicemen who are capable of repairing the very latest receivers. . . . There must be some reason why jobbers are finding it very difficult to locate men who know enough about the circuit design of modern receivers to be able to corner some of these jobs. . . .

There must be some reason for the fact that receiver owners find it difficult to secure service when the receiver is one of the very latest—produced during the past two years. . . . There must be some reason why service station operators quote such high service charges to repair these receivers that the customer cannot afford to pay the price. . . . There must be some reason why the charges are deliberately made so high that the job will not be sent to the shop. . . . *The reason is that many service station operators are afraid to tackle the repair of the receiver.* . . . Not because the mechanical features of the receiver are so intricate that a great deal of time will be lost—but rather because the circuit design involves systems which are not understood. . . .

Each year the warning is sounded that receivers are becoming more and more complicated. . . Service operations continue it is true—but the men are fast approaching the cross roads. . . . What with a number of a.v.c. arrangements—automatic audio volume expanders—automatic frequency control and the forthcoming automatic selectivity control—even the most conscientious serviceman is going to have his hands full. . . .

Receivers equipped with a.f.c., although comparatively new, are already coming into the service shop. . . If the trouble does not lie in the a.f.c. sys-

(Please turn to page 3)

Wells-Gardner 6F Series

In some few cases, excessive a-c. hum may be encountered in the early models of this receiver. These can be identified by the letter "A" stamped on the under side of the chassis base. This hum can be eliminated by following the procedure outlined below. However, as a general rule, changing the tubes is all that is necessary and the other steps should be followed only if necessary. Later production—that can be identified by the letter "B" stamped on the chassis—has all the changes incorporated.

The 6B7 (signal diode and a-f. amplifier) and the 6F7 (bass amplifier) tubes are those referred to above. Several new tubes should be tried and the effect noted.

The filter choke, L4, should be mounted on a cardboard shim (3/32" x 3⅞" x 3¾") with corner holes cut to match the mounting holes on the choke. A slot, approximately 1 inch long, should be cut in one side to allow for the leads.

The electrolytic condenser, C-35, 4 mf., should be replaced with a 12-mf., 300-volt, electrolytic condenser, Part No. P-44 x 26, in the r-f. chassis. *See page 7-12 in Rider's Volume VII.* If the hum level is still objectionable after the above changes have been effected, the 6B7 and 6F7 tube filaments can be rewired for d-c. operation.

REWIRING 6B7 AND 6F7 FILAMENTS FOR D-C. OPERATION

R.-F. Chassis Procedure

1. Remove the wires from the heater terminals of the 6B7 and 6F7 tube sockets, leaving the ground connection on the 6F7 tube socket. Remove the ground wire from the terminal strip to the "A" power cable plug terminal and from the latter terminal connect a wire (white) to a ground lug near the 6K7 2nd i-f. tube socket, as shown in Fig. 1.

Remove the wire connecting the heater of the 76 AVC diode tube to the insulated terminal strip. The other heater connection of this tube should be removed from the terminal of the "A" power cable plug and connected, as shown in Fig. 1, to the lug on the insulated terminal strip, to which one terminal of candohm resistor R20 is also connected. This last heater connection and the heater wire for the 6K7 2nd i-f. tube and the ground wire (white) from th "A" power cable plug, referred to above, should be twisted together and kept away from the 6B7 and 6F7 tube sockets as shown.

Connect the other terminal of candohm resistor R20 to the opposite terminal of the "A" power cable plug with reference to its former position, as shown in Fig. 1 and Fig. 3.

2. Connect the 6F7 and 6B7 heaters in series between ground and the terminal of "A" power cable plug to which the candohm resistor R20 was formerly connected.

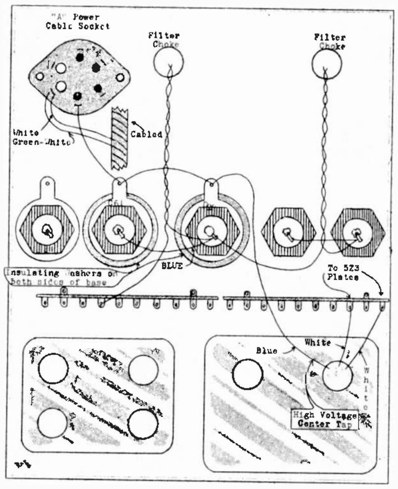


Fig. 2. The revised wiring for the a-f. chassis of the Wells-Gardner 6F Series

3. A new resistance candohm R39 (130 ohms, 2.5 watt, Part No. P-43 x 53—Code R39) is placed near the volume control in the position shown in

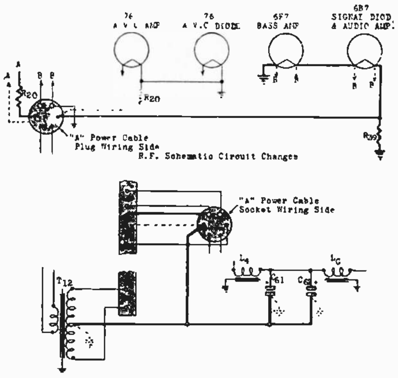


Fig. 3. Schematic changes in both chassis

Fig. 1. It will not be necessary to drill holes, but the ground lug should be bent over so that the resistor can be slipped under the shielded wires. As shown in Fig. 1 and Fig. 3, the ungrounded lug on R39 is connected to the heater terminal of the 6B7 tube socket, which also connects to the terminal of "A" power cable plug.

