THE

RME-70

COMMUNICATIONS RECEIVER

OPERATING and SERVICE MANUAL

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PEORIA 6, ILLINOIS

SERVICE NOTES FOR THE
RME-70 RECEIVER

CHAPTER I

ALIGNMENT

One of the first evidences of misalignment in a receiver is low over-all gain of the receiver. In the RME-70 Receiver this is evidenced by low meter read-ings. Due to the tremendous gain available in the audio system of the RME-70 a misalingment due to loss of gain may not be noticed if the condition of the receiver is judged by audio output, since it may be possible to turn the volume control to maximum output position and still obtain high values of audio output. Misaligment, however, does not effect the circuits of the audio amplifier and has solely to do with the intermediate frequency amplifier and the radio frequency amplifiers. Principal among the contributions to low gain is the part which the intermediate frequency amplifier plays in providing over-all sensitivity and selectivity of a satisfactory order.

Misalignment of the radio frequency section (principally that part of the section which is made up of the high frequency oscillator) shows up in the receiver calibration. This section also is susceptible to certain outside influences which can cause variations to such a degree that the stated calibration of the receiver is changed to other values. However, this effect is not a common effect and usually the calibration of the receiver, unless tampered with by inexperienced hands, will remain very close to its stated value indefinitely.

This loss of gain when occurring in the radio frequency section of the receiver is usually due to the fact that the oscillator has been grossly misaligned so that it is apparent in the frequency calibration of the receiver. In other words, it might well be said that a loss of sensitivity in the receiver occurring simultaneously with a wide-spread condition of off calibration might indicate the fact that the loss of gain is caused by misalignment of the radio frequency section of the rec.

On the other hand, if the gain of the receiver, is low, but the calibration is correct, it might be said without hesitation that the most probable cause for the low gain is the misalignment of intermediate frequency amplifiers relative to the trimming condensers of the intermediate frequency amplifier transformers.

It is for the purpose of realignment of these intermediate frequency transformers that the following test procedure is outlined. IMPORTANT NOTE. It is essential that the 465 KC intermediate signal which is used for realignment of the intermediate frequency amplifier is not set according to any arbitrary calibration on the test ocsiallator itself since it has been found that commercial test oscillators for service work vary considerable at least to an extent which will permit proper alignment of a communication type receiver in which is installed a quartz filter. It is therefore better if no test oscillator is had, since a broadcast station of constant signal strength will furnish adequate test signal for alignment of the intermediate frequency amplifier. using the quartz filter for establishing the proper I.F. frequency as indicated in the following procedure.

The meter on the RME-70 receiver affords an excellent method of indicating the peak alignment of each of the transformers. The location of the three intermediate frequency amplifier transformers, 5-3, 5-4, and 5-5 is given on Fig. 4 of the illustrated sheet attached. The two padding condensers located in each of these transformers and accessible through apertures in the top of the shields can also be seen

OUTLINE ...DURE FOR CORRECT ALIGNMENT OF THE INTERMEDIATE FREQUENCY AMPLIFIER TRANSFORMER OF THE RME-70 RECEIVER

The intermediate frequency amplifiers in the RME-70 Receiver are designed for a frequency of 465 KC. Since these receivers are always supplied with a quartz crystal filter, it is essential that the intermediate frequency amplifier transformers be accurately aligned with the crystal frequency. Crystals are supplied in frequencies slightly at variance from the above started value of intermediate frequency by an amount not greater than one kilocycle plus or minus 465 KC. Rather therefore than align the intermediate frequency amplifier stages of the RME-70 to a set frequency of 465, it is essential that the alignment be done in conjunction with the quartz filter so that alignment of the intermediate frequency amplifier is achieved at the frequency of the filter. This is done as follows and when the process as herein outlined is followed accurately, maximum results will be obtained. The use of any other process of a general type will produce inferior result

The first step in the alignment procedure is to tune in a broadcast station, pr e-ferrably in the low frequency portion of the broadcast band. The signal should be one of medium signal strength so that the R meter indicates a signal level of R9 or slightly less. If no station of this amplitude is available but a stronger station is available, a reduction in the efficiency of the antenna by the connection of a short wire to the antenna post may help to bring the signal strength as indicated down to R9. Usually between 550 and 800 KC in most any territory a station can be received at most any time for this test and adjustment.

When the station has been chosen, let us assume that its frequency is 700 KC. The next step is to slightly detune the main tuning control so that the frequency reads approximately 715 or 720 KC. This of course will tune the station out. It does not necessarily have to be the frequency mentioned or the exact frequency of detune, but the general procedure is to tune the main tuning control slightly higher than the chosen station so that it may be brought back to resonance by decreasing the scale reading of the band spread control. This is done merely to provide vernier tuning.

With the station chosen and resonated on the band spread scale, the crystal filter is switched into the circuit by setting the phasing control pointer to vertical upright position (approximately) 30 deg. clockwise from "OFF" position). The band spread scale is then adjusted with respect to signal so that maximum meter reading is obtained. This procedure is one which requires patience and accuracy of adjustment since the receiver is ultra sharp with the crystal filter in and there will be one definitely sharp peak indicating crystal resonance. The receiver should be tuned to this peak and lft on it during all adjustments to be made regarding the intermediate frequency amplifier.

When this peak has been tuned to and the meter is at maximum reading, a small standard intermediate frequency trimmer tool of the insulated screwdriver type should be used. Then the selectivity control, fig. 2, should be set so that the condenser it adjusts is set at 50% mesh. Then, without particular attention to a course of procedure, in tuning, any transformer may be adjusted at any particular time, the important factor being that they all be adjusted so that the R meter adjustment will not require very much tunning of the adjustment screws, a good procedure to follow is to start with the 5.5 transformer and align in sequence 5.4 and 5.3. All adjustments should be made as before mentioned so that the meter reading is maximum.

It is advisable from time to time to make sure that the signal is still adjusted to peak resonance of the crystal by slightly varying the adjustment of the band-spread control. When this procedure has been completed as outlined and all transformers have been adjusted and left at maximum meter reading, the intermediate frequency amplifier of the receiver is in peak adjustment and the crystal aligned with it for maximum effecriveness in filter action.

PHASING CONTROL OPERATION

The phasing control of the RME-70 receiver, located on the front panel in the top right corner is indicated by the words "CRYSTAL PHASING". Directly to the left of the shaft is the word "OFF". There is a stop connected with the shaft so that when the receiver is to be used without the crystal filter, rotation of the crystal phasing control is set so that the pointer points to the "OFF" position and further counter-clockwise rotation is impossible due to the stop. This indicates that the crystal filter has been removed from the circuit and normal receiver operation is possible. This function is provided by a cam operated switch connected with the phasing control of the crystal filter. In order to put the crystal into operation it is necessary to rotate the crystal phasing control clockwise to a position where the pointer is approximately in a vertical position similar to that normally required of the selectivity control located just below it.

Failure of the crystal to cut out the circuit when the crystal phasing control pointer is set to the "OFF" position is due either to the fact that the knob has slipped or the switch contacts arebad and probably need adjustment. The cam switch closes when this pointer is in the "OFF" position, shorting out the crystal unit. Failure, of course, to short out the crystal unit will make it possible for the crystal filter to be in operation at all times. Slight pressure or bending of the contacts can improve this function should it fail.

When the crystal filter is being used the phasing function is provided by the variation in capacity of a phasing condenser controlled by the crystal phasing knob. Usually this isindicated by minimum noise or background response when the receiver is tuned off of the signal and the crystal is being used. This position, as before indicated, will be approximately one which allows the pointer to be vertical. Slight variations either clockwise orcounter-clockwise, from this minimum noise response position change the rejection point of the crystal and make it possible to tune the rejection characteristic of the crystal to various slightly higher and lower frequencies for rejection purposes during QRM from a heterodyne on a desired signal.

If the phasing control does not work it is indicative of the fact that probably a connection is broken or that the R.F. choke connecting the AVO to the grid of the tube (indicated on the schematic drawing by R.F.C. in the crystal filter circuit is open. The continuity check between the grid of the first I.F. amplifier tube and the junction of resistor 1.8 on the automatic volume control terminal strip should show continuity when the crystal is in the operating position.

CHAPTER II

ALIGNMENT OF RADIO FREQUENCY SECTION OF THE RME-70 RECEIVER

Alignment of the radio frequency section of the receiver will effect principally the calibration of the receiver. Within certain limits this of course will also effect the sensitivity. Small variations in frequency (up to 2%) will not materially reduce the sensitivity of the receiver although they of course will show up as variations in the calibrations as indicated by the required setting of the main tuning dial indicator. Correction for any variation in calibration can be made by following the suggestions outlined on the following page.

Band 1 includes the frequencies between 550 and 1500 KC. For band 1 there are two frequency adjustments for adjusting the indicator to proper calibration. The adjustmenst (condensers 2.51 & 2.50) are adjusted as indicated on Figure 4 through the top of the shield can just in the rear of the main tuning condenser assembly. 2.51 adjusts the bank 1 osc. calibration in the low freq. portion of the range condenser 2.50 is the adjustment for the high freq. end of band 1. The procedure is this: Put the main tuning indicator to a position so that the pointer falls just below the line above the numbers indicating the various channels. In this respect it will partially cofer the top half of the numerals indicating the different tuning bands on this scale. In other words, the line which borders the semi-circular scale at the extreme counter-clockwise position should rest on the top edge of the pointer as itis turned to maximum counter-clockwise roation and the condenser plates are at full mesh.

The next step is to choose a station or a signal of accurately known freq, around 700KC, and set the main indicator to the freq of the signal which is going to be used for the test. For example: There is a station available with fairly good signal strength or a test oscillator is avialable which can ACCURATELY be set at 700KC. If the receiver indicator on the main tuning dial is set at 700, and the receiver is considerable out of calibration of course, the signal will not be received. However, leave the indicator at the correct frequency of the signal being used for the test and set the bandspread control to a reading of 180 on the dial at which position it has no material effect on the tuning circuits of the receiver and permits the calibration of the main tuning dial to indicate accurately the freq. of setting.

Then by means of condenser (2.51) (fig.4) accessible through the trimming hole in the oscillator shield can for Band 1, adjust until the signal is brought in with the pointer set at the proper frequency. Then choose a signal at about 1200 or 1300 KC, and set the main tuning dial indicator to the correct freq. for that signal and bring the signal in on that setting with trimmer 2.50. It will then be necessary to return to the former freq. setting of 700KC to make sure that the variation of 2.50 ahs not made some slight change in the setting for the lower frequency calibration point and it may be necessary to readjust condenser 2.50 slightly again. Then in order to make certain of the accuracy of both settings return to the frequency chosen between 1200 and 1300KC and if necessary, slightly readjust condenser 2.51 again. After several checks on each freq. it will be found that the calib. can be made satisfactorily.

Calibrations on the higher freq. bands are controlled for bands 2,3,4,5, and 6 by the trimmers 2.49, 2.48, 2.47, 2.46, 2.45, (fig.3)respectively. High side beat is used on all freq. on the RME-70 receiver which means that all of the condensers 2.49, 2.48, 2.47, 2.46, 2.45 must be set to the lowest capacity setting which will provide a beat and the proper calibration for the freq in the respective bands. Calibration freq. used are as follows:

Band 2: 2 megacycles and 3 megs.
Band 3: 4 megs, 5 megs, 6 megs
Ban Band 4: 7 megs, 9 megs, 11 megs
Band 5: 14 megs, 1 5 megs, 17 megs
Band 6: 30 megs.

