THE

RME-69

COMMUNICATIONS RECEIVER

OPERATING and SERVICE MANUAL

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PEORIA 6, ILLINOIS

INTRODUCTION

The material and information compiled in the following pages has been gotten together for the purpose of providing the user of an RME-69 Receiver with the maximum operating efficiency, greatest amount of satisfaction in receiver performance, and for the purpose of informing him as to some of the whys and wherefores regarding the care and operation of his receiver. The information contained herein will be found to be useful and should be read through thoroughly in order to avoid misunderstanding and incorrect procedure insofar as the operation of the receiver is concerned.

It embodies the results of several years of observation which has been made in a great number of varied installations and a number of the points which have been emphasized are those which are most frequently the source of some misunderstanding. Although it is usually rather boring to carefully peruse printed matter of this type, it will be found in all cases to pay dividends where the instructions and the information contained herein have been thoroughly digested. Approximately seventy-five percent of all the difficulties which have been called to our attention regarding the operation of these receivers can be directly traced, not to the receiver but to misunderstanding on the part of the user as to the exact function of the various components of the receiver.

This is a direct result of failure to read the instruction book thoroughly. We hope that you will be rewarded by your conscientious following of the instructions given in this book and also that you will find adequate information for the proper procedure in making minor adjustments should such be necessary.

ANTENNAE FOR RECEIVING

The installation of the RME-69 Communication Receiver is a comparatively simple process, but care should be taken to see that certain rules are observed. Principal among these requirements for proper installation of any sensitive receiver is the positive nature of all external connections, namely antenna and ground or doublet feeder. Wherever junctions in the wire circuits occur, positive contacts should be assured. Loose and variable poor contacts are a great source of noise and every effort to positively eliminate them should be made.

« VERY IMPORTANT »
UNLESS RECEIVER IS OPERATED
ACCORDING TO INSTRUCTIONS
RADIO MFG. ENGINEERS
CANNOT BE HELD
RESPONSIBLE.

Antennae for receiving have come into considerable neglect regarding attention to their length and location. The receiving antenna is as important as the transmitting antenna. When it receives the same consideration it pays dividends in the form of reliable and improved reception. A sensitive receiver such as the RME-69 will pick up with seemingly good signal strength foreign stations on from five to ten feet of wire as an antenna when these stations are laying a reasonably strong signal in the vicinity of the receiver, but this is no reason for using such a length as an aerial. It is recommended that an antenna of the Marconi type, forty to forty-five feet in length (measured from the receiving post to the remote tip of the antenna wire), be used in conjunction with a good ground and that this wire be placed as much in the clear as possible.

A doublet type of antenna might be used also, having the proper wire length on each side of the twisted pair line used to supply the antenna energy to the receiver. Sketches in Figure 1 show various methods for connecting various forms of antennae. The antenna should be located in a space which insofar as possible is free of metallic objects, numerous wires, buildings (especially those of a structural steel construction) and dense foliage. It should also be placed at the greatest possible distance from electric wiring in order to prevent the transfer of disturbances from the wiring to the antenna. These disturbances are especially noticeable on the shorter wave lengths. And thus all efforts to isolate the antenna and lead-in insofar as these wiring circuits are concerned will be well repaid in better reception.

The installation of the antenna should be attended to with the same diligence that is applied to working with any high frequency circuit. Extraneous noises of the "static" effect of poor installation will thus be avoided.

There is no substitute for a tuned antenna. Tuned antennae, however, offer a maximum of efficiency over a very narrow range of frequency. The range of frequency in actual kilocycles becomes greater as the frequency becomes higher. It is therefore possible in the amateur band to locate the tuned point of an antenna at approximately a mid-band position. For example: an antenna which is tuned to 3750 kilocycles will be quite efficient over the whole 75 meter amateur band. That is, from 3,500 to 4,000 KC. The coverage efficiency becomes greater as the frequency goes up so that on 14 mc. an antenna tuned to 14,200 KC is a very fine and efficient antenna for all frequencies in the amateur 20 meter band. For general coverage where it is desired to tune a number of different bands and where space provides, it is always advisable to provide specially tuned antennae for these bands in order that the greatest amount of signal strength may be built up for supplying the receiver.

The antenna input impedance to an RME-69 Receiver varies in the vicinity of 250 to 350 ohms. The antenna supply should therefore be of the Marconi type which is fed at current maximum to the receiver or of the twisted pair type where impedances of lines involved are in the vicinity of the 250 ohms previously mentioned. For maximum selectivity insofar as the input circuit is concerned, the value of this impedance should be taken into account. Antennae which are supplying the receiver signal at a high potential point should not be used in conjunction with the RME-69 Receiver because of the great loss in voltage transfer encountered in such a combination. The half-wave doublet type of antenna providing a tuned antenna system for a certain range of frequencies has certain marked directional characteristics. These directional characteristics are evident in the fact that the greatest pick-up occurs in a direction at right angles to the axis of the antenna, forming in effect a Figure 8 pattern in which the lobes are located off the sides of the antenna instead of off the ends.

This sometimes is of great advantage where a great deal of interference lies in direction off the end of the antenna. Where, however, it is desired to receive in all directions this can be remedied by erecting the antenna in a vertical position. It then has a circular pickup pattern and receives well in all directions. If the antenna is located at a distance from the receiving position and fed by a twisted pair balanced type of line to the receiver it may be located in an "interference-free" location and the feeder line may run through the area in which the interference is present providing an efficient interference rejection system due to the fact that the antenna is remote from the source of such disturbance.

If it is desired to go into the matter of receiving antennae to a greater extent, it is suggested that the operator consult any of the numerous textbooks on the subject in addition to several recognized Amateur Radio Handbooks.

CONNECTING THE RECEIVER AND GENERAL PROCEDURE FOR TUNING

The Radio Manufacturing Engineers manufacture several types of receivers insofar as the input to the power supply is concerned. These vary in voltage from 110 volts to 250 volts and in frequency from 25 to 60 cycles. The standard receiver is designated as the RME-69. This receiver is supplied in frequencies and voltages mentioned. Whenever the power supply is designed for a voltage and frequency other than 110 volts, 50 and 60 cycles, the required line voltage and frequency is given on a red tag fastened to the service-cord of the receiver. In addition to this a stamped aluminum plate is fastened on the rear of the receiver chassis and is visible from the rear of the receiver.

On this plate is stamped the model, the serial number, and the voltage and supply frequency for which the receiver is designed if it is designed for other than 115 volts, 50 and 60 cycle. It is well therefore to examine the above mentioned position for this name plate and if one is present to note the voltage and supply frequency for which the receiver is intended so that no damage will be caused the receiver due to incorrect line voltage or frequency. A receiver which is designed and constructed for use on a 115 volt, 25 cycle supply will operate satisfactorily on any 115 volt supply, having any frequency of 25 cycles or higher. It is not possible, however, to operate a receiver intended for 115 volt, 50 to 60 cycle supply, on 25 cycles. Therefore it can be seen that it is essential that the frequency and voltage of the service in the particular location in which the receiver is to be used should be known, and this should be identical with the line voltage and line frequency for which the receiver is intended, except in the case of the inter-change between the 25 and the 50 cycle as just mentioned. When the user of the receiver has made certain that the line voltage available and its frequency coincides with the voltage and frequency for which the receiver is designed, the service cord may be plugged into the standard type of outlet. At the time this is done or just before the time at which the service cord is plugged into the receptacle, it should be made certain that the line switch control "A" (Figure 2) should be turned in the maximum counter-clockwise position which is the turn-off position of the receiver.

When this has been done arrangements should be made for connecting the proper speaker to the receiver. Reference to Figure 3 will give details for proper connection and will suggest the proper method and the place to connect the speaker. As indicated, two output impedances are available. One 4,000 ohm for use with ordinary speaker output transformers and the other 600 ohm for use in feeding low impedance lines. The speaker which is supplied on order by Radio Manufacturing Engineers, is designed to work out of the 4,000 ohm supply connection. This speaker is designed to give the best possible results in conjunction with an RME-69 Receiver audio system. The speaker itself is an eight inch dynamic type of reproducer which has its own field supply in the form of a large permanent magnet. This speaker is supplied with a cord and plug properly wired so that it is necessary only to plug it into the speaker socket provided on the receiver. Receivers supplied without speakers are shipped with a suitable plug for making proper speaker connections to other types of speakers. When this speaker is supplied in the flare baffle of small dimensions for use in communication work in connection with the receiver, the reproduction is not intended to be wide range and of the type called high fidelity. It will, however, be found to be an excellent reproducer of the human voice and in communication work this is the most requisite feature of the reproduction. If it is desired to obtain wide range fidelity, the speaker can be mounted in a large baffle made up of dead material such as fibre board or Celotex or the equivalent and it should be at least four feet square with the speaker mounted in the center. With such a device, the audio reproduction possible with the RME-69 Receiver will be fully realized and the maximum of audio fidelity will be obtained.