4. The pilot light lead, which formerly connected to the 6B7 heater terminal, is now connected to the 76 oscillator tube heater terminal. This is best accomplished by drilling a ¼" hole in the chassis near the oscillator tube socket and bringing the lead down from the left hand side of the dial assembly.

A. F. Chassis Procedure

1. Remove condensers C61 and C62 from chassis. Ream or file holes to 29/32" diameter. Place one offset washer on each electrolytic and mount on chassis so that offset part of washer fits into hole. Put on the plain fibre washer, contact lug, lockwasher and nut, respectively.

2. Then disconnect the high voltage center tap of "B" power transformer, T12, at the ground lug and connect it to the negative contact lug on one of the electrolytics. Next connect the negative contact lugs of the two electrolytics together—See Fig. 2.

3. Replace the choke wires on the positive side of the electrolytics, C61 and C62, and also the blue wire connecting the two positive terminals together.

4. At the "A" power socket, disconnect the green and white tracer wire at the cathode terminal and connect to the cathode heater terminal. Connect the cathode terminal to the contact lugs on the electrolytics—See Fig. 2 and Fig. 3.

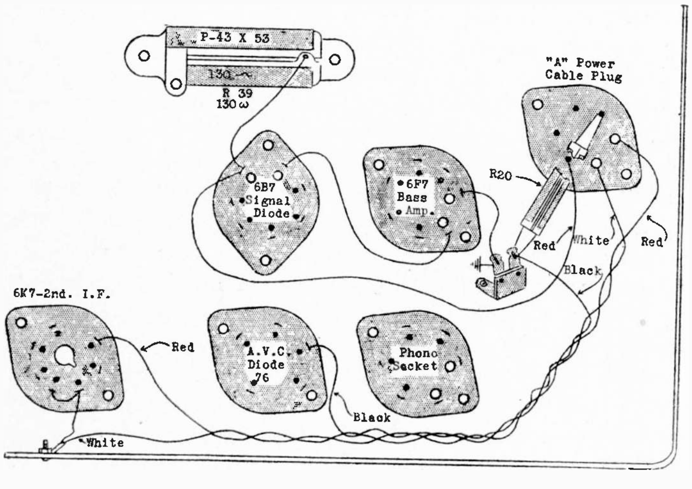


Fig. 1. On the left is shown the tube sockets and cable plug of the radio-frequency chassis of the Wells-Gardner 6F Series with the revised heater wiring, as explained in the accompanying text

A Plea for More Education

(Continued from page 1)

tem, repair is effected without much trouble, but in very many cases trouble in the automatic frequency control system remains there and proper service is not rendered.

That such a condition should exist shortly after the announcement of the receivers which incorporate such systems is in itself not very surprising—as a matter of fact, to be expected—but that service men should stay away from meetings at which such matters are discussed by engineers is quite surprising. . . . Some of the men who usually absent themselves from such technical sessions put on by receiver manufacturers, jobbers, and associations—honestly confessed that the material was too highly technical. . . . Maybe that is true—but if so—correction is imperative. . . . Attendance at such meetings is the best way of acquiring technical knowledge—because the opportunity exists to ask questions. . . Book study is essential, but no book is capable of answering the perplexing problems which arise in the mind of the reader—who is reading technical details entirely new and foreign to him. . . .

Because of the great need for technical knowledge, no serviceman who takes his work seriously can afford to miss any technical meetings of any kind—that is, meetings intended for the members of the servicing industry. . . . Being busy is really no excuse—because if the information furnished at these meetings is not procured and assimilated—the busy days will soon be over. . . . Often times, receiver manufacturers are disheartened at the comparatively meagre attendance at such meetings—and if analysed, only one conclusion can be arrived at—namely, that the servicemen do not care . . . and if true, most certainly this is not the correct attitude.

Some servicemen have expressed the fact that radio magazines do not publish the type of data they need to keep abreast of the times. . . . If so, why don't the servicemen communicate with the magazines and state their needs or at least their ideas and beliefs. . . Not that radio magazines can be edited to conform with the ideas of every radio serviceman—but we are certain that the editor of every radio magazine is vitally interested in the likes and dislikes of his readers and if humanly possible—will cater to them—for that is the very purpose of the magazine. . .

Again we say that we are not playing the role of Calamity Jane—but we cannot help but call attention to the fact that every serviceman who is interested in making his living in radio service work, must resort to every method of securing the information necessary to keep abreast of modern technical developments.

Time is a factor in every man's life, but more often than not we waste more time than we use to good advantage. . . . In this connection many men say that they do not have sufficient time to study and keep abreast. . . . Maybe the business requires a great deal of your time—but it cannot do so to the exclusion of time needed for technical reading and study. . . . Bear one thing in mind and that is if you do not devote a certain amount of time to technical reading and study—your business will suffer. . . .