After the calibration has been made accurately on all of the freq. or if the receiver has been found to be accurately set insofar as its calibration is cone rned on all freq, the trimmers2.2 and 2.1 have a distinct effect upon the RF grid circuits for bands 5 and 6 respectively. They are adjusted as follows: With a steady incoming signal on between 14 and 15 megs and the most effective setting of the resonator control for signal in that region, and with the antenna connected, the condenser 2.2 is adjusted for maximum meter reading. With these same conditions existing on 30 megs with the band switch set on band 6 and the antenna connected, 2.1 is adjusted for maximum response on a given steady signal. All other trimming and adjusting is done manually by means of the resonator control, a variable RF amplifier and detector grid padder, which can be critically adjusted for peak resonacne at any frequency it is desired to tune to.

It is of importance to note the setting of the condenser 2.4 (fig. 4). This is the antenna coupling condenser used when the receiver is set to Band 1. It should be set to practically its minimum capacity in order to provide constant alignment and proper coupling to the antenna when using Band 1. Excessive capacity in the condenser 2.4 will cause misalignment of the RF amplifier and hence promiscuous beating of the harmonically related broadcast frequency end of the broadcast band. When the receiver leaves the factory it isset at a very small capacity and should not be set at any other capacity or material reduction in the efficiency of operation will be produced.

The padders 2.2 and 2.1 materially contribute to the image signal rejection on the bands 5 and 6. Special csre should therefore be taken in the adjustment of these condensers when the receiver is aligned.

CHAPTER III

ADJUSTMENT OF THE BEAT OSCILLATOR (C.W. TONE, Figure 2)

The beat oscillator has its frequency adjustable on the panel by means of the C.W. Tone control, Fig 2. This control is normally set for zero beat with the condenser 2.59 (C.W. Tone control) set at 50% mesh. If it is found that zero beat does not occur or that the beat oscillator is not beating with the intermediate freq. to produce an audible solid beat, it is probably due to the fadt that the beat oscilla istuning to a frequency other than the intermediate freq. of the receiver. This can be remodied by the following procedure:

Set the Band Switch to position Number 1, and tune in a broadcast station so that it reads maximum on the R meter. With this condition existing, snap on the C.W. Tone Control (Fig.2). Then by making certain that the condenser 2.59 is set to 50% mesh, the condenser 2.60 (fig.4) located in the beat oscillator compartment jus below 2.59 (fig.4) near the top plate of the chassis in front of the beat oscillato tube should be adjusted by means of a screw-driver so that zero beat is achieved with the signal tuned in as before mentioned. When this is achieved variation of the beat oscillator from minimum to max. mesh will give a total beat freq. variation of eight KC (± 4 KC from zero beat).

DHAPTER IV

NOISE: ITS CAUSES AND A METHOD OF ELIMINATION

Noisy operation of a receiver can be caused by several things. Principal among these are loose elements in a vacuum tube, poor seating of a tube in its respective socket, and a loose or broken connection in the circuit wiring of the receiver, or the abnormal position of two circuit components which should be normally isolated from each other, but due to some cause or other have become bent into such a position as to occasionally contact and change the circuit conditions to an extent which produces over-all receiver noise.

The first trouble of course has an obvious remedy in the replacing of the tubes. The second also has a simple remedy of making certain that the tubes are well seated in their sockets, and this can be done by removing the tube shield caps and pressing firmly on the bulb until the tube comes to a stop with the base directly against the socket material.

The third condition can be checked by examination and observation. If the connection which is poor is in a DC circuit it will usually cause a variation in the DC voltages as can be measured by a meter and checked with the values herein giv for the proper voltages at the various points in the radio frequency and power circuits of the receiver. If of course the effect is not such as to produce a change in the DC voltages, the trouble will be more difficult to find, but an outline is given below for a simple procedure which will save time and be very thorough in method so that many intermittent troubles can be located easily and quickly.

The fourth cause of the trouble can be located in the same fashion as suggested for the intermittent contact since it in itself is of that type of trouble. Before any investigation of the receiver itself is made, the antenna connections to the receiver must be removed in order to insure that they are not causing the trouble by allowing outside interference to be picked up.

When the antenna leads have been disconnected so that it is made certain that the noise, if it still continues, is not being caused by any variation in the antenna circuit, a general procedure can be carried out which will isolate all four of the types of noise described above and localize the source to a point where it will be much easier to work on due to the fact that the observations and investigations can be concentrated in a small portion of the circuit.

METHOD:
Resonate the receiver so that it is all adjusted to peak tune as will be evidenced by the receiver noise itself. Then remove all of the tube shield caps from the radio freq. amplifier, the detector, the two intermediate freq. amplifier tubes, and the 6K7 audio amplifier tube. Then by means of a padded tool of some kind -- a rubber stick or something which will not in itself make noise upon contact with the metal parts of the receiver -- the receiver should be gently tapped in various parts in order to determine whether or not tapping on certain parts of it will cause the noise to occur more readily than on others. This will give also an idea as to the localization of the source of the noise. The tapping should be continued in this place found to be most effective in the production of the noise by carrying on the following succession of tests:

Take a .1 mfd paper by-pass condenser with good clean leads on it, and solder one lead to the ground or clip it to the ground of the chassis of the receiver. Then, continuing the tapping of the place found to be most productive of the noise, connect the other side of the .1 condenser first to ghe grid cap of the first radio reeq. amplifier, then to the grid cap of the first detector, then the first IF, tha the second IF, and so forth, until the noise is stopped. When it is placed on a grid cap which suddenly stops the noise, it is indicative of the fact that the noise is caused by the stage just ahead of the tube which when shorted stops the noise. For instance, there is a loose connection in the plate circuit of the first radio freq. amplifier tube, and it is found that by tapping the receiver on the main condenser cover the noise is readily produced and continued. By continued tapping of this part of the receiver (even with several of the fingers of the hand) the first grid is by-passed to ground by means of a .1 microfarad condenser. However, the noise continues. This indicates that the noise is probably not being caused by the grid circuits of the radio frequency amplifier tube. The condenser free load is then connected to the grid cap of the first detector tube in which position the noise stops, indicating that the trouble is undoubtedly caused just preceding the grid of the first detector tube by not preceding the grid of the radio freq. amplifier tube since by-passing the grid of the radio frequ. amplifier tube to gnd did not stop the noise.

Another condition may be also caused by the fact that by by-passing the grid of the detector tube and the radio frequency tube the noise was not stopped, but it did stop when the by-pass was applied to the grid of the first intermediate frequency amplifier. This indicates that the difficulty is just preceding the first intermediate freq. amplifier. However, it does not necessarily mean that the loose connection or the trouble is in the first detector tube since it might be caused by a variation of contact in some part of the oscillator tube. Therefore, the oscillator tube shield cover should be removed, and the by-pass lead applied to the grid of theheterodyne oscillator between the filter pack and the broadcast band oscillator coil just at the rear of the main tuning condenser assembly, and if this stops the trouble, it is likely that the noise is being caused in the oscillator circuit. However, in any case, the noise will be localized in the oscillator and first detector circuits. This same thing can apply to any part of the receiver. It is merely mentioned here to describe the principle involved which is merely a process of eliminating various parts of the circuit until the noise is eliminated and if it is done, step by step, the various steps can be accounted for as either being free of the cause or as causing the nnoise in themselves.

In this connection, it might also be well to say here that oftentimes such noise is caused by variable contact between tools on the bench lying near the receiver, especially if a sheet metal ground plate is used on which to test the instrument. It will also be found that a screw driver or pair of pliers lying on a metal bench will, when the table is jarred, cause a variable contact and hence a "staticky" effect in the receiver. Therefore, it should be made certain that the "staticky" effect or the variable or intermittent noise source is not vested in tools or loose wires which make variable contact with ground potential plates or leads when this work is being carried on.

CHAPTER V
RECEIVER INOPERATIVE

Of course, the first thing to do in case of an inoperative receiver is to check the voltages as given in the list in this instruction booklet.

Another check which can be given immediately upon finding the receiver dead is to apply a finger to the grid cap of the 6K7 audio amplifier tube. It should be made certain that when this is done the volume control should be turned to maximum clock-wise position so that the audio level is adjusted for maximum output. A squealing tone should be received or at least a loud hum showing that the audio system is not at fault. This will indicate that the difficulty lies ahead of the audio system, and routine test oscillator checks can be made on each stage by applying the output of the oscillator to the grid caps and noting the results on the level meter of the receiver. IMPORTANT: In order to prevent shorting out the AVC system when connecting the test oscillator output leads to the various tube grids, insert a .1 microfarad condenser in series with the connection to be placed on the grids for test purposes. If accurate signal generators are had for the testing of these receivers, the following gains can be measured for test purposes: (meter should be adjusted to zero with no signal, and antenna should be disconnected) 100,000 microvolts (or .1 volts) fed to the grid of the second intermediate freq. amplifier grid should produce a reading of R7 on the R meter. An R7 reading on the meter should be produced by applying 2,000 microvolts to the grid of the first intermediate frequency amplifier as just described.

With the band switch set to Band 1 and the main dial set to 1,000 KC or one MC on the main tuning scale an input of thirty to forty microvolts at 465 KC to the grid of the first detector tube should be productive of a meter reading of R9. All these reading are subject to a variation of plus or minus 6 db. or 1R on the meter. These readings are given only for use when service work is carried on by means of an accurately attenuated signal generator which can be used to give a calibrated output. Since most service generators are not calibrated this material cannot be used with them.

Signal generators such as the laboratory type General Radio Signal Generator and the Ferris Microvolter which are accurately calibrated to deliver outputs in known values of voltages can be used to advantage in quickly determining the alignment of these receivers.

If the receiver is dead and the R meter does not fall to zero it is indicative of a loss of load on the B supply to the intermediate freq. and radio freq. amplifiers. A defective tube shich loses its heater continuity, in other words, which burns out, or a tube which loses its emission, will reduce theload on the meter bridge circuit so that the meter will not return to zero but will read up on the scale. An open plate or an open screen on any of the tubes will be productive of the same difficulty as evidenced by the high scale meter reading. A tube which has become loosened in its socket so that its contacts do not make proper continuity with socket connections, principally the plate, cathode, and screen connection, will also sometimes open up theplate, screen, or cathode circuit to the extent that the total load on the bridge circuit will be reduced, and any reduction in the total plate current drawn by the amplifier tubes will of course cause the R meter to read up on the scale. In a condition which causes the R meter to read up on the scale and which can not be compensated for by normal adjustment of the carrier level meter control on the rear of the receiver chassis, it is probably due to a loss of circuit continuity in the RF or IF amplifier stages. Checking of the cathode voltage, screen voltage, and plate voltage at the tube socket connections on each of the stages will probably determine which tube is at fault. A tube which is not drawing current will show plate and screen voltage probably but will show either "no cathode voltage" or if the external cathode circuit is open, it will show an extremely high cathode voltage. Proper values of these voltages are given in the table appended to this service booklet.