When the speaker circuit has been taken care of, it would be well to examine the receiver to see that all the tubes are in their places and that the auxiliary packing material inserted within the cabinet of the receiver to pad up various shields and parts of the chassis is carefully removed.

A glance at the photograph (Figure 4) will show the position of the various tubes required in the receiver. If the receiver has been ordered without the tubes and they are to be installed at the same time the receiver is connected for use, the line drawing in connection with photograph in Figure 4 will indicate the socket locations of the respective tubes. The person who installs the tubes should make sure that they are well down in the sockets, that the grid connectors, if used, are snugly placed on the grid cap, and that the shields for the various tubes are tightly in place and have their caps properly placed. We recommend that whenever possible the purchaser of a receiver should order the instrument with tubes so that maximum possible results are assured.

After the most economical and suitable arrangement insofar as an antenna is concerned has been selected it should be connected to the receiver in the fashion indicated in Figure 1.

Control "B" should be set to a position equivalent to "O" as indicated in Figure 2A. The switch "I" which controls the beat frequency oscillator for telegraph reception should be set in the "off" position as indicated.

The receiver is now ready to turn on. The indicators on Knob "C" and "E" should be placed in an upright position so that they point directly to the knob above them. The knob "G" is used to select the frequency range through which it is desired to tune. The full range of the receiver (550 to 32,000 KC) is tuned in six steps. The common broadcast band or frequency range from 550 to 1500 KC is covered on Tap No. 1 of the range switch "G". Designation given just above may be used by referring to the photograph in Figure 2A. The table below gives the taps in consecutive order as indicated on the escutcheon plate of the Range switch "G", and opposite number is the frequency range which may be covered by setting this range switch to the number indicated.

SWITCH POSITIONS:	TUNING RANGE IN MEGACYCLES
1	.55--1.5
2	1.5--3.1
3	3.1--6.8
4	6.8--13.0
5	13.0--20
6	20--32

Note: Actually these figures do not represent the complete range of each band since there is a generous over-lap between the stopping of one band and the starting of another.

It will be seen from a glance at the main tuning control marked "Main Tuning Dial No. 1" (Figure 2A) that the frequency range is divided up frequently so that very accurate calibration can be utilized to the fullest extent. For a preliminary test of the receiver, and in order to familiarize the operator with the operation and performance of the device, it might be well to set the band-switch "G" to position marked "No. 1" on the position plate of this switch. Following this, the band-spread control so marked on the scale and designated on the layout of the panel in Figure 2A as Dial No. 2 may be set to a reading of 180 on the band-spread dial. When dial No. 2 is so set, the calibration as indicated on the scale of Dial No. 1 is correct.

After making this setting just described, snap on the Line Switch "A" and turn to a maximum clockwise position. This will require approximately 270 degress of rotation after the snap of the switch is heard. This operation connects the power supply of the receiver to the 110 volt line or whatever supply it is and also rotates the tone control to a position of natural reproduction. If the switch control "A" is left in a position just beyond that of the snap of the line switch, it will be set for maximum bass response and minimum high frequency response. During operation of the receiver, if it is desired to decrease the high frequency response of the audio system of the receiver, it is only necessary to rotate the control "A" counter-clockwise from the maximum clock-wise position to a point where the reproduction meets with the approval of the listener.

It will take ten or fifteen seconds for the heaters of the various tubes to come to the operating temperature. While this is being awaited, the control "F" should be examined and tested for its position. This control for the initial check of the receiver should be placed in a maximum counter-clockwise position which is in the "off" position insofar as the snap switch in tandem with it is concerned.

It is also well during the warm-up period, to pull the control "H" outward. This removes the plate voltage from the RF and IF amplifier tubes and the R meter. During the warm-up period the meter will read off-scale if the control "H" is permitted to remain pushed in toward panel. While no damage or any bad effects whatsoever can occur so far as the meter is concerned by reading off-scale, it is well not to allow it to rapidly swing with an impact against the pegs to the right off-scale when the receiver is first warming up and the tubes are not drawing any current whatsoever. The pulling of the control "H" outward and leaving it there during the warm-up period permits the meter to rest out of the circuit until the components of the receiver come to a stable operating condition. In fact, the normal operation of the receiver or rather its readiness for functioning are indicated to a great degree by the return of the meter indicator to zero with no signal coming in.

Control "H" may now be rotated in a clockwise direction after it has been pushed in toward the panel as far as it will go. This increases the input to the audio amplifier, and therefore allows reproduction should a signal be coming in on the antenna. By turning the control marked "Dial No. 1" to the various frequencies indicated on Scale No. 1 of Dial No. 1 (it will be remembered that the switch "G" was set to No. 1 as an initial setting) various broadcast stations may be received, depending upon their signal strength at the particular time and in the location in which the receiver is being used. In order to convert the calibration numbers in this scale to kilocycles it is necessary only to move the decimal point three places to the right in each case. Example: Pointer is set to the calibration number marked .7 on scale No. 1 of No. 1 control dial. By moving the decimal point three places to the right we get 700 which is a frequency in kilocycles of a broadcast station. In other words, .7 megacycles is equivalent to 700 kilocycles. One megacycle is equivalent to 1,000 kilocycles and 3.5 megacycles is equivalent to 3,500 kilocycles. These examples are stated in case the listener is accustomed to determining frequencies in terms of kilocycles. It may make it more simple for him in the case of this receiver where the calibration is indicated in the terms of megacycles. The calibration of radio receivers has been standardized and the standard calibration is in terms of megacycles. As a general rule if the former method for changing megacycles to kilocycles does not appear convenient, a simple fact may be remembered, and it will materially assist in the conversion. This fact is that 1,000 kilocycles are equal to one megacycle.

The control "D" should be adjusted following the selection of a station on Dial No. 1 to a point where the signal strength as indicated on the carrier level meter is a maximum. This adjustment should preferrably be made on a station in the high frequency end of the broadcast band since here the control adjustment is most critical and will therefore be most satisfactory over the entire range. It may also be well to make certain that the control "E" is adjusted to peak efficiency. This fact can be determined by turning it slightly from one side of the vertical to the other side, noting the reading of the "R" meter on a steady signal. All adjustments should be left so that they provide the maximum possible "R" meter reading provided by their respective adjustments.

The volume control "H" has no effect whatsoever on the level reading of the meter. However, if it is pulled out, it removes the meter from the circuit. The meter indicates continuously the average level of the carrier being received. A paragraph will be presented later in which the action of the meter and some of its uses will be fully described.

The various portions of the receiver circuit will be taken up in the following paragraphs separately. Their function, method of control, and results to be expected will be fully set forth in these paragraphs to follow.

BAND-SPREAD

The band-spread control on the RME-69 Receiver is a very valuable feature. Band-spreading in the RME-69 is accomplished by control of Dial No. 2. The scale is calibrated in uniform units from zero to 180. When the indicator is at the designation 180 on the scale, the band-spread condenser is at a minimum capacity or a highest frequency position. As before mentioned, when the band-spread indicator is in position indicating 180 on the scale, the calibration of the receiver is correct as indicated on Dial No. 1. If the band-spread indicator is set to a lower number on the band-spread scale than 180, the actual tune of the receiver is somewhat lower than that indicated by the calibrated scale of Dial No. 1.