The Editors and Technicians of
SUCCESSFUL SERVICING
wish you
A Merry Christmas
and
Prosperous New Year

It is true that every service station will be able to service receivers for a long time to come—even if the operator does no studying at all. . . . However, the number of receivers which he will be capable of servicing will gradually dwindle as more of the old sets are replaced with new and modern receiving systems. . . .

Business is on the upswing—but that does not mean that more of the old and simple receivers will come in for service. . . . The public is spending more money to buy new receivers. . . . The volume of receiver sales during 1936 approximated about 8,000,000 receivers and this is more than for many years. . . . All of these are new receivers and while it is true that some were bought by people who have never owned radio sets before—very many replaced older and simpler receivers. . . . Someone will be called upon in time to come to repair these systems which incorporate every modern development of radio engineering. . . Who will do this work? . . . Most certainly not the men who are too busy to study, attend technical meetings—read books—enroll in corresponding courses, etc.

Being familiar with receiver design details used in years past is not sufficient fortification against the future to enable the man to sit back contentedly and say "I'll get by.". . . To use slang "them days are gone forever.". . . A new day has come. . . . There will be no middle path. . . . There will be men in each community who believe what we say and who will know what they are doing. . . . They will get the complicated jobs and by rendering good service will acquire the reputation and the shekels. . . . The rest of the men—well, they will continue trying to get by. . . .

•

Random Observations

An examination of facts relating to receiver sales during 1936 shows the combination radio and phonograph unit increasing in popularity. . . .

More and more of the service data released by receiver manufacturers contains d-c. resistance values of the r-f., a-f. and i-f. transformers, power chokes and transformers. . . .

One manufacturer offered shielded test rooms for sale during 1936. . . . He is pioneering for a good cause and unless we miss our guess—more such equipment will be offered during 1937.

The miniature cathode-ray tube, the RCA 913, suitable for operation at about 500 volts, makes a swell modulation indicator for "ham" outfits—but it also is nicely adapted to a comparatively inexpensive and really portable cathode-ray oscillograph for radio servicing.

Incidentally, the cathode-ray oscillograph has taken hold and many people who purchased their units in 1935. learned how to use them in 1936 and it is our guess that they'll be willing to part with much equipment—but not with the cat-ray outfit. . . .

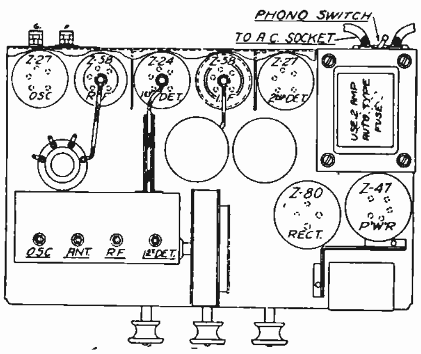
From what we hear some of the radio parts manufacturers are doing a swell business manufacturing parts for refrigeration. . . .

We know of an outfit now working upon the development of an intermittent contact checking device which will cover the entire receiver—if the development is successfully completed.

The public address business is on the upswing . . . although some of the portable jobs we heard during the last presidential campaign were foreign address systems—judging by the way some of them sounded.

Zenith 210, 220, 221

The schematic and socket layout for chassis 2022-A & B, which is used in the above receivers, will be found on *page 3–2 in Rider's Volume III and on page 2730 in the Rider-Combination Manual.* We have just received the voltage data and the layout showing the location of the trimmers, which are reproduced herewith.



Socket and trimmers locations for Zenith Models 210, 220 and 221

Tube	Plate	Cath-ode	Screen	Sup-pressor	Plate ma.
Z-58 R.F. ...	248	3	115	3	9.5
Z-24 1st Det.	248	22	115	..	0.4
Z-27 Osc....	118	..	..	..	3.0
Z-58 I.F.	248	3	115	3	8.0
Z-27 2nd Det.	110	50	..	..	0.4
Z-47 O.P. ...	226	..	245	..	38.
Z-80 Rect. ...	360	..	..	..	32.

The intermediate frequency is 175 kc. The condenser gang is adjusted at 1500 kc. and the oscillator padder at 600 kc.

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Fairbanks-Morse 64 Battery

The schematic of this receiver was published in *Rider's Volume VI on page 6–4.* We have just received the alignment data and the socket and trimmer layout, which you will find below.

Emerson H-5

The schematic of this chassis appears on *page 3-6 of Rider's Volume III and page 884 of the Rider-Combination Manual.* The voltage data and socket layout appears on *page 4–5 of Rider's Volume IV.* Also on this latter page is the schematic diagram for the chassis No. H-5-L, which receiver has the same voltage and socket layout with the following exceptions:

A 6A7 tube is used as a 1st detector-oscillator and the "screen" voltage reading in the table should be 50 instead of 98. This tube in the socket layout is the top one on the right-hand side nearest the gang condenser and should be so marked on the above-mentioned page, bearing in mind, of course, that this layout also applies to the H-5 chassis, which uses a 78 tube as a 1st detector-oscillator.

Also please note that the model numbers of this chassis, H-5, are 30, 250, and 300.