CHAFPTER VI
CONDITIONS INDICATING LOSS OF AUTOMATIC VOLUME CONTROL

The principal result of less of automatic volume control will be the barbled output of the overloaded blocking condition caused on stron signals when they are tuned to exact freq. Loss of automatic volume control can be caused by either a ground anywhere on the automatic volume control system or mal-adjustment of the 2nd IF amplifier output transformer 5.3. Since proper adjustment of this transformer 5.3 is necessary in order to provide the diode detector 6H6 with full driving energy in order to produce the maximum intensity of automatic volume control voltage, it is necessary that it be properly aligned. If all the other stages are aligned, delivering normal grid voltage to the second intermediate amplifier tube and 5.3 is misaligned to a point where it does not provide adequate automatic volume control voltage, the overloading-blocking condition which causes the audio output to become badly barbled will be noticed. Similarly, asbefore mentioned, any ground on the automatic volume control supply circuit will probably cause overloading on strong signals. Even a resistance of 250,000 ohms caused by lakage to ground will destroy full AVC action. This same effect can be noticed by turning the manual gain control to a point where the switch controlled by it just snamps on, shorting out the automatic volume control. In this position, the amplifiers do not have sufficient grid bias to prevent grid current flowing in the last intermediate freqquency amplifier and the same effect will be noticed. It will be necessary, of course, to continue rotation of the manual gain control, to raise the bias to a;point where the signal input to the later stagesof the amplifier is not excessive and will not cause rectification or grid current to flow in the respective circuits of these tubes.

Distorted output can also be caused by a defective 6H6, 6K7 tube or a 6F6 amplifier tube. Loss of bias on the 6F6 tube will of course produce excessive distortion. A continued predominate muffled bass output may be indicative that the tone control which is connected between the grid of the 6F6 tube and ground is defective to the extent that the resistance is at all times zero, connecting the tone control condenser directly from grid to ground. The tone control resistance 1.24 is a potentiometer type resistor having a total resistance of 1 million ohms.

When set so that it provides a 1,000,000 ohm resistor in series with a .01 condenser across the grid to ground of the 6F6 tube, it haslittle effect on the audio characteristic of the receiver. When set so that this resistance is zero and in effect the .01 condenser is connected directly between the 6F6 grid and ground, the receiver audio characteristic is cut off rather abruptly around between 1,000 and 2,000 cycles.

CHAPTER VII
HUM

Hum canbe classified in two groups: One type of hum is that which is caused by the filter of the receiver and is applied to the tube circuits in such a way that it is reproduced continuously regardless of signal or whether there is any output to the receiver or not. This type of hum is almost always due to a defective filter dondenser and canbe remedied of course by replacing the filter black or at least shunting the defective section with a good condenser.

There is another type of hum which appears only with signal. This type of hum can be caused by two things: The most common source is a poor ground. A ground in which considerable alternating current from the supply mains is circularing and which is by some non-linear characteristic of the ground system modulating the radio freq. circulating in that ground will actually modulate the carrier before it is impressed on the receiver.

The other sourde is a defective tube. Either one of these two hums are noticed only with signal.

Hum is also possible due to excessive heater to cathode leakage in the 6A6 noise suppresser tube in the RME-70. In models produced after February 15, 1939, the heater voltage on this tube has been reduced to a point where the heater to cathode leakage is almost zero and therefore will probably not be a cause for hum except in cases where the tube leakage is exceptionally bad. It is possible to rectify difficulty in older receiving if it is impossible to obtain tubes with sufficiently low cahtode to heater leakage at normal heater voltages, by removing one of the heater connections to the socket and tapping up the junction so that the removed heater wire will not contact ground, then connecting the vacated heater terminal to ground. This puts 3.15 volts on the heater allowing it to operate satisfactorily as a Noise Silencer tube but reducing the heater voltage to a point where heater to cahtode leakage on most all tubes will be insignificent.

This type of hum can be checked by noticing wwhether or not the hum is present with the noise silencer in the circuit and absent with the noise silencer out of the circuit, as controlled by the position of the audio level and standby control knob on the front of the panel. (fig.2). The noise silencer is in the circuit when it is pulled to the first notching point and, of course, the receiver is dead when the control is pulled all the way out from the panel. If a hum is noticed with the control at the innermost position and is absent with the control in the middle positon it is undoubtedly due to the noise silencer and can be cured by the prodedure just mentioned.

There is also another type of hum, and that is due to coupling between the 80 tube and the 6F6 audio amplifier tube. In some receivers the 6F6G tubes are supplied and in the case of an 80 tube whose emission characteristic was of a peculiar type certain types of electrostatic coupling was noticed so that hum was induced in the 6F6 tube due to the presence of the 80 tube. A metal 6F6 type tube, or replacement of the 80 tube will probably cure the trouble. This difficulty was very remote and noticed in about 1/2% of the receivers examined

CHAPTER VIII
NOISE CAUSED BY FAULTY VARIABLE RESISTORS

The several variable resistors in the receiver can with age cause some noise during rotation. The remedy for this of course is the replacement of the control. All controls of this type, depending upon the design, have a certain life as does any type of rotating equipment. After a control is a year or so old it may wear to a point where the rotating contact makes variable contact as it rotates providing a certain amount of noise, which can be cured of course by replacement of the control. It is also possible in connection with the audio level and standby control on the receiver to experience an intermittent operation of the switch connected with this system due to slight eccentricity of the control shaft. There is always a slight amount of eccentricity depending upon the tolerance of the metal components used but the leeway insofar as the switch contacts are concerned is always sufficient to take care of this eccentricity. Should however a certain set effect the springs of the switch so that they no longer hold this condition, examination of the switch with the receiver turned off, in order to prevent shock, will probably throw some light on the contacts which are not holding as close as they should and a slight pressure or bending of the springs will remedy the difficulty.

By referring to the schematic diagram, the switch 3.8 is the standby control switch and also provides the function of taking the noise silencer in and out of the circuit. The innermost pair of contacts control the noise silencer and when the standby switch is in the middle position these contacts should be open as well as the set of contacts connected to the relay control terminals. During operation with the the standby control closest to the panel, the break-in contacts and the noise silencer contacts should be closed. The relay control contacts should be open. In the middle position the break-in contacts should be closed, the noise silencer control contacts should be open and the relay control contacts should be open. In the maximum outward position the break-on contacts should be open, the noise silencer contacts should be open and the relay control contacts should be closed. Adjustments for this state of affairs, relative to the switch operation, can be made by examination, if any noise is produced by the operation of the volume control and found not to be in the volume control itself, it is possible due to intermittent contacting of the switch element.

Noisy operation of the selectivity control, or the CW tone control or the resonator control is probably due to either dirt or dust between the plates or a plate which might have become bent and is lightly touching an adjacent rotor or stator plate ot cause the noise. Examination of this condition will usually make apparent the difficulty. Bad bearings in the selectivity control and the CW tone control may also cause noise and the best remedy for this sort of trouble is the replacement of the control.

CHAPTER IX
FREQUENCY INSTABILITY

In the RME-70 receiver the intermediate frequency amplifiers are designed for maximum selectivity and consequently the sides of the selectivity curve are very steep. Slight variations in oscillator frequency, due to microphoning caused by the impinging of high level sound waves on the components of the receiver will be quite noticeable as evidenced by howl.

Instability when using the beat frequency oscillator on the high frequencies may be caused by loose elements of the heater wires in the high frequency oscillator tube. There are two types of heater construction: One is called the folded filament type of heater and the oter is the reverse coil type of heater. The folded filament type of heater is desirable from certain standpoints due to its electrical characteristics, but it is not desirable when used in electron coupled oscillators. All RME-70 receivers leave the factory with reverse coil heaters in the tubes of the high freq. oscillator circuit. However, if a tube having a loosely constructed folded filament type of heater is placed in the sokcet, variations with vibration cause a slight change in the tuned frequency of the oscillator and consequently a wobbly CW note and other disagreeable effects due to the instability caused. As indicated in this paragraph, the remedy is the installation of a tube which has a stable heater which will not vibrate inside the cathode shell. There are a certain percentage of reverse coil type heater tube in this socket will remedy this difficulty to a great extent.

Frequency instability can be caused by a number of factors. Principal among these factors is the oscillator tube itself. Excessive drift or rapid fluctuation due to vibration can be caused by the oscillator tube itself. Replacement with a satisfactory tube will remedy the situation. Another cause of instability can be tight bearings, principally, the main tuning condenser. If these bearings are so tight that during normal heating of the unit, causing expansion of the metal parts, the shaft is warped, it will cause excessive freq. drift. The normal freq. drift of the receiver in the first 30 min. of warming up is between 8 and 10 KC at 15 MC. At lower freq. the drift is proportionately less and at high freq. it is proportionately greater. Values greatly in excess of this are not normal and are cuased by either poor grounding contacts on the coil assembly and the coil shield and coil switch assembly underneath the chassis or a defective oscillator tube, a defective oscillator grid coupling condenser 2.55 (fig.4) which is a small mica condenser mounted on the bakelite terminal strip on the end of the main tuning cond.

Correction for the main tuning condenser tension as a cause of the frequency drift can be reduced by releasing the tension on the rear bearing of the main tunging condenser so that the condenser has fredom of rotation, not to the point, however, which will allow it any end play whatsoever, since this will be productive of very erratic tuning.

This same tightness in the bearing of the condenser can also cause backlash in that it will produce an excessive load on the spring loaded gears of the dial drive and give an apparent "rubbery" action at the knob. A poor contact in the oscillator section of the band switch or in the band circuit wiring will also be productive of freq. shift, usually of the rapid type which will produce a wavering of the signal t the point of a flutter. The effect of the band switch from one band to another, having on one band tuned in a station. It should always be possible to return the band switch to that band and have the station remain in tune.

If changing the band switch away from the particular band being used and then putting it back again into the same position caused a shift in freq., it is probably due to the switch contacts themselves and can be improved upon by increasing the pressure of the collector ring which pressed the small contactor lug up against the fingers of the switch. The collector ring is on the opposite side of the switch from the fingers which are the contacts on the switch.

CHAPTER X
MICROPHONICS

Microphonics are usually due to the fact that some element in the receiver is subject to variations in its electrical characteristics when placed in a strong sound field or in a field where there is considerable vibration. This means that if the receiver is responsive to vibrations and jarring by producing a ringing tone when a signal is tuned in or setting up a howl under the same conditions it is more or less microphonic. All receivers are microphonic to a certain degree, depending upon the tightness of the coupling between the speaker and the receiver itself. Oftentimes a defective oscillator tube will be productive of considerable microphoning action. This is evidenced by the fact that the slightest jar when a signal is tuned in, especially on the very high freq., will produce a ringing sound which may turn into a continued howl increasing in amplitude as the time increases. It will be found usually that the remedy is to put the speaker at a slight distance from the receiver cabinet itself. This type of difficulty can be feduced to a very low point by changing the oscillator tube.

There is one other element in the receiver which is also subject to a microphonic action, and that is the main tuning condenser. These plates act like small diaphragms when the sound intensity is very large and vibrate causing a shift in the tune of the receiver at an audio freq. The action is dependent again as before upon the tightnedss of coupling accoustically between the speaker and the dabinet of the receiver. Usually breaking a stiff phisical contact between the cabinet of the receiver and speaker will reduce the howl and its is almost certain to stop if the sound from the speaker is made to emerge in a direction which will not impinge upon the receiver housing itself. These effects are noticeable more with the crystal in the circuit where the selectivity is very high and also at the high freq. where the possible freq. variation by varying the position of elements in the receiver is the greatest. Howling will be set up easiest when the tuning is not exact. That is, when the station is not tuned exactly at resonance. Therefore, by not providing positive tuning adjustment on the carrier the howling will be sett up quite easily. Experience in accurate tuning is productive of a very minimum of acoustic coupling as evidenced in the form of microphonic howl.

CHAPTER XI
THE NOISE SILENCER

The noise silencer in the RME-70 receiver is a very simple automatic limiting circuit, which chops off high peaks which would exceed a normal value equivalent to 100% modulation with any given carrier. The silencer circuit is principally built around a 6A6 tube. Certain resistors and capacitors associated with the diode lead circuit and the audio circuit are also parts of the noise silencer circuit using these components mutually.