Band-spreading is used chiefly in communication work where it is desired to continuously scan a rather narrow range of frequencies, for instance, one amateur band. This can be accomplished easily and effectively by setting the indicator of Dial No. 1 to the high frequency limit of the band through which it is desired to tune. Leaving dial No. 1 set at this high frequency limit of the desire band, the band-spread indicator of Dial No. 2 may be varied and as the indicator rotates to indicate the lower numbers on the scale, the frequency of tune of the receiver lowers. In other words, the numbers as indicated on the band-spread scale of Dial No. 2 are somewhat indicative of the direction of tune insofar as frequency is concerned. That is, when the indicator is passing from the lower numbers to the higher numbers, the frequency is increasing, and when the indicator is being rotated so that it passes from a higher reading on the scale to a lower reading, the frequency of the receiver is being lowered. The following example as a suggestion for setting the band-spread indicator may be of some assistance in illustrating the statements made just above: Let us assume that it is desired to cover the so-called 75 meter amateur band. This band is bounded in frequency by 3.5 megacycles on the low end and by 4 megacycles on the high end. In order to effectively band-spread this region, it is necessary to set Dial No. 1 to 4 megacycles. When the band-spread scale is set to 180, the frequency to which the receiver is tuned is then four megacycles. As the knob of Dial No. 2 is rotated so that the indicator passes to the lower numbers on the band-spread scale, the frequency of tune of the receiver is lowered so that when the indicator reaches the region of ten or zero on the scale, the low frequency limit of the 75 meter amateur band has been reached and the band has been covered in the sweep of the band-spread indicator.

On certain of the high frequencies, the coverage is greater than one amateur band. It is therefore satisfactory in the case of the amateur 40 meter band and the amateur 20 meter band to set the indicator of Dial No. 1 to a frequency slightly higher than the upper limit of the respective amateur band just mentioned. In the case of the 7 megacycle amateur band, or what is familiarly known as the 40 meter band, it is satisfactory to set the indicator of Dial No. 1 to a reading of 7.4 megacycles. Passage of the indicator of Dial No. 2 from a reading of 180 to zero will then pass into and cover the entire 7 megacycle amateur band.

In the case of the 20 meter amateur band or what is called the 14 megacycle amateur band, it is satisfactory to set the indicator of Dial No. 1 to a reading of 14.5 megacycles which is slightly higher and outside on the high end of the amateur band. By rotating the knob of Dial No. 2 and causing the indicator to pass from 180 to zero on the band-spread scale, the amateur band is approached on the high end as the numbers lower on the band-spread scale and the actual frequency of tune will pass to a frequency outside the amateur band on the low end. Various methods of setting the Dial No. 1 can be used. That which appeals most to the operator of course is the most advisable to use. It happens that certain definite broadcast frequencies coincide in a position insofar as the indicator on Dial No. 1 is concerned with certain of the band limits or do so approximately. For instance, the frequency of broadcast stations around 680 to 720 kilocycles sometimes provide very effective marker signals for setting the Dial No. 1 for band-spreading amateur bands. Some operators use this system. However, it will be found that the control of Dial No. 1 can be set so that the indicator is either set to one side or the other of a given line on the calibrated scale and the band-spread control will be found to be within a half or one division of the signal which it was desired to set to.

It will be found that the receiver warms up slightly as operation continues. This causes a slight change in the frequency of calibration. This may amount to approximately 8 kilocycles at 15 megacycles during the first twenty minutes. Receiver calibration is correct after the receiver has warmed up to the point just mentioned. All logging therefore should be done at the stable operating temperature. A radio receiver, the same as any other device which encounters variable temperature, changes its mechanical dimensions to a certain degree and also some of its electrical dimensions when changing from the cold condition to the normal operating temperature. In view of the fact that these receivers are not kept at constant temperature this change will produce certain changes in the tuned frequencies. However, due to proper selection of component parts and adequate ventilation and rigid construction, the drift in the RME-69 Receiver has been kept to a very practical minimum. There is no such thing as a receiver incorporating a heterodyne oscillator which does not drift to some degree or other.

THE QUARTZ CRYSTAL FILTER FOR RECEIVING

The quartz filter is used to great advantage in a specially designed circuit in the RME-69 Receiver. Before describing the procedure for correct operation of the receiver with the crystal filter switched into the circuit, it is advisable to make some comments regarding the quartz filter in general.

The quartz filter is in effect a very selective tuned electro-mechanical circuit. Due to its extreme merit as a selective circuit, it produces frequency discrimination of marked degree over a very narrow range of frequency. When this filter is used in communication work in receivers with which it is intended to receive continuous wave telegraph signals the apparent signal output of the receiver so far as the ear is concerned is not diminished when the receiver is so adjusted that the intermediate frequency produced by the signal and the heterodyne oscillator is in exact tune with the crystal frequency. In the case of CW reception we are dealing only with one frequency. That is the carrier, which in a succession of selective circuits is finally changed to a lower frequency, generally the intermediate frequency of the receiver.

It stil, however, retains its original identity insofar as the single frequency nature is concerned. The quartz filter deals very effectively with such a single frequency, permitting it to pass unattenuated through the intermediate frequency amplifier. Frequencies slightly different, say 400 cycles different than this frequency, are materially reduced. In congested amateur bands the merit of such a system is quickly realized. Communication, however, is carried on by other means, principally telephone. The use of the crystal filter in telephone reception is again very valuable. Although in general the audio output of the receiver is greatly reduced when using the crystal filter with the quartz filter in the series position in the bridge, it is usually possible to bring through signals otherwise entirely masked by heavy interference.

In amateur reception today the principal object may be called a desirability for intelligence, not how perfect or how strong the signal can be brought in. This is of course with reference to highly congested frequency bands. If it is desired only to get the intelligibility of a signal which it is in case of extreme QRM and it is not necessary to get high fidelity, the quartz filter can be used to great advantage on telephone reception. The carrier itself during reception with the crystal filter is not reduced as can be demonstrated easily by reading the "R" meter on a given carrier with the crystal filter in and then with the crystal filter switched out of the circuit. Further reference to this fact will be made later in this discussion.

It may therefore be stated that the series crystal can be used to great advantage in cases of extreme QRM for bringing one particular signal up to intelligibility and eliminating or pushing into the background the rest of the signals which tend to interfere. In contrast to this procedure when switched to the position "P" or parallel position in the RME-69 (Figure 2A) the crystal can be used to eliminate any given carrier which may be causing interference and in the elimination of the carrier, remove disagreeable heterodyning. It must be understood, however, that this effect can be applied to only one carrier at a time, and where two carriers each on opposite sides of the desired signal are causing heterodyne interference, only one may be dealt with at a time by the crystal filter switched to parallel position. However, it oftentimes materially aids reception by being able to eliminate one of the interfering carriers. There is no such thing however as infinite attenuation, Depending on the strength of the signal some of the interfering signal is bound to reproduce in the speaker. It is the ratio between the desired signal and the interfering signal insofar as response is concerned that is the important thing and if it is possible to bring the desired signal to a point 100 times that in intelligibility and sound intensity as compared to an interfering signal, the performance of the filter may be said to be successful. In telegraph reception it is possible to make a greater distinction between the desired and the interfering signal than that value just mentioned.

With particular reference to the crystal filter of the receiver being described, one fact may be mentioned as of prime importance. It is very seldom possible to tune in a signal, even though it is adjusted to peak meter reading and then switch the crystal filter from the "off" position to the "series" position and have the signal resonant or respond at a maximum through the crystal filter. This is due to the fact that the narrow acceptance range of the crystal filter is so small as compared with the total characteristic resonance of the receiver that the probability of being able to land exactly on the crystal resonance region is very remote. IT CANNOT THEREFORE BE STRESSED TOO STRONGLY THAT IT IS NECESSARY WHEN USING THE CRYSTAL FILTER FOR SELECTIVE PURPOSES TO TUNE THE RECEIVER WITH THE CRYSTAL IN THE SERIES POSITION SO THAT THE ADJUSTMENT MAY BE PROPERLY MADE.

This fact is not generally appreciated, and when neglected will not produce the proper degree of selectivity or the accuracy of adjustment which is necessary for proper operation of the crystal filter. Reference to Figure 2A and especially to control "B" which makes it possible to switch the crystal off, in series, or in parallel, depending upon which is desired, will give details as to the operation of the crystal switch. Below control "B" control "E" somewhat controls the selectivity of the crystal. It is possible to broaden out the crystal characteristic so that at a point it may be four times as broad as it is in the maximum selective position and this sometimes is valuable in phone reception for providing a maximum of intelligence when interference conditions will permit.