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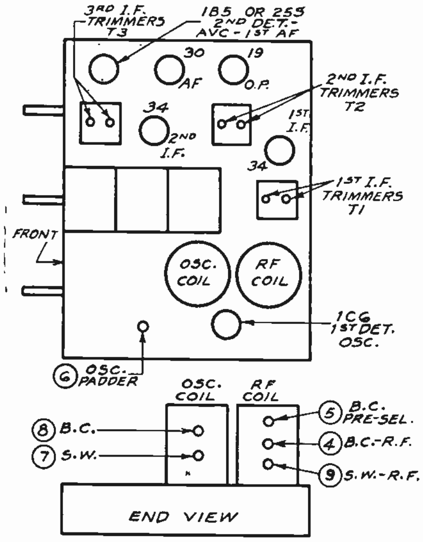

The trimmers on the Fairbanks-Morse Model 64 Battery set are identified by number corresponding to the table below

Waveband Sw. Position	Dial Position	Dummy Antenna	Sig. Gen. Frequency	Sig. Gen. Connection	Trimmer Adjusted	Output Signal
Brdcst.	Fully Meshed	0.1 mf.	456 kc.	1C6 grid	T3, T2, T1	Max.
Brdcst.	1500 kc.	.0002 mf.	1500 kc.	Antenna	4, 5, 8	Max.
Brdcst.	600 kc.	.0002 mf.	600 kc.	Antenna	6 [1]	Max.
Police	2.4 mc.	400 ohm carbon	2.4 mc.	Antenna	Note 2	Max.
Sht. Wave	16 mc.	400 ohm carbon	16 mc.	Antenna	7	Max.
Sht. Wave	16 mc.	400 ohm carbon	15.1 mc.	Antenna	Image check [3]	
Sht. Wave	16 mc.	400 ohm carbon	16 mc.	Antenna	9	Max.

1. Adjustment made while rocking gang condenser. Repeat all adjustments if the alignment is off appreciably.
2. The signal should be received near the calibrated section of the dial. If not, check oscillator tube, switch connections, and coils. No adjustment is necessary on this band.
3. Increase signal generator output. Image signal should be received at this point. If not, the oscillator has been aligned to the image frequency and the oscillator trimmer must be backed out until the correct signal is received at 16 mc. and the image at approximately 15 mc. If readjustment is found necessary, the antenna and r-f. trimmers should also be checked again.

Philco 65

The schematic of this receiver was published on the following pages of *Rider's Volume I: page 1-16 of the revised edition and page *459 of the early edition; and on page 1638 of the Rider-Combination Manual.* At the time of publication the values of the parts were unobtainable and these are now given in the list below. The first column is the identifying number used on the schematic; the second column is the part number; and the third column is the value.

Schematic Number	*Part Number*	*Value*
1	3524	10,000 ohms
5	3292A	.1 mf. — 250 ohms
6	3584A	.05 mf. — 250 ohms
13	3583	.5 mf.
14	3525	32,000 ohms
21	3422	200 "
22	3526	5,000 "
23	3518	4,000 "
24	3512	2700 ohms (700,2000)
25	3528	2,000 ohms
26	3628	6 "
27	3292B	.05 mf. 00 250 ohms
29	2850	3200 "

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Coronado 30-A

Below will be found the alignment procedure and the voltage readings for this receiver, the schematic of which will be found on *Gamble page 7–91 in Rider's Volume VII.*

Connect the output of the signal generator to the antenna terminal of the set. Waveband switch to broadcast and set dial to 1400 kc., to which frequency the signal generator should also be set. Adjust the trimmers on the top of the gang condenser for maximum output. (Note: generally the rear gang condenser trimmer has to be adjusted to minimum capacity.)

Set the waveband switch to short wave and set the dial to 4.0 mc. With the signal generator set to 4.0 mc., adjust the trimmer mounted on the coil beneath the chassis for maximum, rocking the gang condenser while making the adjustment.

Voltage:

Tube	Plate	Screen	Cathode
6D6 R.F.	225	85	2
6C6 Det.	105	85	3.5
42 O.P.	200	225	15*

*Read from 375-ohm resistor, No. 1267, to ground.

Line voltage: 115. Volume control: Full on.

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Dedicated to financial and technical advancement of the radio service man.

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Vol. 3 DECEMBER, 1936 No. 4

IS SANTA CLAUS A MYTH?

IF some bright-eyed youngster were to put this question to you, what would your answer be? Would you tell him that the bewhiskered old gentleman was a legend that started about fifteen hundred years ago when St. Nicholas lived in Greece or that the whole story could be traced back a few more centuries to the pagan god Silenus, a more or less disreputable old fellow who was equally fond of children and a good glass of wine? Or would you help him keep one of childhood's most beautiful illusions and do a little artistic lying?

Altogether too many people in this modern, speeded-up age in which we live are only too ready to pounce on illusions and ridicule them as being old-fashioned. . . . They forget that those same illusions brought them happiness when they were young—they forget first principles and surely, the happiness of a child is one of the most important first principles that has ever existed. These disillusioned folks seem to take an unholy delight in seeing that others become sophisticated and worldly wise as soon as possible. The age-old driver of *Prancer* and *Dancer* and *Donner* and *Blitzen* is just a myth to them—nothing more.

And how they are wrong!