Whenever, a defective tube or an opening up of a connection in the various resistor networks associated with the diode rectifier, second detector, and the 6A6 suppressor tube are probably the only causes for inadequate operation of the silencer. In other words, this silencer circuit is very simple and a check of the circuit-wiring and the connections to various resistors and ground is all that is necessary to detect the trouble -- if the tube is satisfactory. A check of the operation of the silencer should be made with no signal coming in but during periods of automobile ignition interference as found while listening on 30 MC.

CHAPTER XII

TEST VOLTAGES OBTAINED AT VARIOUS POINTS IN THE RECEIVER

Measurements made with voltmeter having internal resistance of 1,000 ohms per volt. Instruments with other internal resistances give entirely different readings)

Note: Line voltage should be 115V.

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE (Switch makred Audio level and Standby in toward panel)	CORRECT VOLTAGE (Switch marked Audio Level and Standby pulled outward frm panel)
Radio Freq amplifier Plate to ground.	240 volts	0 volts
Radio freq. amplifier Screen and ground	100 volts	0 volts
Radio frequency amplifier cathode and ground	3.2 volts	0 volts
First detector plates	240 volts	0 volts
First detector screen and gnd	75 volts	0 volts
First detoctor cathode & gnd.	3.5 volts	0 volts
First intermediate freq. amp. screen and ground	100 volts	0 volts
1st inter mediate freq. amp. plate and ground	250 volts	0 volts
6K7 Audio amp. plate & gnd	115 V	OV
6K7 screen and ground	25V	OV
6F6 plate and ground	244V	OV
6F6 screen and ground	248V	OV
6F6 cathode and ground	16V	OV
80 rectifier fil. and ground	258V	OV
Oscillator plate & ground	248V	OV
Oscillator screen & gnd	115V	OV
Beat oscillator plate & gnd	180V	OV
Beat oscillator screen & gnd	100V	OV
The voltage across 1.32	14V	OV

These voltages are subject to a flucuation of plus or minus 15% without indication of material difficulties.

CONTINUITY CHECKS

Receiver turned off, and no jumper between A-2 and ground on the antenna terminal strip.

MEASUREMENTS MADE BETWEEN	CORRECT RESISTANCE VALUE
A-1 and ground	Infinite, all bands
A-2 and ground	Infinite, all bands
RF amplifier grid to ground	1.25 megohms ±20%
	Band 1--3.5 ohms
	Band 2--1.5 ohms
	Band 3-- .8 ohms
	Band 4-- .3 ohms
	Band 5--Less than .2 ohms
	Band 6--Less than .2 ohms
First IF grid to ground	1.5 megohms ±20%
Second IF grid to ground	1.25 megohms ±20%
Oscillator grid to ground	50,000 ±20%
Beat oscillator grid to ground	100,000 ohms ±20%
CK7 Audio amplifier grid to gnd	Should vary from 50,000 to [illegible],000 ohms between minimum and maximum rotation of the control "Audio Control & Standby"
Oscillator section of band spread condenser and ground	Band 1--Infinite
	Band-- .8 ohms
	Band 3-- .5 ohms
	Band 4-- .2 ohms
	Band 5--Less than .2 ohms
	Band 6-- Less than .2 ohms
Cathode of H.F. oscillator to ground	Band 1--.75 ohms
	Band 2-- .3 ohms
	Band 3-- .2 ohms
	Band 4--Less than .2 ohms
	Band 5--Less than .2 ohms
	Band 6-- Less than .2 ohms

RME-70 PARTS LIST (Page 1)

RESISTORS

1.1 30,000 ohm Variable
1.2 150 ohm 1/2 W
1.3 20,000 ohm 1W
1.4 5,000 ohm 1/2W
1.5 100.000 ohm 1/2W
1.6 5,000 ohm 1/2W
1.7 1 megohm 1/2W
1.8 250,000 1/2W
1.9 2,000 ohm 1/2W
1.10 100,000 ohm 1/2W
1.11 1,500 ohm 1/2W
1.12 1 megohm 1/2W
1.13 10,000 ohm 1/2W
1.14 300 ohm 1/2W
1.15 50,000 ohm 1/2W
1.16 50,000 ohm 1/2W
1.17 1 megohm 1/2W
1.18 100,000 ohm 1/2W
1.19 250,000 ohm volume control
1.20 50,000 ohm 1/2W
1.21 1 megohm 1/2W
1.22 100,000 ohm 1/2W
1.23 250,000 ohm 1/2W
1.24 1 megohm potentiometer
1.25 400 ohm 1/2W
1.26 5,000 1/2W
1.27 2,000 ohm 1/2W
1.28 200 ohm R meter pot.
1.29 7,200 ohm bleeder
1.30 6,800 ohm bleeder
1.31 2,000 ohm 1/2W
1.32 2,000 ohm 1/2W
1.33 2,000 ohm 1/2W
1.34 50,000 ohm 1/2W
1.35 50,000 ohm 1/2W
1.36 10,000 ohm 1/2W
1.37 100,000 ohm 1/2W
1.38 100,000 ohm 1/2W

Condensers

2.1 30μμfd Adj.
2.2 30μμfd Adj.
2.3 .01μfd 400 V
2.4 30μμfd Adj.
2.5 Tuning condenser
2.6 Tuningcondenser
2.7 Bandspread Condenser
2.8 Resonator
2.9 .002 mica
2.10 Tuning condenser
2.11 Tuningcondenser
2.12 Bandspread Condenser
2.13 Resoator
2.14 .01 400V
2.15 .01 400V
2.16 .01 400V

CONDENSERS (con't)

2.17 .01 400V
2.18 I.F. Trimmer
2.19 I.F. Trimmer
2.20 25 μμfd Variable
2.21 30 μμfd Adj.
2.22 .01 400V
2.23 .1 400V
2.24 .1 400V
2.25 I.F. Trimmer
2.26 I.F. Trimmer
2.27 .1 400V
2.28 .1 400V
2.29 .01 400V
2.30 1" of shielded braid capacity approx 10μμfd
2.31 .1 400V
2.32 I.F. Trimmer
2.33 .00005 Mica
2.34 I.F. Trimmer
2.35 .00005 Mica
[illegible] .1 400V
[illegible] .1 400V
2.38 .01 400V
2.39 .00025 Mica
2.40 .01 400V
2.41 40μfd 25V Electrolytic
2.42 .1 400V
2.43 .01 400V
2.44 .1 400V
2.45 30μμfd Adj.
2.46 7-μμfd Ajd.
2.47 30μμfd Adj.
2.48 30μμfd Adj.
2.49 30μμfd Ajd.
2.50 30μμfd Adj.
2.51 .004 Mica
2.52 Tuning Condenser
2.53 Tuning Condenser
2.54 Bandspread Condesner
2.55 .0001 Mica 5% tol.
2.56 .01 400V
2.57 .01 400V
2.58 .1 400V
2.59 25 μμfd Variable
2.60 50μμfd Adj.
2.61 .00025 Mica
2.62 .0001 Mica
2.63 .01 400V
2.64 .00025 Mica
2.65 .01 400V
2.66 .01 400V
2.67 10μfd 450V Elec.
2.68 15μfd 450V Elec.
2.69 15μfd 450V Elec.
2.70 70μμfd Adj.
2.71 .00025 Mica

SWITCHES

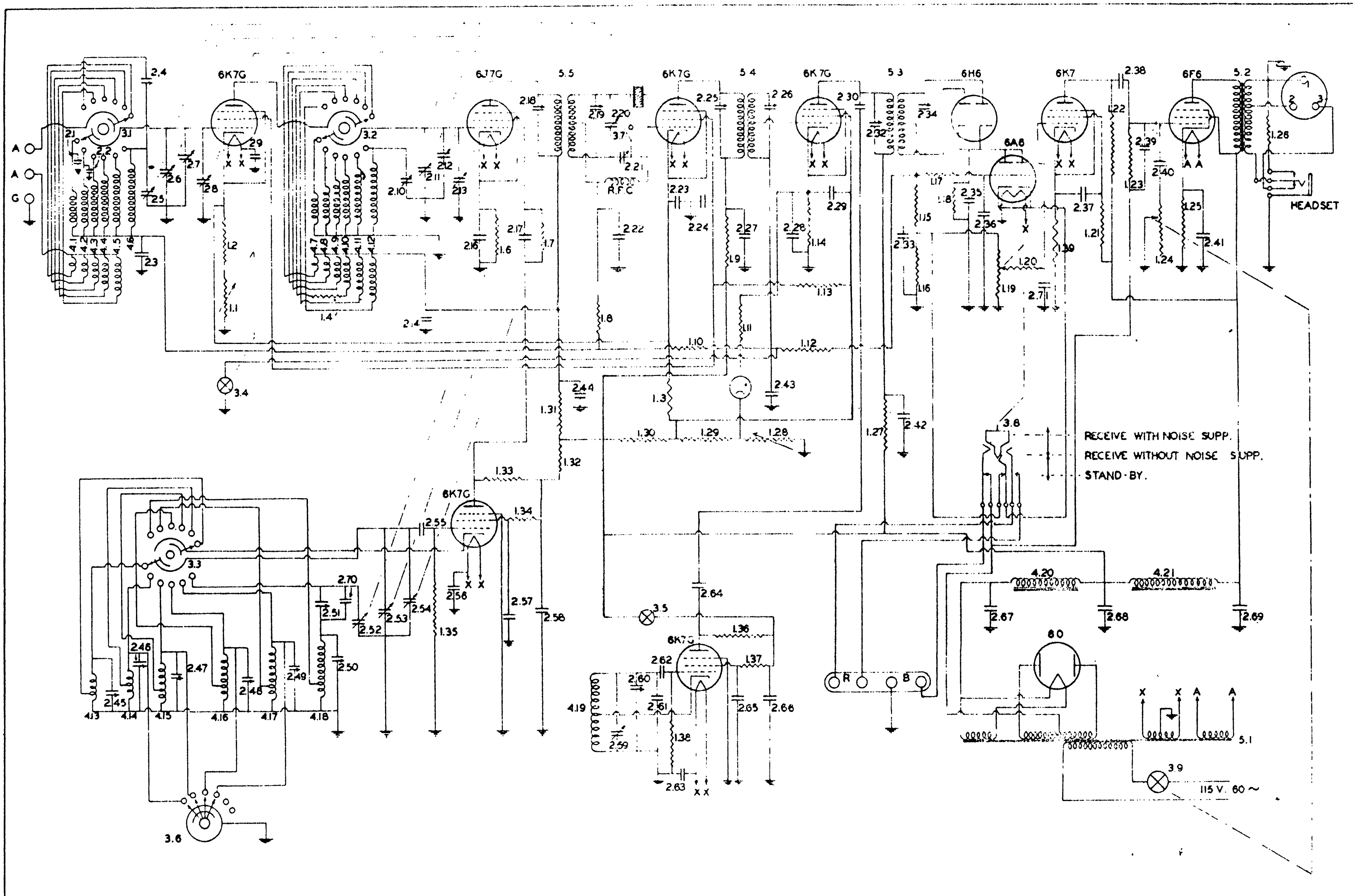
3.1 Band change switch
3.2 Band change switch
3.3 Band change switch
3.4 AVC On*Off
3.5 Beat oscillator
3.6 Band change switch
3.7 Crystal switch
3.8 Noise suppressor and stand-by
3.9 Line switch