After a period when the crystal filter has been used and especially after the control "E" has been varied for changing the selectivity of the crystal, when the receiver is again switched to the "off" crystal position and is used in normal fashion, control "E" might well be checked for correct adjustment indicated by maximum meter reading on a given signal.

THE RESONATOR CONTROL

The resonator control provided on the RME-69 (Figure 2A, Control "D") is very valuable in that it allows the operator to continually peak the receiver insofar as the alignment of the RF and detector tuned circuits are concerned. It is advisable to check the position of this resonator for any band of frequencies being tuned so that maximum meter reading on a given signal is provided. It has no effect on the tuning of the receiver insofar as changing the frequency or calibration of the receiver is concerned.

The control "D" has an aluminum indicator pointer mounted on it and when the receiver leaves the factory this pointer is set so that when the condensers which compose the resonator assembly are set at half mesh, the pointer is exactly vertical and points toward the bearings of the carrier level meter. It will be found in the broadcast band that this pointer will read considerably to the right of center, and for the most part almost horizontal to the right. This same position over a sector approximating 45 degrees in the right hand quadrant will be found to be the correct area of variation for Band 2, and 3, and 4. On band 5, it will be found that the indicator will read in the left quadrant or with the indicator of control "D" close to the left hand horizontal position. It will also be found that on switch position 5, this resonator can be set almost horizontally to the right, a false setting, so that another apparent reception point of maximum signal strength is reached. This is due to the fact that at the frequency used when the switch is set to position 5 the resonator can almost approach the tune of the image frequency, and the build-up in background noise as well as signal when the resonator control "D" is set horizontally to the right is almost the exact resonance point for the image. It is therefore necessary to see that the resonator control is set in the position indicated in the above sentences which is in the position to the left of vertical, and almost horizontal or within an angular variation of zero to 45 degrees up from the left horizontal position when tuning band 5.

For switch position No. 6 it will be found that the indicator pointer has its optimum setting approximately 45 degrees to the right. Since it is possible also on switch position No. 6 to tune to the image by use of the resonator knob, it should be set so that the calibration of band No. 6 is correct. This is always the stand to take regarding the resonator control. If for instance a high frequency broadcast station is received in the 14 megacycle region with considerable signal strength, the resonator is not set right since it should not occur there because of its misplaced frequency. The calibration of the RME-69 will remain very close to its correct calibration over long periods of time. Even then, when it shifts it shifts very little. It is always safe therefore to assume that the calibration is very close to being correct.

All settings of control "D" should be left so that they provide maximum signal as indicated by the reading of the carrier level meter and that at the true frequency. Figure 5 shows control "D" and approximate region of variation for various frequencies.

THE BEAT FREQUENCY OSCILLATOR FOR TELEGRAPH RECEPTION

The beat frequency oscillator in the RME-69 is an electron coupled oscillator and the circuit employs a separate tube for generating the beat frequency. The control of the beat oscillator insofar as placing it in operation is concerned is vested in control "I" which is a toggle switch located on the lower right hand corner of the panel (Figure 2, "A"). Its panel position on special model receivers varies. (See Figures 2B, 2C, and 2D)

An escutcheon plate marks the "on" and "off" position. It can easily be placed into operation by placing the toggle lever to the position marked "on". Its use for telegraph reception need not be discussed since it is the only method of converting the continuous wave telegraph signal to an audible note. It further has the advantage of being able to locate very weak carriers that otherwise may not be audible by producing a beat note at the frequencies at which they are being received.

When the receiver leaves the factory, the control "C" which controls the pitch of the CW beat oscillator has an aluminum indicator pointer set in a vertical position pointing directly to control "A". This is the zero beat position or approximately so. Turning this control to the right or clockwise 90 degrees raises the beat frequency 4,000 cycles. Changing it to the left or counter-clockwise 90 degrees from the vertical lowers the frequency an approximately similar amount. It is therefore possible by merely changing the control "C" to vary the pitch of the beat note and do it on either side of the frequency of the signal. It will be found that judicious use of control "C" will provide sometimes effective means for providing the most suitable tone of the signal being received for breaking through disagreeable QRM. It is possible when using the beat oscillator to use either the automatic volume control or the manual volume control.

It will be found that for ordinary speeds of keying the automatic volume control will operate satisfactorily. However, it is recommended that the manual gain control be used in order to keep the receiver free from surging, especially if the keying frequency approximates the time constant of the automatic volume control circuit.

The manual gain control can be placed in operation by turning the control "F" slightly clockwise. This operation operates a switch which removes the automatic volume control from the circuit. Continued rotation clockwise of the control "F" reduces the gain of the receiver manually. Since the meter is controlled by the gain of the receiver, anything which changes the gain of the receiver will make the meter change its reading. Therefore clockwise rotation of the manual gain control "F" is productive of increased carrier level meter reading, indicating lower receiver gain.

The control "F" in conjunction with control "H" will provide the optimum value of RF signal as compared to audio output and provides a very smooth and efficient means of getting a full-bodied audio tone with a given telegraph signal. The control "F" can also be used of course in telephone reception when a strong telegraph signal is a few cycles displaced from a desired telephone signal and produces the effect that the keying chops up the voice due to the varying sensitivity of the receiver caused by the strong telegraph signal operating the automatic volume control. Such a condition will usually bring out the full intelligence of the phone signal if the beat note caused by the telegraph signal heterodyning the phone signal is not too objectionable. This is another important use of the manual gain control.

THE HEADPHONE JACK

During certain periods it is oftentimes desirable to dispense with the loud-speaker reproduction. During such periods the insertion of a pair of headphones with a suitable plug will eliminate the loud-speaker reproduction and provide reception on headphones. The jack for this purpose is located in the lower left corner of the front panel of the receiver. Any good pair of headphones is recommended for this use.

A loading resistor is provided across the jack so that most of the power is absorbed in the resistor. It will be found that the headphone reception on the RME-69 is very excellent in quality and can oftentimes be used to great advantage in the location of weak DX signals.

THE MONITOR CIRCUIT

An audio frequency monitoring circuit of rather good fidelity has been built into the RME-69 Receiver. The operation of this circuit is obtained by pulling the knob "H" outward from the panel. The input for the monitor circuit is supplied by connection of a small piece of wire to a terminal marked on the illustrated photograph (Figure 3). The length of this wire is determined by the relative power of amount of radio frequency energy circulating in the immediate vicinity due to the local transmitter. It will usually be found that ten or twelve feet of wire lying over close to the transmitter in the room will be quite sufficient for proper operation of this monitor circuit. It must be stated here that the monitor is unsuitable for monitoring CW signals unless an external oscillating monitor is provided. (For constructional details see any amateur radio handbook on the subject.) For method of connection see Figures 3 and 6. The rotation clockwise of the control "H" while it is pulled out in the monitoring position determines the audio level of the monitor. It must be realized that if a microphone is being used to modulate the transmitter that headphones are necessary for listening to the monitor output since a loudspeaker will produce acoustic feedback.

If, however, modulation originates in a phonograph disc or in another receiver a loudspeaker can be used. Any acoustic device, however, will require the use of headphones for listening purposes. It may be found that if the receiver is set to a switch position which places in the circuit the band in which the frequency of the transmitter is located, the antenna picking up considerable transmitter energy will produce a blocking of the radio frequency stages and hence of the diode used as a rectifier for monitoring purposes so that it will be necessary to switch the control "G" to some other switch point. This can be determined if by listening to the local modulation a muffling occurs or a lack of modulation is evident in the audio reproduced by means of the monitor circuit. A procedure which will always permit operation when any doubt occurs as to whether or not this is taking place consists of turning the Control "G" to the position No. 1 or the broadcast band, or switching on the manual gain switch operated by Control "F".

ADDITIONAL INSTRUCTIONS FOR OPERATION OF RME-69 RECEIVERS WITH LS-1 NOISE SUPPRESSORS BUILT IN.

Radio Manufacturing Engineers have designed and are manufacturing a unit which is especially dimensioned for direct installation in the RME-69 Receiver. This unit is a small sub chassis which is arranged to plug into the sockets formerly occupied by two 6D6 intermediate frequency amplifier tubes. Their removal permits the installation of the accessory unit.

These units may be installed in the receiver when it is being fabricated from the original order or it may be installed at the factory for a nominal charge. It is not supplied separately as a unit since it has been found that for careful readjustment of the receiver with the unit installed definite experience and a certain amount of equipment is required and these are not usually found in the possession of the average operator of the receiver.