As we said, they forget first principles . . . they are like the fellow who came in to see us the other day and bewailed the fact that he had ever gone into this radio business, which was full of gyps, rapidly going to the bow-wows and so on ad nauseam. . . . When that man first started in business, the chances are he saw radio eye to eye with those pioneers in the art who worked untiringly to give humanity something new in the way of relaxation and beauty. . . . He must have had a bit of vision to go into something that was as young as radio. . . . In the course of time this man received some hard knocks—certainly not through any fault of radio in its role of a first principle—and so now the radio industry as a whole is all wrong.

But he is just as much in error as the person who would pull aside the magic curtain of Santa Claus and let a child see that Father is really the one who supplies the Christmas gifts. Nothing is the matter with the radio business as a whole. . . . Thousands of people are earning good livings as a result of their association with it and not getting any more knocks than if they were engaged in some other occupation . . . and this is especially true of servicemen, who have kept locked up in some secret spot inside themselves the idea that radio is something real and is helping millions of people to get just a bit more happiness out of living. They may be disillusioned themselves, but they have enough of that spirit, that is usually only shown at this season of the year, to last them the other fifty-one weeks and to keep something of the Santa Claus idea always alive.

Yes, there is a Santa Claus . . . he is no myth . . . he is a state of mind and if everyone in this radio business of ours would let this "jolly old elf" guide them, even just a little, they would find that Christmas lasted much longer than just one day.

John F. Rider

Did You Know That

In May, 1659, **the Puritans of the Colony of Massachusetts** passed a law which made it illegal *to observe Christmas as a holiday.* If the law was broken, the fine was five shillings, but this law lasted only twenty years.

January 6th is known as *Old Christmas Day or Twelfth-tide and* was celebrated in Spain as Christmas.

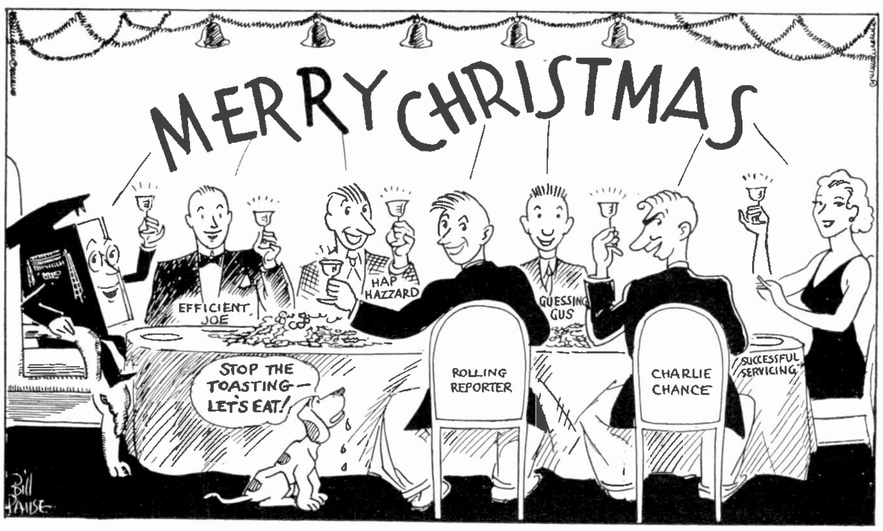
Before the Russian revolution January 7th was that country's Christmas day, due to the difference in their calendar.

The earliest historical reference to a **Christmas tree** was made by an English traveler who wrote that he saw a *fir tree lit with candles* in Strassburgh, capital of Alsace-Lorraine, during the Christmas season in 1605.

The early Dutch settlers introduced the use of a fir or spruce tree at Christmas to America.

At the end of the year the ancient Egyptians set up a **palm tree,** which has one shoot a month, as a symbol of the passage of the twelve months. This custom was followed by the Romans at their **Saturnalia,** when they set up a fir tree placing *twelve* candles on it, one for each month, as an offering to Saturn and Apollo, the gods of time and light.

The festivals of the **Saturnalia and Bacchanalia** (Roman and Greek respectively) occurred at the winter solstice, *about December 25th,* and were occasions of feasting and merrymaking.



Philco Auto Sets Alignment

Below will be found the models and the page numbers in Rider's Manuals to which the alignment data given applies. *Model J, page 6–84; Model R (both Hupmobile and Reo) pages 6–76 and 6–103; Model Q, page 6–85; G, Code 122, (used by Chrysler, DeSoto, Dodge, Hupmobile, and Plymouth) pages 6–85, 5–4, and 6–72.* The trimmer locations for Models J, R, and Q are shown in Fig. 1 and for Model G, Code 122, in Fig. 2.

Dial Position	Dummy Antenna	Sig. Gen. Frequency	Sig. Gen. Connection	Trimmer Adjusted	Output Signal
Remove grid clip from detector-oscillator tube.					
....	....	260 kc.	Cont. grid. of det.-osc. tube	1[1]	....
....	....	"	"	2[2]	Max.
....	....	"	"	1[3]	"
....	....	"	"	3[1]	....
....	....	"	"	4[2]	Max.
....	....	"	"	3[3]	"
Connect grid clip to detector-oscillator tube.					
Note 4	150 mmf.	1580 kc.	Antenna[5]	5	"
140	"	1400 kc.	"	6	"
"	"	"	"	7	"

Note 1. This is a screw adjustment. Turn all the way in.