INDUCTANCES

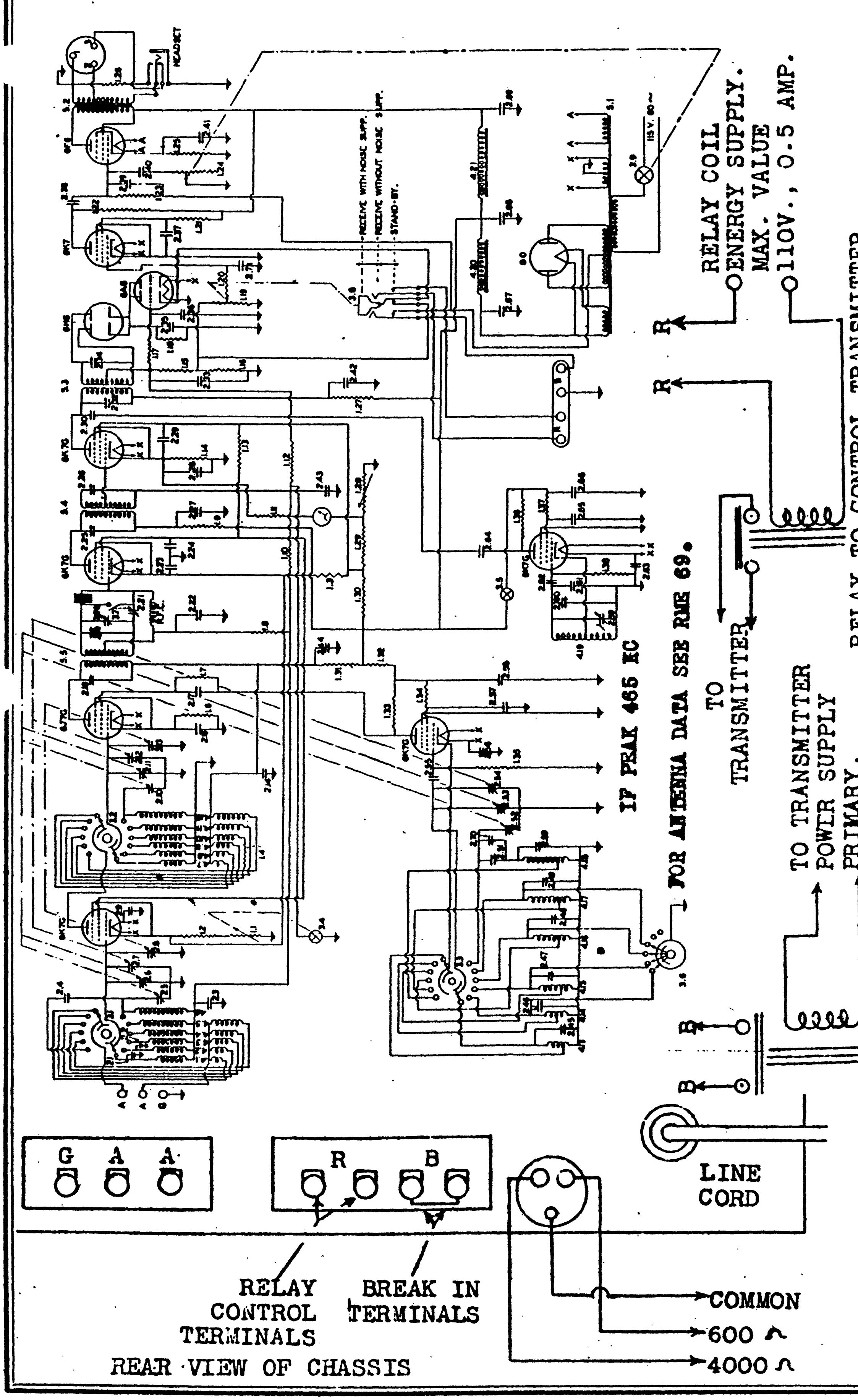
4.1 Band 6 R.F. Grid coil
4.2 Band 5 R.F. Grid Coil
4.3 Band 4 R.F. Grid Coil
4.4 Band 3 R.F. Grid Coil
4.5 Band 2 R.F. Grid Coil
4.6 Band 1 R.F. Grid Coil
4.7 Band 6 1st Det. Coil
4.8 Band 5 1st Det. Coil
4.9 Band 4 1st Det. Coil
4.10 Band 3 1st Det. Coil
4.11 Band 2 1st Det. Coil
4.12 Band 1 1st Det. Coil
4.13 Band 6 osc. Coil
4.14 Band 5 osc. coil
4.15 Band 4 osc. coil
4.16 Band 3 osc. coil
4.17 Band 2 osc. coil
4.18 Band 1 osc. coil
4.19 Beat Oscillator Coil
4.20 30H 100MA Filter choke
4.21 30H 50MA Filter choke
RFC 10MH R.F. Choke

TRANSFORMERS

5.1 Power transformer
5.2 Audio transformer
5.3 I.F. Transformer #1
5.4 I.F. Transformer #2
5.5 I.F. Transformer #3



SCHEMATIC R.M.E. 70	C-130	RADIO MFG. ENGINEERS, Inc. 111 HARRISON STREET PEORIA, ILLINOIS	RME-70



TYPICAL CIRCUIT FOR REMOTE BREAK-IN CONTROL OF RECEIVER. TERMINAL PAIR MARKED B ON RECEIVER CONNECT TO B - B. CIRCUIT BETWEEN B PAIR IS CLOSED WHEN RELAY OR REMOTE SWITCH IS CLOSED DURING TRANSMITTER STAND-BY PERIODS.

TYPICAL CIRCUIT DIAGRAM OF CONNECTING OF RELAY CONTROL CIRCUIT OF RECEIVER. LEADS R - R CONNECT TO TERMINAL PAIR MARKED R., ON RECEIVER. RELAY CLOSES WHEN RECEIVER STAND-BY CONTROL IS PULLED OUTWARD FROM PANEL. (MAXIMUM POSITION)

MODEL 70
Voltage
Parts

RADIO MFG. ENGINEERS, INC.

TEST VOLTAGES OBTAINED AT VARIOUS POINTS IN THE RECEIVER CIRCUIT
(Measurements made with voltmeter having internal resistance of 1,000 ohms per volt. Instruments with other internal resistances give entirely different readings) Note: Line voltage should be 115v.

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE (Switch marked Audio level and Standby in toward panel)	CORRECT VOLTAGE (Switch marked Audio level and Standby out ward from panel.)
Radio frequency amplifier plate and ground.	240 volts	0 volts
Radio frequency amplifier screen and ground	100 volts	0 volts
Radio frequency amplifier cathode and ground	3.2 volts	0 volts
First detector plates	240 volts	0 volts
First detector screen and ground	75 volts	0 volts
First detector cathode and ground	3.5 volts	0 volts
First intermediate frequency amplifier screen and ground	100 volts	0 volts
First intermediate frequency amplifier plate and ground	250 volts	0 volts
6K7 Audio Amp. plate and ground	115 volts	0 volts
6K7 screen and ground	25 volts	0 volts
6F6 plate and ground	244 volts	0 volts
6F6 screen and ground	248 volts	0 volts
6F6 cathode and ground	16 volts	0 volts
80 rectifier filament and ground	258 volts	0 volts
Oscillator plate and ground	248 volts	0 volts
Oscillator screen and ground	115 volts	0 volts
Beat oscillator plate and ground	180 volts	0 volts
Beat oscillator screen and ground	100 volts	0 volts
The voltage across 1.32	14 volts	0 volts

These voltages are subject to a fluctuation of plus or minus 15% without indication of material difficulties.

RME-70 PARTS LIST

Resistors

1.1	30,000 ohm variable
1.2	150 ohm 1/2 watt
1.3	20,000 ohm 1 watt
1.4	5,000 ohm 1/2 watt
1.6	5,000 ohm 1/2 watt
1.7	1 megohm 1/2 watt
1.8	250,000 ohm 1/2 watt
1.9	2,000 ohm 1/2 watt
1.10	100,000 ohm 1/2 watt
1.11	35 ohm 1/2 watt
1.12	1 megohm 1/2 watt
1.13	5,000 ohm 1/2 watt
1.14	150 ohm 1/2 watt
1.15	50,000 ohm 1/2 watt
1.16	50,000 ohm 1/2 watt
1.17	1 megohm 1/2 watt
1.18	100,000 ohm 1/2 watt
1.19	250,000 ohm volume control
1.20	50,000 ohm 1/2 watt
1.21	1 megohm 1/2 watt
1.22	100,000 ohm 1/2 watt
1.23	250,000 ohm 1/2 watt
1.24	1 megohm potentiometer
1.25	410 ohm section of bleeder
1.26	5,000 ohm 1/2 watt
1.27	2,000 ohm 1/2 watt
1.28	200 ohm R meter Pot.
1.29	7,200 ohm bleeder
1.30	6,800 ohm bleeder
1.31	2,000 ohm 1/2 watt
1.32	2,000 ohm 1/2 watt
1.33	2,000 ohm 1/2 watt
1.34	50,000 ohm 1/2 watt
1.35	50,000 ohm 1/2 watt
1.36	10,000 ohm 1/2 watt
1.37	100,000 ohm 1/2 watt
1.38	100,000 ohm 1/2 watt

Condensers

2.1	30 μμfd Adj.
2.2	30 μμfd Adj.
2.3	.01 μfd 400 volt
2.4	30 μμfd Adj.
2.5	Tuning condenser
2.6	Tuning condenser
2.7	Bandspread condenser
2.8	Resonator
2.9	.002 Mica
2.10	Tuning condenser
2.11	Tuning condenser
2.12	Bandspread condenser
2.13	Resonator
2.14	.01 400 volt
2.16	.01 400 volt

Condensers cont.

2.17	.01 400 volt
2.18	I.F. Trimmer
2.19	I.F. Trimmer
2.20	25 μμfd variable
2.21	30 μμfd Adj.
2.22	.01 400 volt
2.23	.1 400 volt
2.24	.1 400 volt
2.25	I.F. Trimmer
2.26	I.F. Trimmer
2.27	.1 400 volt
2.28	.1 400 volt
2.29	.01 400 volt
2.30	1" of shielded braid--Capacity approximately 10 μμfd.
2.32	I.F. Trimmer
2.33	.00005 Mica
2.34	I.F. Trimmer
2.35	.00005 Mica
2.36	.1 400 volt
2.37	.1 400 volt
2.38	.01 600 volt
2.39	.00025 Mica
2.40	.01 400 volt
2.41	40 μfd 25 v. electrolytic
2.42	.1 400 volt
2.43	.01 400 volt
2.44	.1 400 volt
2.45	30 μμfd Adj.
2.46	70 μμfd Adj.
2.47	30 μμfd Adj.
2.48	30 μμfd Adj.
2.49	30 μμfd Adj.
2.50	30 μμfd Adj.
2.51	.0004 Mica
2.52	Tuning condenser
2.53	Tuning condenser
2.54	Bandspread condenser
2.55	.0001 Mica 5% Tol.
2.56	.0004 Mica
2.57	.01 400 volt
2.58	.1 400 volt
2.59	25 μμfd variable
2.60	50 μμfd Adj.
2.61	.00025 Mica
2.62	.0001 Mica
2.63	.01 400 volt
2.64	.00025 Mica
2.65	.01 400 volt
2.66	.01 400 volt
2.67	10 μfd 450 V. Elec.
2.68	15 μfd 450 V. Elec.
2.69	15 μfd 450 V. Elec.
2.70	70 μμfd Adj.
2.71	.00025 Mica

RADIO MFG. ENGINEERS, INC.