This suppressor unit is of the ultra rapid automatic volume control type which operates on the pulses of short duration. In view of this fact, it is quite effective in combatting the staccato interference of automobile ignition and of atmospheric static whose response is of the same type as automobile ignition interference. Several other types of interference can also be dealt with but in the main these are the principal types of interference which yield to treatment insofar as the suppressor is concerned.

It can in no way be inferred that the noise suppressor or anything similar to it can be used to eliminate all types of noise. In fact, it is not intended to eliminate the noise, but merely to reduce it. In this respect it is quite effective on the very high frequencies where automobile ignition interference is sometimes quite heavy. One noticeable feature is the fact that during the suppression of the high rough peaks of noise a constant high frequency hiss is produced. It is generally acknowledged that this high frequency hiss resultant from the suppressor action is considerably less objectionable than the rough blanketing staccato response of automobile ignition interference or atmostpheric static.

In cases of extremely strong signals, the suppressor will not be necessary since usually in such cases the ratio of signal to noise is such that the noise is pushed into the background. Due to the nature of the circuit, a wide range is usually not satisfactory so that on the strong signals peculiar results may be observed if it is attempted to place the suppressor in the circuit.

General instructions for the control and operation of the receiver with the suppressor built in are far from being involved. Reference to controls may be easily followed by a glance at Figure 2B which shows the front panel of an RME-69 Receiver with the LS-1 noise suppressor built in. It will be noticed that the CW beat oscillator switch "I" has been changed from the lower right hand corner to a position just under the headphone jack. In place of the control "I" a control designated "J" has been installed which is a knob bearing a pointer behind which is a scale marked in units from 0 to 100 over 270 degrees of arc. This control adjusts the threshold at which suppression begins.

When it is set at a reading of 100, the receiver operates in an entirely normal fashion and the suppressor is not active. As the scale reading is reduced toward the zero end of the scale, or counter clockwise rotation, the threshold at which suppression begins is lowered. Depending upon the signal strength and the intensity of the noise, suppression will occur at a very low number for very weak or low noise and at a high noise level suppression may begin at a reading of approximately twenty or twenty-five on the scale.

When using the suppressor in connection with telephone reception it is advisable to use the manual volume control since at times due to the surging of the suppressor unit when working in conjunction with the AVC, a pulse may be produced which blocks the receiver. Switching on the control "F" so that manual gain is provided and especially if rotation is continued so that a normal signal level results, the suppressor will be found to operate in an entirely stable fashion.

There will be found a considerable difference between the operation of the suppressor when using telephone as compared with the operation of the suppressor when the receiver is used in connection with telegraph reception. For telegraph reception, the operator is dealing with one frequency which is the carrier of the telegraph station. When receiving telephone reception, the operator is not only dealing with the carrier, but he is also dealing with modulation peaks which represent instantaneous carriers of twice the average value.

In order to permit undistorted and unattenuated signal response it is necessary to set the suppressor control so that it does not chop off the modulation peaks which in effect are quite similar to the high noise peaks. If the suppressor is set too low, positive modulation peaks will be entirely removed from the incoming signal, producing an unintelligible speaker response. It is therefore seen that if the threshold must be set for twice the average carrier, approximately somewhat more noise will be received when using it on telephone reception as compared to that experienced when using it for telegraph reception. Some skill will be required in determining the proper setting when using the suppressor in connection with telephone reception.

However, in all cases it will be found to be well worth the patience required when heavy periods of static and automobile ignition interference are present. It is like the crystal filter and other parts of the receiver. It requires some skill on the part of the operator. This is true of any good receiver which has many of its controls variable. The fact that they are variable infers that there must be an optimum combination of adjustment for any particular receiving conditions. It is often said that the successful amateur station is due fifty percent to the equipment and fifty percent to the skill of the operator. Impatient and hasty decisions insofar as adjustments are concerned will result in slipshod operation.

THE CARRIER LEVEL INDICATOR METER

The RME-69 Receiver is equipped with a sensitive meter called the carrier level indicator for indicating continuously the average value of the carrier being received. This carrier is not affected by side-bands or other variations accompanying the modulation. It reads only the average value of the carrier as the signal passes through the receiver. Its operation is closely tied up with the functioning of the automatic volume control since the meter is an indicator of variations in the balance of a simple Wheatstone bridge, one leg of which (the variable leg) is composed of the static plate resistances of the several controlled tubes. The static plate impedance of the several controlled tubes varies with the signal strength due to the action of the automatic volume control circuit. This variation disturbs the balance of the Wheatstone bridge afore-mentioned causing various indications on the meter. These indications vary with the signal strength.

On the rear apron of the receiver chassis (Figure 3) a small screw-driver adjustment will be seen. This screw-driver adjustment is placed there to balance the bridge when line voltages considerably different than 115 volts are encountered. This adjustment should be made so that the carrier level indicator reads at the zero mark with the antenna disconnected and the crystal filter placed in the series position and the receiver should not be tuned to any station, local or otherwise, so that the zero indication of the meter is entirely a static indication of the receiver circuit.

The receiver has been calibrated in RME "R" units. The Radio Manufacturing Engineers have decided after a survey of practical operating tests and considerable inquiry into the matter of signal strength that the variation between one "R" and another can be suitably stated as 6 db. Since one hundred microvolts input to the receiver will produce maximum audio output (all signals greater in strength than 100 microvolts tend to be held at the same audio volume due to AVC action) one hundred microvolts input was chosen as the R9 value for the carrier level indicator scale.

Therefore successive Rs lower than 9 were calibrated in steps of 6 db, zero level being .4 of a microvolt input, approximately. R9 therefore is 48 db. above .4 of a microvolt. It was further convenient to calibrate stronger signals than R9 since R9 was somewhat determined by the audio response of the receiver so that it is possible to measure carrier up to and including 78 db. on the scale of the meter.

The usefulness of such an accurately calibrated scale is quite obvious, especially in this day of extensive antenna research and numerous experimental projects being carried on in the amateur fraternity. The operator of an RME-69 Receiver has, in effect, a comparative signal strength or field strength measuring device very accurately calibrated so that with any given antenna exact quantitative variations in signal strength can be exactly recorded by observation of the reading of the carrier level indicator meter on the receiver.

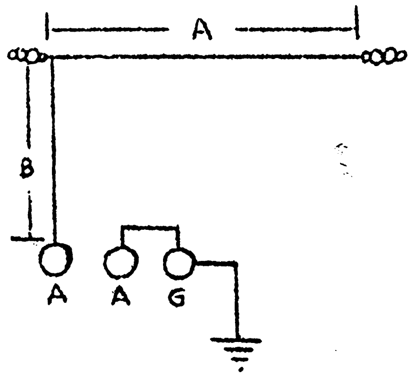
This meter as was before mentioned, operates in conjunction with the functioning of the automatic volume control. Since the operation of the manual volume control operates a switch which removes automatic volume control, the meter will not automatically indicate signal strength when the receiver has its gain manually controlled. However, various settings of the manual gain control of the receiver produce corresponding variations in R meter reading. In other words, when the manual gain control is set for low gain, the R meter reading reads to a high value indicating that if a signal is coming through at that particular setting of the manual gain control, it must be of considerable strength as approximately indicated by the fixed setting of the carrier level indicator for that manual gain control setting.

Numerous other uses can be easily imagined and considerable use will be found in other fields for the accurate calibrated carrier level indicator meter on the RME-69 Receiver. In case it is desired to interpret various signal strengths other than in the logarithmic sequence such as decibels, it may be well to remember that a variation of six decibels is equivalent to an actual numerical ratio of two to one, so that if a signal varies between R7 and R8 on the meter, it is twice as strong when it indicates R8 as it is when it indicates R7, etc. If one carrier is being received at R2, and another carrier is being received at R4, the latter signal has four times the signal strength of the former. A difference of three Rs between two signals indicates that one is eight times stronger than the other and so on.

It will be found that under conditions of wide ranges of variation in the line voltage, that is, between 105 to 125 volts, the R meter zero position with no signal will vary somewhat also. It is therefore advantageous to maintain some semblance of stability insofar as the line voltage is concerned, either with a Variac or some similar variable transformer, in case line voltage at the operating position is subject to variations.