Note 2. This is a nut adjustment.

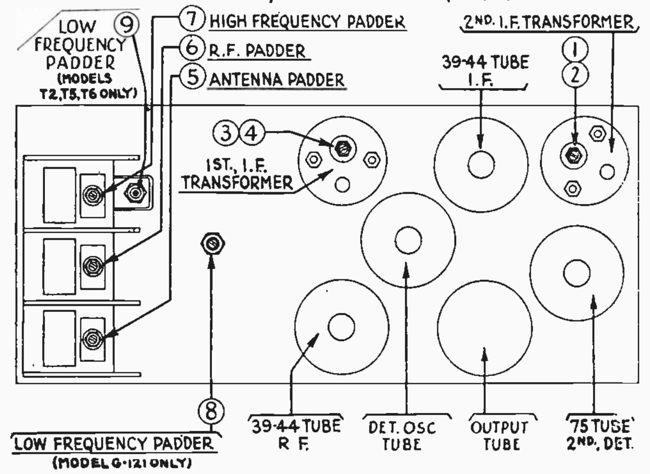
Note 3. This adjustment is critical. Note maximum reading obtainable and then turn the screw in again, just bringing it up to the maximum reading. Do not pass this point. If you do, repeat complete operation.

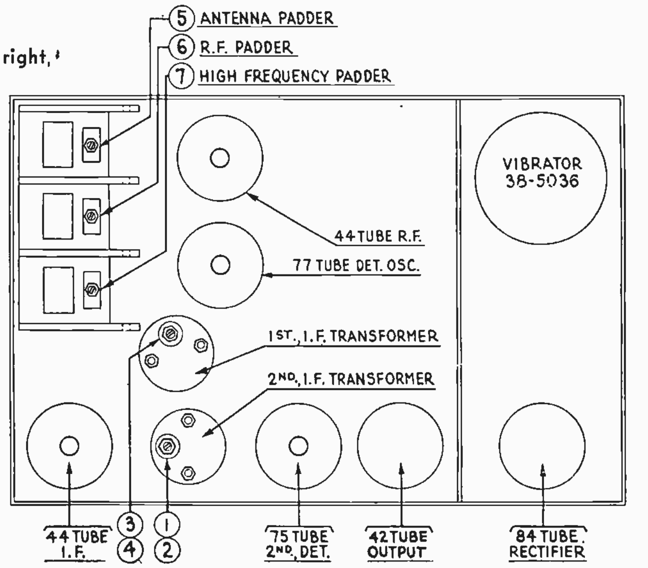
Note 4. Using a piece of paper about .006 inch thick, as a gauge between the heel of the rotor and the stator plates, turn the rotor plates until they strike against the paper. This is the correct adjustment for 1580 kc.—158 on the dial scale.

Note 5. When the antenna stage adjustment is made with the receiver installed in the car, the receiver must be connected to the car antenna in the usual manner. Connect the signal-generator output to a wire placed near the car antenna, but not connected to it.

(Note: This is an excerpt from the book now in preparation "Aligning Philco Receivers" by John F. Rider, and will show you the manner in which the alignment data is presented.)

Fig. 1, below, is the layout for Philco Models J, R, and Q and Fig. 2, right, is the layout for Model G, Code 122





Freed FE-52

We have been advised by the manufacturer that an error was made in their schematic, which was published on *page 7–2 of Rider's Volume VII.* The resistor connected between the secondary of the first i-f. transformer and the junction of the secondary of the second i-f. transformer and the 500,000-ohm resistor, is marked "1M." This should be one megohm. Please make this change on the above-mentioned page of your Rider's Volume VII.

•

Emerson 35

The voltage readings for Chassis T6, used with the model 35, will be found below. The schematic of this receiver will be found on *page 4–3 of Rider's Volume IV.*

Tube	Plate	Screen	Cathode	Suppressor
78 1st R.F.	98	98	1-3.5	0
78 Det-Osc.	98	98	13	13
78 I.F.	98	98	1-3.5	0
75 2nd Det. AVC	50	..	1.0	..
43 O.P.	90	98	0	..

The bias for the 43 tube is measured across the filter choke and should be between 15 and 18 volts. The voltage across the speaker field should be approximately 115.

•

Zenith 462

To replace the power supply unit of this receiver, the servicing data for which appears on *pages 4–3 and 4–4 of Rider's Volume IV,* the steps below should be followed:

Unsolder two red leads from the rectifier (6Z4) socket; the blue lead from the terminal strip near tone control and the black lead from green terminal on electrolytic condenser. These leads run through the chassis base beneath the power supply unit.

Remove the four 8/32 screws which hold power supply unit in place beneath the chassis base.

If the loud speaker has to be replaced, the steps below should be followed for its removal:

Remove the four 8/32 screws at lower left and right hand corners of the front panel. Unsolder the speaker leads from the terminal strip and 42 socket on under side of chassis. Remove the four 8/32 speaker screws from around grill on panel.