ALIGNMENT

One of the first evidences of misalignment in a receiver is low over-all gain of the receiver. In the RME-70 Receiver this is evidenced by low meter readings on signals which were formerly capable of producing higher meter readings. Due to the tremendous gain available in the audio system of the RME-70 Receiver, a misalignment due to loss of gain may not be noticed if the condition of the receiver is judged by audio output, since it may be possible to turn the volume control to the maximum output position and still obtain high values of audio output. Misalignment, however, does not effect the circuits of the audio amplifier and has solely to do with the intermediate frequency amplifier and the radio frequency amplifiers. Principal among the contributions to low gain is the part which the intermediate frequency amplifier plays in providing over-all sensitivity and selectivity of a satisfactory order.

Misalignment of the radio frequency section (principally that part of the section which is made up of the high frequency oscillator) shows up in the receiver calibration. This section also is susceptible to certain outside influences which can cause variations to such a degree that the stated calibration of the receiver is changed to other values. However, this effect is not a common effect and usually the calibration of the receiver, unless tampered with by inexperienced hands, will remain very close to its stated value indefinitely.

This loss of gain when occurring in the radio frequency section of the receiver is usually due to the fact that the oscillator has been grossly misaligned so that it is apparent in the frequency calibration of the receiver. In other words, it might well be said that a loss of sensitivity in the receiver occurring simultaneously with a wide-spread condition of off calibration might indicate the fact that the loss of gain is caused by misalignment of the radio frequency section of the receiver.

On the other hand, if the gain of the receiver is low, but the calibration is correct, it might be said without hesitation that the most probable cause for the low gain is the misalignment of the intermediate frequency amplifiers relative to the trimming condensers of the intermediate frequency amplifier transformers.

It is for the purpose of realignment of these intermediate frequency transformers that the following test procedure is outlined. IMPORTANT NOTE. It is essential that the 465 KC intermediate signal which is used for realignment of the intermediate frequency amplifier is not set according to any arbitrary calibration on the test oscillator itself since it has been found that commercial test oscillators for service work vary considerably, at least to an extent which will not permit proper alignment of a communication type receiver in which is installed a quartz filter. It is therefore better if no test oscillator is had, since a broadcast station of constant signal strength will furnish adequate test signal for alignment of the intermediate frequency amplifier, using the quartz filter for establishing the proper I.F. frequency as indicated in the following procedure.

The meter on the RME-70 receiver affords an excellent method of indicating the peak alignment of each of the transformers. The location of the three intermediate frequency amplifier transformers, 5-3, 5-4, and 5-5 is given on Figure 4 of the illustrated sheet attached. The two padding condensers located in each of these transformers and accessible through apertures in the top of the shields can also be seen.

OTHER DATA IN VOLUME XI

OUTLINE OF PROCEDURE FOR CORRECT ALIGNMENT OF THE INTERMEDIATE FREQUENCY AMPLIFIER TRANSFORMER OF THE RME-70 RECEIVER.

The intermediate frequency amplifiers in the RME-70 Receiver are designed for a frequency of 465 KC. Since these receivers are always supplied with a quartz crystal filter, it is essential that the intermediate frequency amplifier transformers be accurately aligned with the crystal frequency. Crystals are supplied in frequencies slightly at variance from the above stated value of intermediate frequency by an amount not greater than one kilocycle plus or minus 465 KC. Rather therefore than align the intermediate frequency amplifier stages of the [illegible] to a set frequency of 465, it is essential that the alignment be done in conjunction with the quartz filter so that alignment of the intermediate frequency amplifier is achieved at the frequency of the filter. This is done as follows and when the process as herein outlined is followed accurately, maximum results will be obtained. The use of any other process of a general type will produce inferior results.

The first step in the alignment procedure is to tune in a broadcast station, preferrably in the low frequency portion of the broadcast band. The signal should be one of medium signal strength so that the R meter indicates a signal level of R9 or slightly less. If no station of this amplitude is available but a stronger station is available, a reduction in the efficiency of the antenna by the connection of a short wire to the antenna post may help to bring the signal strength as indicated down to R9. Usually between 550 and 800 KC in most any territory a station can be received at most any time for this test and adjustment.

When the station has been chosen, let us assume that its frequency is 700 KC, the next step is to slightly detune the main tuning control so that the frequency reads approximately 715 or 720 KC. This of course will tune the station out. It does not necessarily have to be the frequency mentioned or the exact frequency of detune, but the general procedure is to tune the main tuning control slightly higher than the chosen station so that it may be brought back to resonance by decreasing the scale reading of the band spread control. This is done merely to provide vernier tuning.

With the station chosen and resonated on the band spread scale, the crystal filter is switched into the circuit by setting the phasing control pointer to vertical upright position (approximately 90° clockwise from "OFF" position). The band spread scale is then adjusted with respect to the signal so that a maximum meter reading is obtained. This procedure is one which requires patience and accuracy of adjustment since the receiver is ultra sharp with the crystal filter in and there will be one definitely sharp peak indicating crystal resonance. The receiver should be tuned to this peak and left on it during all adjustments are made regarding the intermediate frequency amplifier.

When the peak has been tuned to and the meter is at maximum reading, a small standard intermediate frequency trimmer tool of the insulated screw-driver type should be used. Then the selectivity control, should be set so that the condenser it adjusts is set at 50% mesh. Then, without particular attention to a course of procedure in tuning, any transformer may be adjusted at any particular time, the important factor being that they all be adjusted so that the R meter is brought to and left at a maximum meter reading. Usually this adjustment will not require very much turning of the adjustment screws. A good procedure to follow is to start with the 5.5 transformer and align in sequency 5.4 and 5.3. All adjustments should be made as before mentioned so that the meter reading is maximum.

It is advisable from time to time to make sure that the signal is still adjusted to peak resonance of the crystal by slightly varying the adjustment of the band-spread control. When this procedure has been completed as outlined and all transformers have been adjusted and left at maximum meter reading, the intermediate frequency amplifier of the receiver is in peak adjustment and the crystal aligned with it for maximum effectiveness in filter action.

PHASING CONTROL OPERATION

The phasing control of the RME-70 receiver, located on the front panel in the top right corner is indicated by the words "CRYSTAL PHASING". Directly to the left of the shaft is the word "OFF". There is a stop connected with the shaft so that when the receiver is to be used without the crystal filter, rotation of the crystal phasing control is set so that the pointer points to the "OFF" position and further counter-clockwise rotation is impossible due to the stop. This indicates that the crystal filter has been removed from the circuit and normal receiver operation is possible. This function is provided by a cam operated switch connected with the phasing control of the crystal filter. In order to put the crystal into operation it is necessary to rotate the crystal phasing control clockwise to a position where the pointer is approximately in a vertical position, similar to that normally required of the selectivity control, located just below it.

Failure of the crystal to cut out of the circuit when the crystal phasing control pointer is set to the "OFF" position is due either to the fact that the knob has slipped or the switch contacts are bad and probably need adjustment. The cam switch closes when this pointer is in the "OFF" position, shorting out the crystal unit. Failure, of course, to short out the crystal unit will make it possible for the crystal filter to be in operation at all times. Slight pressure or bending of the contacts can improve this function should it fail.

When the crystal filter is being used the phasing function is provided by the variation in capacity of a phasing condenser controlled by the crystal phasing knob. Usually this is indicated by minimum noise or background response when the receiver is tuned off of the signal and the crystal is being used. This position, as before indicated, will be approximately one which allows the pointer to be vertical. Slight variations, either clockwise or counter clockwise, from this minimum noise response position change the rejection point of the crystal and make it possible to tune the rejection characteristic of the crystal to various slightly higher and lower frequencies for rejection purposes during QRM from a heterodyne on a desired signal.

If the phasing control does not work it is indicative of the fact that probably a connection is broken or that the R.F. choke connecting the A.V.C. to the grid of the tube (indicated on the schematic drawing by R.F.C. in the crystal filter circuit) is open. The continuity check between the grid of the first I.F. amplifier tube and the junction of resistor 1.8 on the automatic volume control terminal strip should show continuity when the crystal is in the operating position.

ALIGNMENT OF RADIO FREQUENCY SECTION OF THE RME-70 RECEIVER

Alignment of the radio frequency section of the receiver will effect principally the calibration of the receiver. Within certain limits this of course will also effect the sensitivity. Small variations in frequency (up to 2%) will not materially reduce the sensitivity of the receiver although they of course will show up as variations in the calibration as indicated by the required setting of the main tuning dial indicator. Correction for any variation is calibration can be made by following the suggestions outlined.

Band 1 includes the frequencies between 550 and 1500 KC. For band 1 there are two frequency adjustments for adjusting the indicator to proper calibration. The adjustments (condensers 2.51 and 2.50) are adjusted as indicated on Figure 4 through the top of the shield can just in the rear of the main tuning condenser assembly. 2.51 adjusts the band 1 oscillator calibration in the low frequency portion of the range and condenser 2.50 is the adjustment for the high frequency end of band 1. The procedure is this: Put the main tuning indicator to a position so that the main tuning condensers are fully moshed. The pointer of the main tuning control should then be set at maximum left end of scale so that the pointer falls just below the line above the numbers indicating the various channels. In this respect it will partially cover the top half of the numerals indicating the different tuning bands on this scale. In other words, the line which borders the semi-circular scale at the extreme counter-clockwise position should rest on the top edge of the pointer as it is turned to maximum counter-clockwise rotation and the condenser plates are at full mesh.

The next step is to choose a station or a signal of accurately known frequency, around 700 KC, and set the main indicator to the frequency of the signal which is going to be used for the test. For example: There is a station available with fairly good signal strength or a test oscillator is available which can ACCURATELY be set at 700 KC. If the receiver indicator on the main tuning dial is set at 700, and the receiver is considerably out of calibration of course the signal will not be received. However, leave the indicator at the correct frequency of the signal being used for the test and set the band-spread control to a reading of 180 on the dial at which position it has no material effect on the tuning circuits of the receiver and permits the calibration of the main tuning dial to indicate accurately the frequency of setting.

Then by means of condenser (2.51) (Figure 4) accessible through the trimming hole in the oscillator shield can for Band 1, adjust until the signal is brought in with the pointer set at the proper frequency. Then choose a signal at about 1200 or 1300 kilocycles, and set the main tuning dial indicator to the correct frequency for that signal and bring the signal in on that setting with trimmer 2.50. It will then be necessary to return to the former frequency setting of 700 KC to make sure that the variation of 2.50 has not made some slight change in the setting for the lower frequency calibration point and it may be necessary to readjust condenser 2.50 slightly again. Then in order to make certain of the accuracy of both settings return to the frequency chosen between 1200 and 1300 KC and if necessary, slightly readjust condenser 2.51 again. After several checks on each frequency it will be found that the calibration can be made satisfactorily.

Calibrations on the higher frequency bands are controlled for Bands 2,3,4,5, and 6 by the trimmers 2.49, 2.48, 2.47, 2.46, 2.45, (Figure 3) respectively. High side beat is used on all frequencies on the RME-70 Receiver which means that all of the condensers 2.49, 2.48, 2.47, 2.46, 2.45, must be set to the lowest capacity setting which will provide a beat and the proper calibration for the frequencies in the respective bands. Calibration frequencies used are as follows:

Band 2:	2 megacycles and 3 megacycles.
Band 3:	4 megacycles, 5 megacycles, 6 megacycles.
Band 4:	7 megacycles, 9 megacycles, 11 megacycles, 13 megacycles.
Band 5:	14 megacycles, 15 megacycles, 17 megacycles.
Band 6:	30 megacycles.