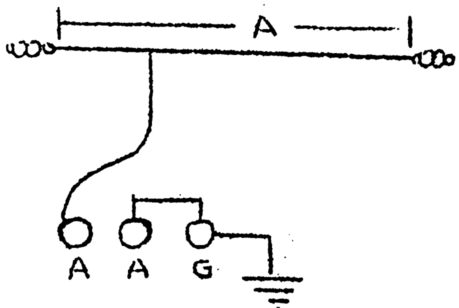
FIG. 1.

(A)



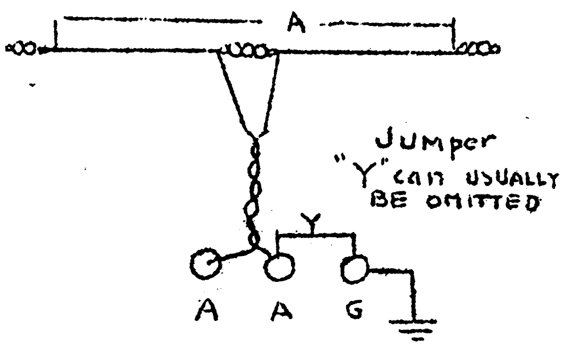
General Marconi connection. Optimum condition exists when $a + b = \frac{\lambda}{4}, \frac{3\lambda}{4}, \frac{5\lambda}{4}$ etc.

(B)



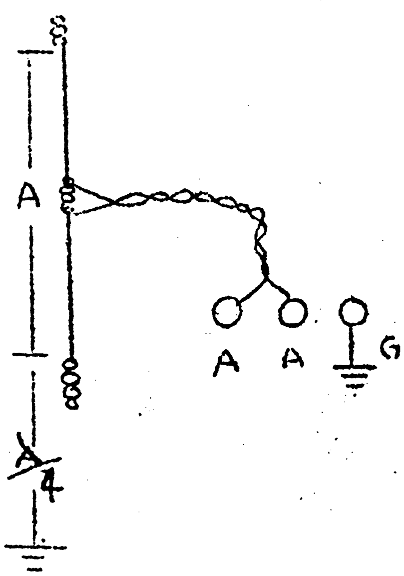
Optimum signal input to receiver when $a = \frac{\lambda}{2}$ and feeder is tapped at proper distance from center. This antenna works quite well usually on even harmonics also.

(C)



Optimum condition when $A = \frac{\lambda}{2}$. Not satisfactory for wide range freq. Excellent for any amateur band if $a = \lambda/2$ is in the middle of the band. For example, for 20 meter band antenna should be designed for 14,200 KC. A = approximately 33 feet. Directional at right angle from line of wire.

(D)



Dimension same as those of C. Antenna good for one narrow band. (For example, amateur band). but is not directional.

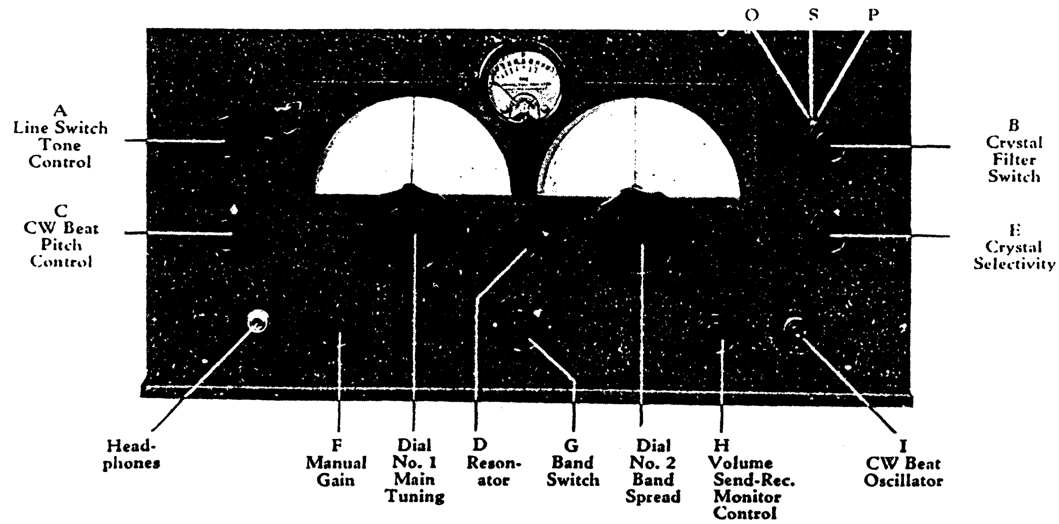


Fig. 2A. Front Panel Layout of the Standard RME-69, AC Model.

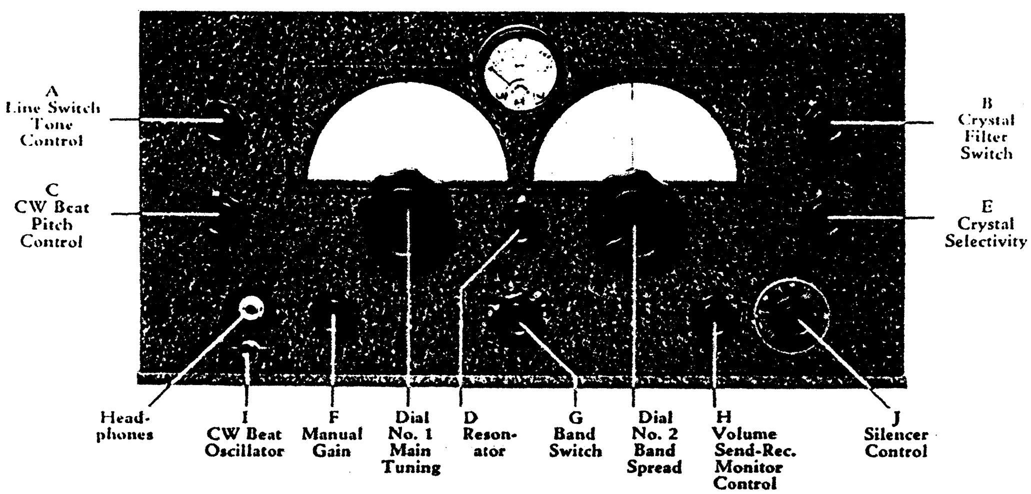


Fig. 2B. Front Panel Layout of the Standard RME-69, AC Model with Built-in Noise Silencer.

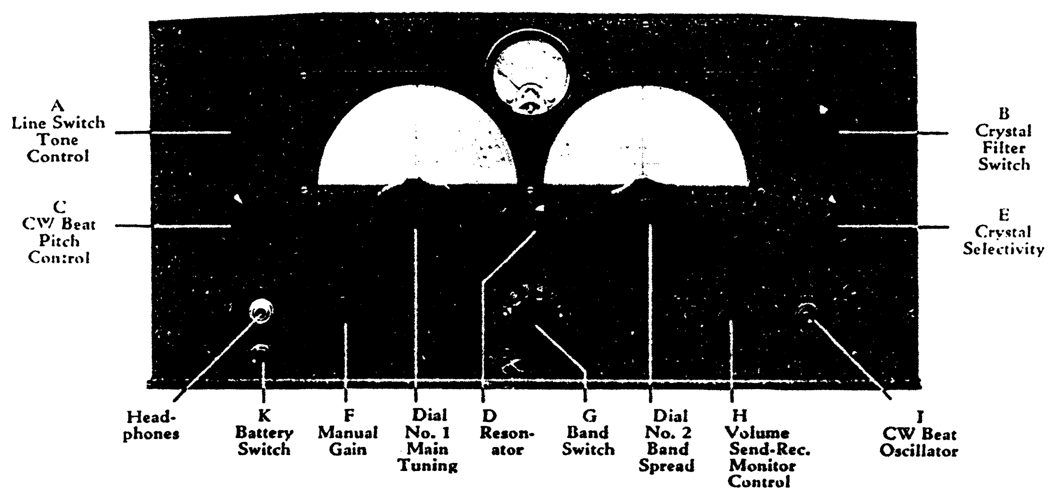


Fig. 2C. Front Panel Layout of the Combination Standard AC and Battery Model RME-69.