Rolling REPORTER

RUMORS. . . . we don't know, BUT we do hear that when television arrives, one important guy may provide kits for home construction of such receiving equipment . . . and it is very likely that the serviceman will appear in the picture. . . . Note, youse guys, *this is strictly a rumor.* . . . It may have a basis—and then again, it may be just so much ————! !

More than a rumor is the reappearance of a well-known radio name which went bye-bye some time ago—we mean Grebe . . . it's now owned by Garod and sets are being produced under that name. . . . And then there's the new Majestic outfit. . . . *From the home roost*—Volume VIII getting in the works—for pub. in November, 1937—**mebbe 2000 pages**—Wonder if this Rider owns stock in a truck company? ? ? ? ? There'll be some real news for live-wire servicers early in the new year—keep your ear to the ground and you'll be hearin' it. . . .

GOIN' TO TELL 'EM. . . . J.F.R. is hitting the trail to Springfield, Mass., on either the 14th or 15th of Dec. . . . to the town of slow trolleys, Philly, on the 17th, and next day to the Pennsylvania Dutchland, Allentown. . . . Don't know what he'll talk about, but he always gives you something to exercise your gray matter on. . . .

1937

This is nigh onto the time of year when folks start thinking about making resolutions *(Editor's Note: Yeah, and how long are they kept? ? ?) (Roll. Rep's. Note: I dunno, I never make 'em),* so why not go into session with yourself and resolve to put your business on a real, honest-to-goodness **BUSINESS BASIS? ? ?** The good thing about that is if once you get it going and find out where all those little money leaks are, you'll not want to give it the go-by and first thing you know, *you'll be keeping a New Year's resolution! ! ! !* Gwan and try it. . . .**We dare yuh! ! ! !**

THEM AS MAILED *EARLY*. . . . **Syd Loke, Toronto, Canada.** . . . For anyone who "is pleased beyond words" with your latest Rider Manual, you sure used some nice ones. . . . Hope you rec'd. the three issues of S.S. okay you were lacking . . . *Lots of luck to you in your new home.* . . . **V. H. Smith, Durant, Okla.** . . . Ur a 100%er all right, all right. . . . You've a record to be proud of—13 yrs. of servicing is *quite a spell.* . . . Bet you'll find that new oscillograph will give you the well-known "lift". . . . **Frank Wolff, Alamo, Ver., Mexico.** . . . The "Big Mogul" sure bopped the tack on the cranium when he said that anyone with some brains plus Rider's Manuals plus an instrument or two can fix any radio, BUT he ain't the first one to find out that fact—*thousands have* . . . we'll be glad to hear how things turn out. . . . **Geo. Laver, N.Y.C.** . . . Don't see how you ever get all that equipment AND THE *SEVEN* RIDER MANUALS in a coupe—Ur not only a busy servicer, you must be a Houdini . . . you'll need that trailer next year when Volume VIII makes its bow. *(Whisper—we heard it was going to be BIGGER than VII! ! ! !).* . . . We hear the same thing about bigger and better business from all parts—"Happy days are here again"—tra-la-la. . . . **Joseph Napora, Uniontown, Pa.** . . . So you weren't surprised when you found "An Hour A Day on A.V.C." was what you wanted, huh? Take our word for it, Joe, the Boss sure does take *plenty pains* to make 'em right . . . wait till you see some of the others that are in the works! ! ! ! **Ramdas Amladi, Bombay, India.** . . . We're only too glad to send you SUCCESSFUL SERVICING—we hope you like it—how about letting us know how servicing goes in Bombay? We always like to hear how things are on the other side of the world . . . and did you know that J.F.R. and yr. Reporter are stamp collectors *Thanx in advance.* . . .

A MERRY ONE. . . . Well, you perusers of this here colyum of this and a little of that, here 'tis Christmas again and as per our loooooong-established custom we gives you and *you* AND **YOU** our gilt-edged wishes for the **Merriest Christmas** that the bewhiskered gent can pull out of his bag of tricks . . . and here's hopin' that **1937** will be so prosperous that you'll have to enlarge your shop and *hire a lotta guys to help you take care of all the business! ! !*

The Rolling Reporter

VOLUME VII—*the best yet!*

By the time you read these lines you will have had a chance to examine **Volume VII of Rider's Manuals.** . . . We would like to call your attention to some of the outstanding features of this latest addition to the *world's greatest collection of servicing data.*