After the calibration has been made accurately on all of the frequencies, or if the receiver has been found to be accurately set insofar as its calibration is concerned on all frequencies, the trimmers 2.2

MODEL RME-69 (Late)
MODEL RME-69 (All Models)
MODEL RME-70

RADIO MFG. ENGINEERS, INC.

and 2.1 have a distinct effect upon the RF grid circuits for bands 5 and 6 respectively. They are adjusted as follows: With a steady incoming signal on between 14 and 15 megacycles and the most effective setting of the resonator control for signal in that region, and with the antenna connected, the condenser 2.2 is adjusted for maximum meter reading. With these same conditions existing on 30 megacycles, with the band switch set on band 6 and the antenna connected, 2.1 is adjusted for maximum response on a given steady signal. All other trimming and adjusting is done manually by means of the resonator control, a variable RF amplifier and detector grid padder, which can be critically adjusted for peak resonance at any frequency it is desired to tune to.

It is of importance to note the setting of the condenser 2.4 (Figure 4). This is the antenna coupling condenser used when the receiver is set to Band 1. It should be set to practically its minimum capacity in order to provide constant alignment and proper coupling to the antenna when using Band 1. Excessive capacity in the condenser 2.4 will cause misalignment of the RF amplifier and hence promiscuous beating of harmonically related broadcast frequencies to the effect that a number of whistling tones will be received on the high frequency end of the broadcast band. When the receiver leaves the factory it is set at a very small capacity and should not be set at any other capacity or material reduction in the efficiency of operation will be produced.

The padders 2.2 and 2.1 materially contribute to the image signal rejection on the bands 5 and 6. Special care should therefore be taken in the adjustment of these condensers when the receiver is aligned.

ADJUSTMENT OF THE BEAT OSCILLATOR

The beat oscillator has its frequency adjustable on the panel by means of the C.W.Tone control. This control is normally set for zero beat with the condenser 2.59 (C.W.Tone control) set at 50% mesh. If it is found that zero beat does not occur or that the beat oscillator is not beating with the intermediate frequency to produce an audible solid beat, it is probably due to the fact that the beat oscillator is tuning to a frequency other than the intermediate frequency of the receiver. This can be remedied by the following procedure:

Set the Band Switch to position Number 1, and tune in a broadcast station so that it reads maximum on the R meter. With this condition existing, snap on the C.W.Tone Control. Then by making certain that the condenser 2.59 is set to 50% mesh, the condenser 2.60 (Figure 4) located in the beat oscillator compartment just below 2.69 (Figure 4) near the top plate of the chassis in front of the beat oscillator tube should be adjusted by means of a screw-driver so that zero beat is achieved with the signal tuned in as before mentioned. When this is achieved, variation of the beat oscillator from minimum to maximum mesh will give a total beat frequency variation of eight kilocycles (plus or minus 4 kilocycles from zero beat).

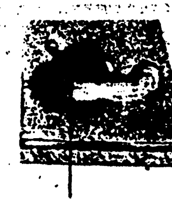


FIG. 7

MODEL 69 (late)

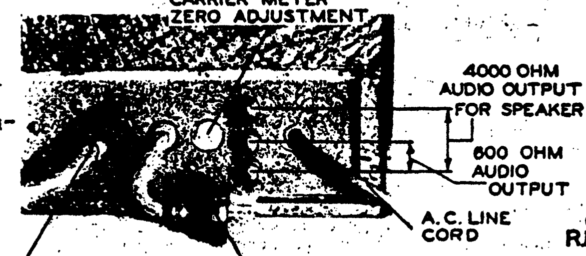


FIG. 8

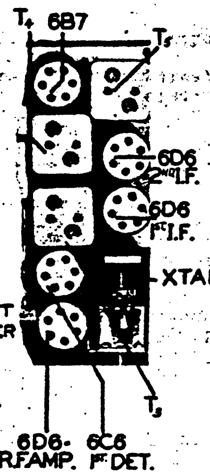


Fig. 4B

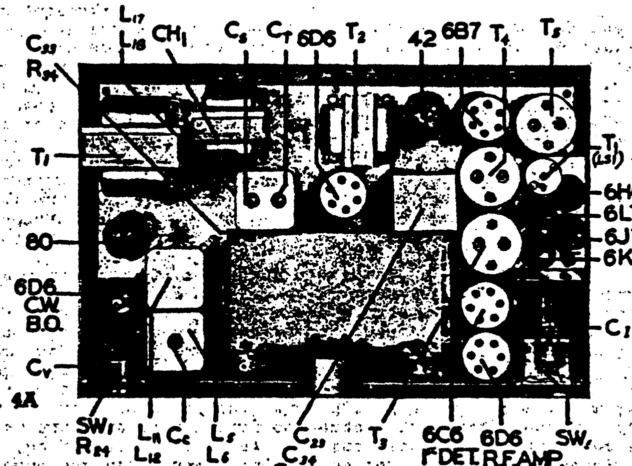


Fig. 4A

Figure 4A shows the component layout for 69 receiver with LS-1 noise silencer. Figure 4B shows the layout of the section which was changed to accommodate the silencer and therefore is standard form of chassis layout. If the receiver is connected for use, the line drawing in connection with the photograph in Figure 4A or 4B will indicate the socket locations of the respective tubes.

FOR ALIGNMENT AND FIGS. 3,6,11A, and 11B SEE RME 69 VOLUME X Pages 3 through 6.

MODEL 70
Chassis, Socket,
Trimmers,
Switch Data

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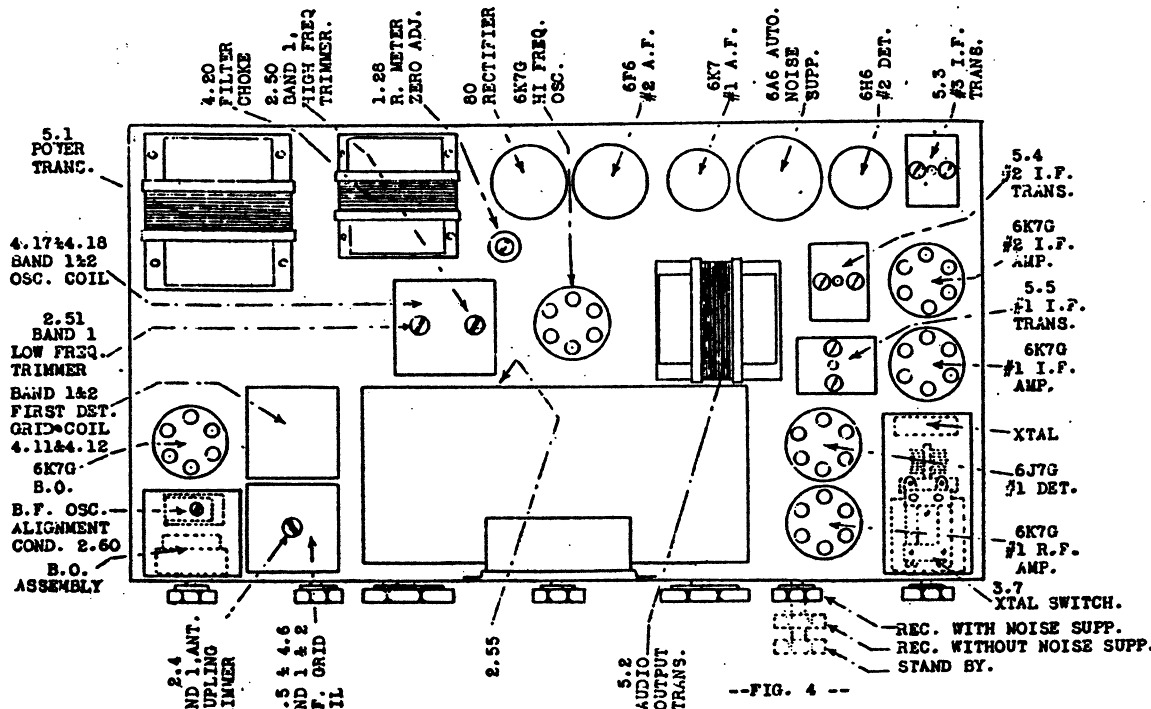


--FIG. 4 --

SWITCHES

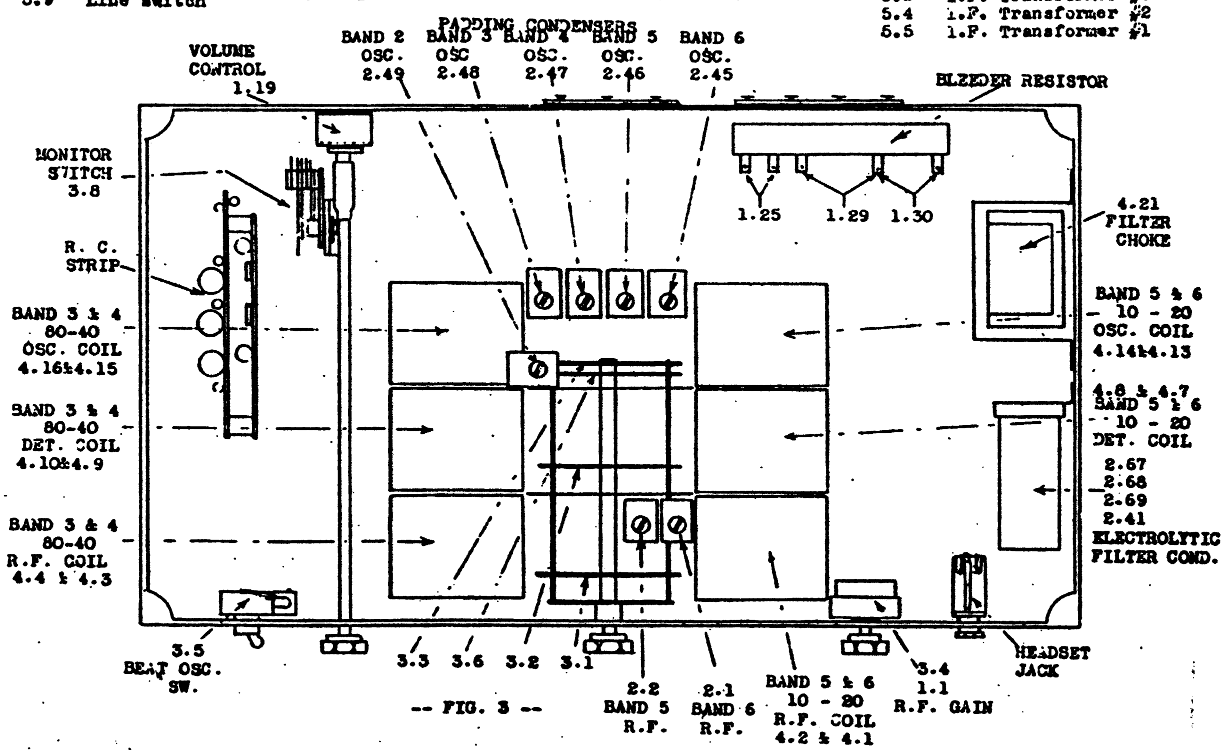
3.1	Band change switch
3.2	Band change switch
3.3	Band change switch
3.4	AVC On-Off
3.5	Beat Oscillator
3.6	Band change switch
3.7	Crystal switch
3.8	Noise suppressor and stand-by.
3.9	Line switch