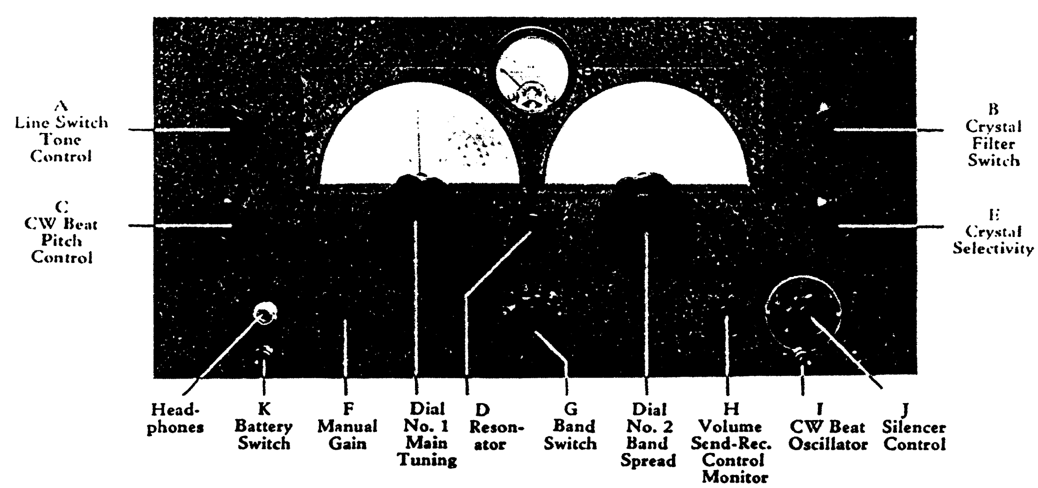


Fig. 2D. Front Panel Layout of the Combination Standard AC and Battery Model RME-69 with Built-in Noise Silencer.