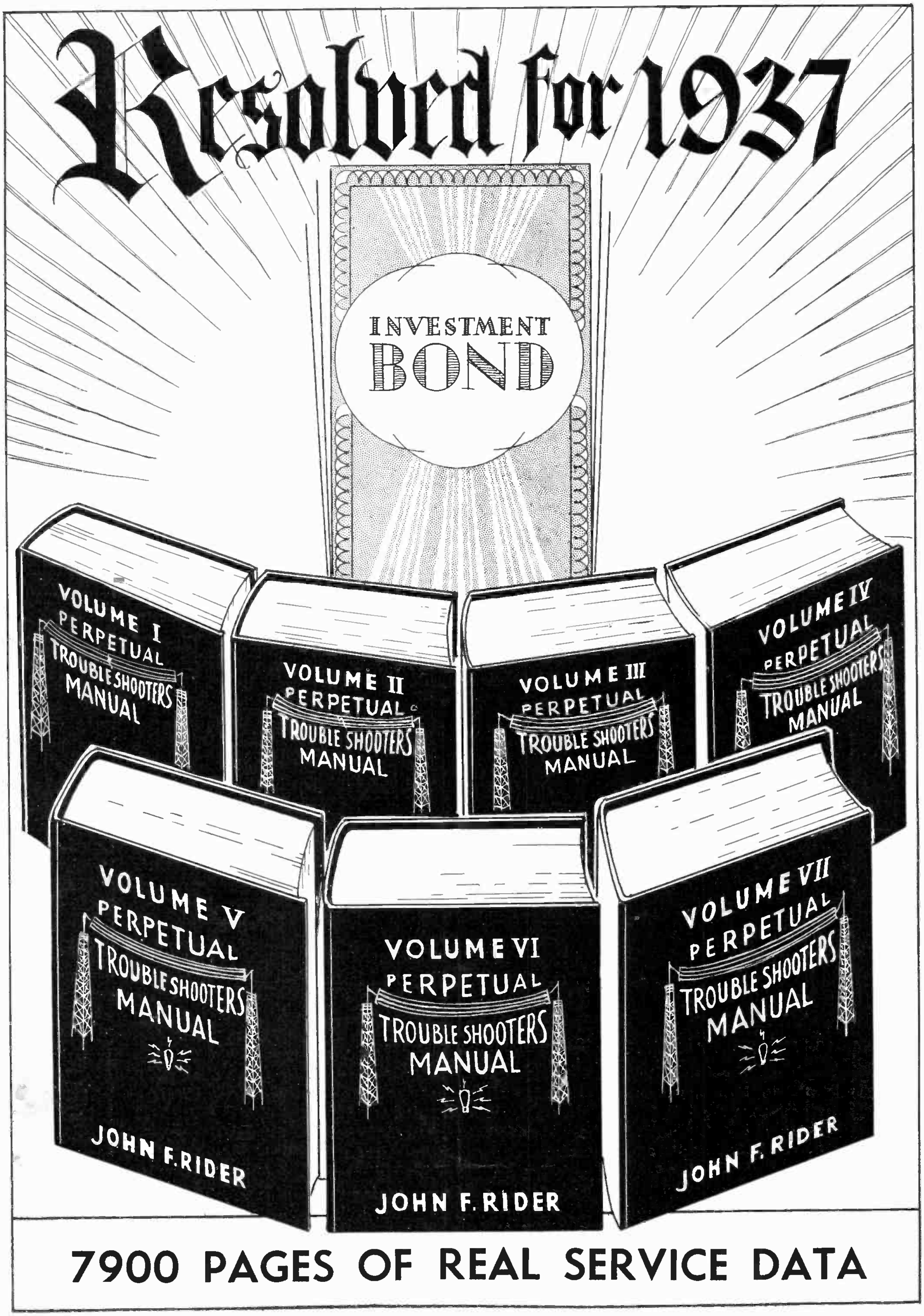
Long before the publication of Volume I of Rider's Manuals way back in 1931, it was our aim to give to the radio serviceman *complete instructions for fixing every model receiver made by every radio manufacturer.* Yes, that was a large order, but of such stuff are dreams and ambitions made. In the course of time this dream is gradually being fulfilled . . . every year sees more and more pages to the succeeding Volumes of Rider's Manuals, meaning that we have been able to gather more and more servicing instructions on both old and new receivers. Of course, we can't get everything, but if you will look over Volumes V, VI, and VII you will find many receivers of ancient vintage . . . sets that are making the Manuals more complete and bringing our ambition nearer realization.

So much for the coverage . . . Let us look at the servicing material itself.

Look over the early edition of Rider's Volume I. . . . It is true that the schematics of the various chassis were presented and in some cases the chassis layouts and wiring diagrams, but that's about all the manufacturers were releasing. . . . And then look at Volume VII! *What a change five years has brought about!!* Now almost every receiver has COMPLETE INSTRUCTIONS . . . and when we say complete, we mean just that—***everything you need to help you work on a set when it comes into your shop for repair.*** Data is being presented in the best form for you to follow easily . . . we have experimented with many forms of presentation and have accepted your suggestions for bettering the material.

We have literally talked with hundreds of service managers throughout the length and breadth of this land, pleading for more and better servicing data—data that will make your job easier—and it is with no uncertain gratification that we see some of this now bearing fruit. **Never before anywhere has a larger percentage of voltage readings, alignment instructions, socket and trimmer layouts, wiring diagrams, parts lists, etc., per chassis been compiled as that which is between the covers of Rider's Volume VII.**

In short, we have incorporated in Rider's Volume VII everything that was available to us at the time we went to press. . . . You will find certain servicing data on receivers there and nowhere else—*for instance, look over the Atwater Kent material.* . . . We devised ways and means of putting the ultimate amount of data on one page, making it possible to give you more servicing material than ever before per page. . . . The products of more manufacturers are covered by more detailed instructions—in short, **in every way possible we have made Volume VII the biggest and best of all the Rider Manuals.**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