INDUCTANCE

4.1	Band 6 R.F. Grid coil	4.10	Band 3 1st Det. coil	4.19	Beat Oscillator coil
4.2	Band 5 R.F. Grid coil	4.11	Band 2 1st Det. coil	4.20	30H 100MA Filter choke
4.3	Band 4 R.F. Grid coil	4.12	Band 1 1st Det. coil	4.21	30H 50 MA Filter choke
4.4	Band 3 R.F. Grid coil	4.13	Band 6 Osc. coil	RFC	10MH R.F. Choke
4.5	Band 2 R.F. Grid coil	4.14	Band 5 Osc. coil		
4.6	Band 1 R.F. Grid coil	4.15	Band 4 Osc. coil		
4.7	Band 6 1st Det. coil	4.16	Band 3 Osc. coil		
4.8	Band 5 1st Det. coil	4.17	Band 2 Osc. coil		
4.9	Band 4 1st Det. coil	4.18	Band 1 Osc. coil		

TRANSFORMERS

5.1	Power transformer
5.2	Audio transformer
5.3	I.F. Transformer #3
5.4	I.F. Transformer #2
5.5	I.F. Transformer #1



-- FIG. 3 --

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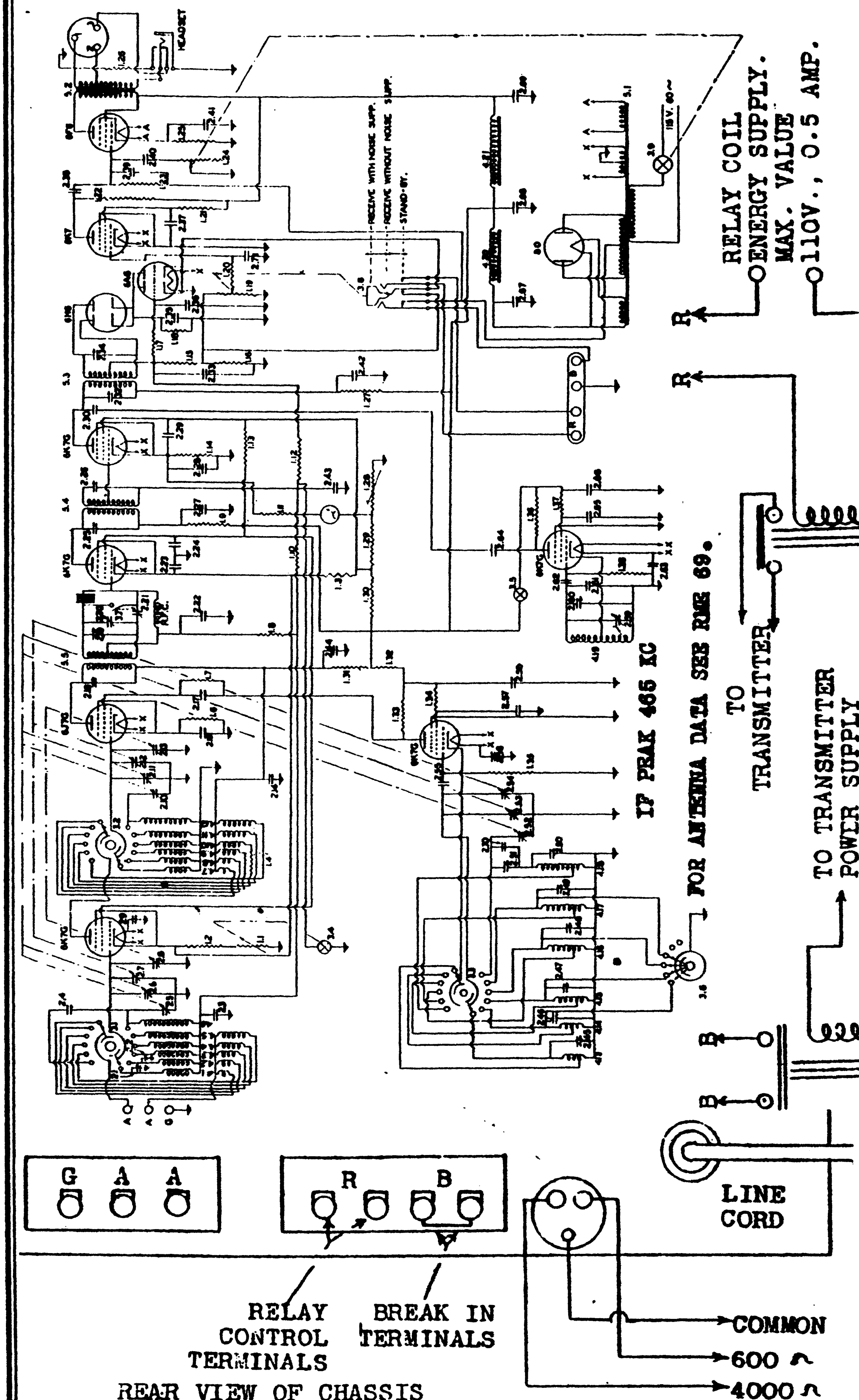
MODEL 70
Schematic



TYPICAL CIRCUIT FOR REMOTE BREAK-IN CONTROL OF RECEIVER. TERMINAL PAIR MARKED B ON RECEIVER CONNECT TO B - B. CIRCUIT BETWEEN B PAIR IS CLOSED WHEN RELAY OR REMOTE SWITCH IS CLOSED DURING TRANSMITTER STAND-BY PERIODS.

RELAY TO CONTROL TRANSMITTER.

TYPICAL CIRCUIT DIAGRAM OF CONNECTING OF RELAY CONNECT CIRCUIT OF RECEIVER. LEADS R - R CONNECT TO TERMINAL PAIR MARKED R., ON RECEIVER.

RELAY CLOSES WHEN RECEIVER STAND-BY CONTROL IS PULLED OUTWARD FROM PANEL.(MAXIMUM POSITION)

MODEL 70
Voltage
Parts

RADIO MFG. ENGINEERS, INC.

TEST VOLTAGES OBTAINED AT VARIOUS POINTS IN THE RECEIVER CIRCUIT
(Measurements made with voltmeter having internal resistance of 1,000 ohms per volt. Instruments with other internal resistances give entirely different readings) Note: Line voltage should be 115v.

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE (Switch marked Audio level and Standby in toward panel)	CORRECT VOLTAGE (Switch marked Audio level and Standby out ward from panel.)
Radio frequency amplifier plate and ground.	240 volts	0 volts
Radio frequency amplifier screen and ground	100 volts	0 volts
Radio frequency amplifier cathode and ground	3.2 volts	0 volts
First detector plates	240 volts	0 volts
First detector screen and ground	75 volts	0 volts
First detector cathode and ground	3.5 volts	0 volts
First intermediate frequency amplifier screen and ground	100 volts	0 volts
First intermediate frequency amplifier plate and ground	250 volts	0 volts
6K7 Audio Amp. plate and ground	115 volts	0 volts
6K7 screen and ground	25 volts	0 volts
6F6 plate and ground	244 volts	0 volts
6F6 screen and ground	248 volts	0 volts
6F6 cathode and ground	16 volts	0 volts
80 rectifier filament and ground	258 volts	0 volts
Oscillator plate and ground	248 volts	0 volts
Oscillator screen and ground	115 volts	0 volts
Beat oscillator plate and ground	180 volts	0 volts
Beat oscillator screen and ground	100 volts	0 volts
The voltage across 1.32	14 volts	0 volts

These voltages are subject to a fluctuation of plus or minus 15% without indication of material difficulties.

RME-70 PARTS LIST

Resistors

1.1	30,000 ohm variable
1.2	150 ohm 1/2 watt
1.3	20,000 ohm 1 watt
1.4	5,000 ohm 1/2 watt
1.6	5,000 ohm 1/2 watt
1.7	1 megohm 1/2 watt
1.8	250,000 ohm 1/2 watt
1.9	2,000 ohm 1/2 watt
1.10	100,000 ohm 1/2 watt
1.11	35 ohm 1/2 watt
1.12	1 megohm 1/2 watt
1.13	5,000 ohm 1/2 watt
1.14	150 ohm 1/2 watt
1.15	50,000 ohm 1/2 watt
1.16	50,000 ohm 1/2 watt
1.17	1 megohm 1/2 watt
1.18	100,000 ohm 1/2 watt
1.19	250,000 ohm volume control
1.20	50,000 ohm 1/2 watt
1.21	1 megohm 1/2 watt
1.22	100,000 ohm 1/2 watt
1.23	250,000 ohm 1/2 watt
1.24	1 megohm potentiometer
1.25	410 ohm section of bleeder
1.26	5,000 ohm 1/2 watt
1.27	2,000 ohm 1/2 watt
1.28	200 ohm R meter pot.
1.29	7,200 ohm bleeder
1.30	6,800 ohm bleeder
1.31	2,000 ohm 1/2 watt
1.32	2,000 ohm 1/2 watt
1.33	2,000 ohm 1/2 watt
1.34	50,000 ohm 1/2 watt
1.35	50,000 ohm 1/2 watt
1.36	10,000 ohm 1/2 watt
1.37	100,000 ohm 1/2 watt
1.38	100,000 ohm 1/2 watt

Condensers

2.1	30 μμfd Adj.
2.2	30 μμfd Adj.
2.3	.01 μfd 400 volt
2.4	30 μμfd Adj.
2.5	Tuning condenser
2.6	Tuning condenser
2.7	Bandspread condenser
2.8	Resonator
2.9	.002 Mica
2.10	Tuning condenser
2.11	Tuning condenser
2.12	Bandspread condenser
2.13	Resonator
2.14	.01 400 volt
2.16	.01 400 volt

Condensers cont.

2.17	.01 400 volt
2.18	I.F. Trimmer
2.19	I.F. Trimmer
2.20	25 μμfd variable
2.21	30 μμfd Adj.
2.22	.01 400 volt
2.23	.1 400 volt
2.24	.1 400 volt
2.25	I.F. Trimmer
2.26	I.F. Trimmer
2.27	.1 400 volt
2.28	.1 400 volt
2.29	.01 400 volt
2.30	1" of shielded braid--Capacity approximately 10 μμfd.
2.32	I.F. Trimmer
2.33	.00005 Mica
2.34	I.F. Trimmer
2.35	.00005 Mica
2.36	.1 400 volt
2.37	.1 400 volt
2.38	.01 600 volt
2.39	.00025 Mica
2.40	.01 400 volt
2.41	40 μfd 25 v. electrolytic
2.42	.1 400 volt
2.43	.01 400 volt
2.44	.1 400 volt
2.45	30 μμfd Adj.
2.46	70 μμfd Adj.
2.47	30 μμfd Adj.
2.48	30 μμfd Adj.
2.49	30 μμfd Adj.
2.50	30 μμfd Adj.
2.51	.0004 Mica
2.52	Tuning condenser
2.53	Tuning condenser
2.54	Bandspread condenser
2.55	.0001 Mica 5% Tol.
2.56	.0004 Mica
2.57	.01 400 volt
2.58	.1 400 volt
2.59	25 μμfd variable
2.60	50 μμfd Adj.
2.61	.00025 Mica
2.62	.0001 Mica
2.63	.01 400 volt
2.64	.00025 Mica
2.65	.01 400 volt
2.66	.01 400 volt
2.67	10 μfd 450 V. Elec.
2.68	15 μfd 450 V. Elec.
2.69	15 μfd 450 V. Elec.
2.70	70 μμfd Adj.
2.71	.00025 Mica