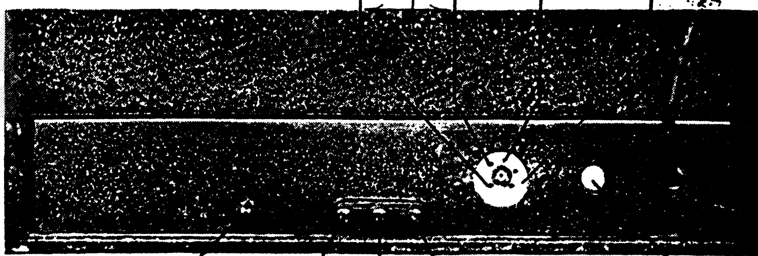


FIG. 3

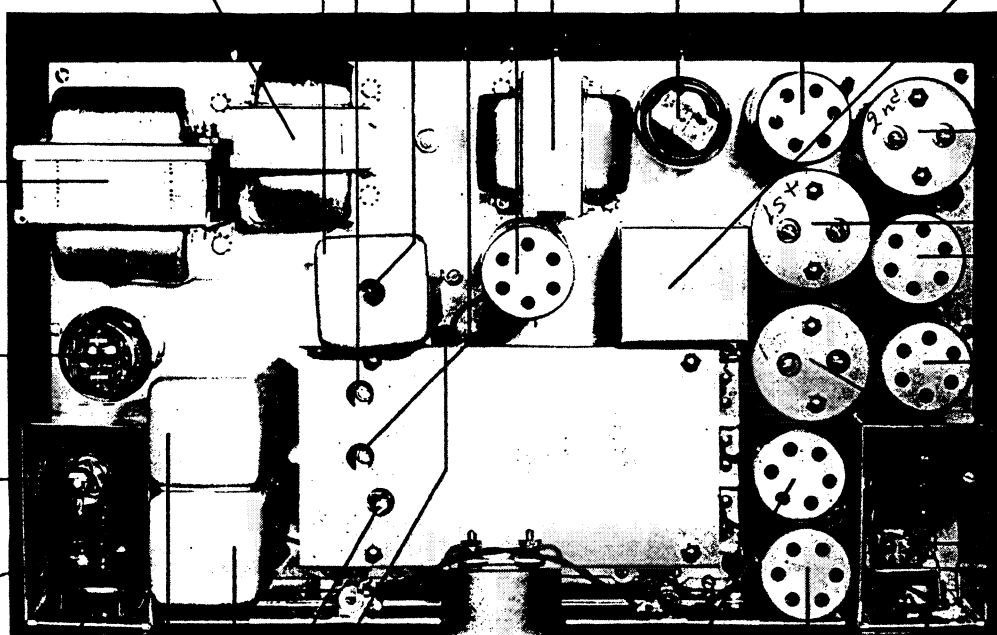


FIG. 4

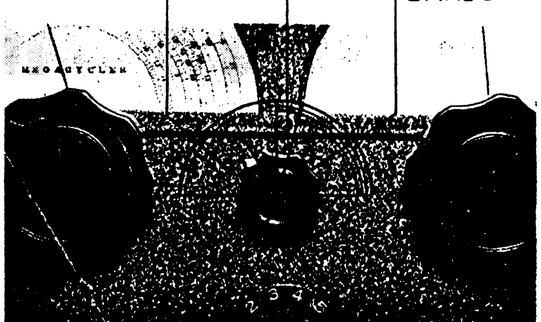


FIG. 5

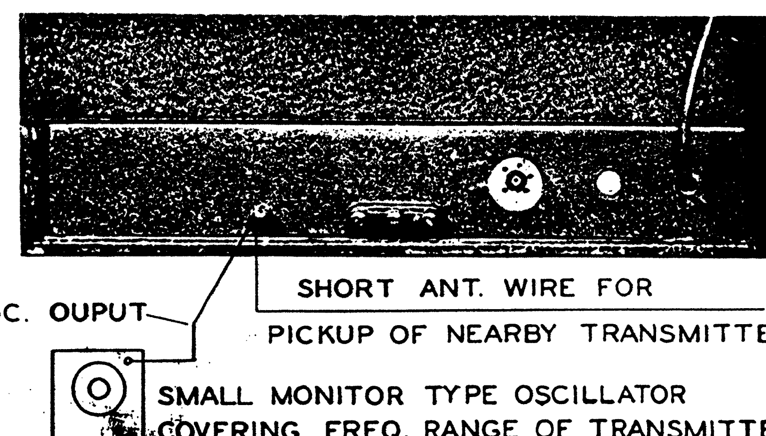


FIG. 6

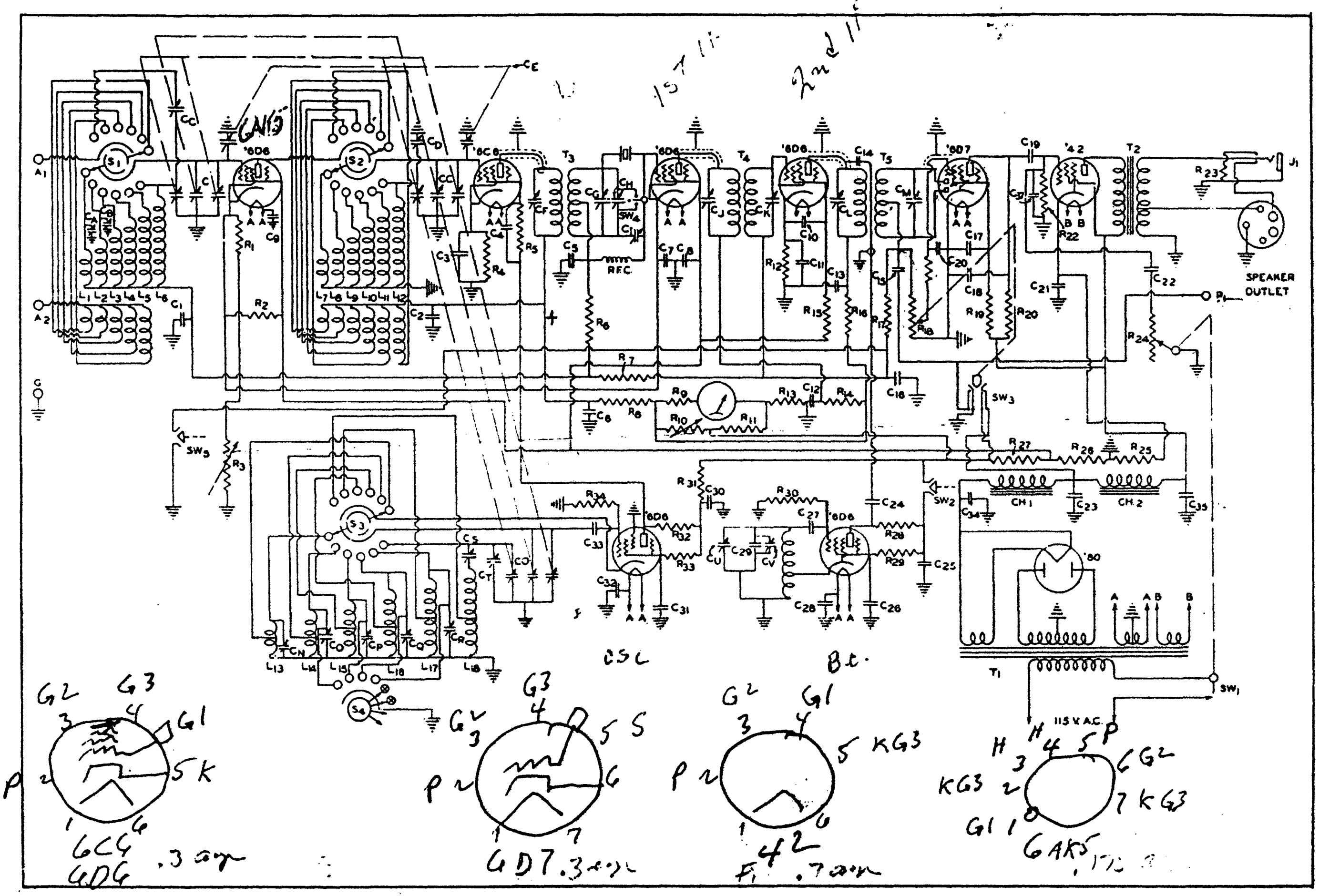


Fig. 12. Schematic Diagram of RME 69 Receiver

INSTRUCTIONS FOR INSTALLATION AND OPERATION OF THE RME-69 RECEIVER

INTRODUCTION

The material and information compiled in the following pages has been gotten together for the purpose of providing the user of an RME-69 Receiver with the maximum receiver performance, and for the purpose of informing him as to some of the whys and wherefores regarding the care and operation of his receiver. The information contained herein will be found to be useful and should be read through thoroughly in order to avoid misunderstanding and incorrect procedure insofar as the operation of the receiver is concerned.

It embodies the results of several years of observation which has been made in a great number of varied installations and a number of the points which have been emphasized are those which are most frequently the source of some misunderstanding. Although it is usually rather boring to carefully peruse printed matter of this type, it will be found in all cases to pay dividends where the instructions and the information contained herein have been thoroughly digested. Approximately seventy-five percent of all the difficulties which have been called to our attention regarding the operation of these receivers can be directly traced, not to the receiver, but to misunderstanding on the part of the user as to the exact function of the various components of the receiver.

This is a direct result of failure to read the instruction book thoroughly. We hope that you will be rewarded by your conscientious following of the instructions given in this book and also that you will find adequate information for the proper procedure in making minor adjustments should such be necessary.

ANTENNAE FOR RECEIVING

The installation of the RME-69 Communication Receiver is a comparatively simple process, but care should be taken to see that certain rules are observed. Principal among these requirements for proper installation of any sensitive receiver is the positive nature of all external connections, namely antenna and ground or doublet feeder. Wherever junctions in the wire circuits occur, positive contacts should be assured. Loose and variable poor contacts are a great source of noise and every effort to positively eliminate them should be made.

Antennae for receiving have come into considerable neglect regarding attention to their length and location. The receiving antenna is as important as the transmitting antenna. When it receives the same consideration it pays dividends in the form of reliable and improved reception. A sensitive receiver such as the RME-69 will pick up with seemingly good signal strength foreign stations on from five to ten feet of wire as an antenna when these stations are laying a reasonably strong signal in the vicinity of the receiver, but this is no reason for using such a length [illegible] recommended that an antenna of the

Marconi type, forty to forty-five feet in length (measured from the receiving post to the remote tip of the antenna wire), be used in conjunction with a good ground and that this wire be placed as much in the clear as possible.

A doublet type of antenna might be used also, having the proper wire length on each side of the twisted pair line used to supply the antenna energy to the receiver. Sketches in Figure 1 show various methods for connecting various forms of antennae. The antenna should be located in a space which insofar as possible is free of metallic objects, numerous wires, buildings (especially those of a structural steel construction) and dense foliage. It should also be placed at the greatest possible distance from electric wiring in order to prevent the transfer of disturbances from the wiring to the antenna. These disturbances are especially noticeable on the shorter wave lengths. And thus all efforts to isolate the antenna and lead-in insofar as these wiring circuits are concerned will be well repaid in better reception.

The installation of the antenna should be attended to with the same diligence that is applied to working with any high frequency circuit. Extraneous noises of the "static" effect of poor installation will thus be avoided.

There is no substitute for a tuned antenna. Tuned antennae, however, offer a maximum of efficiency over a very narrow range of frequency. The range of frequency in actual kilocycles becomes greater as the frequency becomes higher. It is therefore possible in the amateur band to locate the tuned point of an antenna at approximately a mid-band position. For example: an antenna which is tuned to 3750 kilocycles will be quite efficient over the whole 75 meter amateur band. That is, from 3,500 to 4,000 KC. The coverage efficiency becomes greater as the frequency goes up so that on 14 mc. an antenna tuned to 14,200 KC is a very fine and efficient antenna for all frequencies in the amateur 20 meter band. For general coverage where it is desired to tune a number of different bands and where space provides, it is always advisable to provide specially tuned antennae for those bands in order that the greatest amount of signal strength may be built up for supplying the receiver.

The antenna input impedance to an RME-69 Receiver varies in the vicinity of 250 to 350 ohms. The antenna supply should therefore be of the Marconi type which is fed at current maximum to the receiver or of the twisted pair type where impedances of lines involved are in the vicinity of the 250 ohms previously mentioned. For maximum selectivity insofar as the input circuit is concerned, the value of this impedance should be taken into account. Antennae which are supplying the receiver signal at a high potential point should not be used in conjunction with the RME-69 Receiver because of the great loss in voltage transfer encountered in such a combination. The half-wave doublet type of antenna providing a tuned antenna system for a certain range of frequencies has certain marked directional characteristics. These directional characteristics are evident in the fact that to the axis of the antenna, forming in effect a Figure 8 pattern in which the lobes are located off the sides of the antenna instead of off the ends.

This sometimes is of great advantage where a great deal of interference lies in direction off the end of the antenna. Where, however, it is desired to receive in all directions this can be remedied by erecting the antenna in a vertical position. It then has a circular pick-up pattern and receives well in all directions. If the antenna is located at a distance from the receiving position and fed by a twisted pair balanced type of line to the receiver it may be located in an "interference-free" location and the feeder line may run through the area in which the interference is present providing an efficient interference rejection system due to the fact that the antenna is remote from the source of such disturbance.

If it is desired to go into the matter of receiving antennae to a greater extent, it is suggested that the operator consult any of the numerous textbooks on the subject in addition to several recognized Amateur Radio Handbooks.

CONNECTING THE RECEIVER AND GENERAL PROCEDURE FOR TUNING

The Radio Manufacturing Engineers manufacture several types of receivers insofar as the input to the power supply is concerned. These vary in voltage from 110 volts to 250 volts and in frequency from 25 to 60 cycles. The standard receiver is designated as the RME-69. This receiver is supplied in frequencies and voltages mentioned. Whenever the power supply is designed for a voltage and frequency other than 110 volts, 50 and 60 cycles, the required line voltage and frequency is given on a red tag fastened to the service cord of the receiver. In addition to this a stamped aluminum plate is fastened on the rear of the receiver chassis and is visible from the rear of the receiver.

On this plate is stamped the model, the serial number, and the voltage and supply frequency for which the receiver is designed if it is designed for other than 115 volts, 50 and 60 cycle. It is well therefore to examine the above mentioned position for this name plate and if one is present to note the voltage and supply frequency for which the receiver is intended so that no damage will be caused the receiver due to incorrect line voltage or frequency. A receiver which is designed and constructed for use on a 115 volt, 25 cycle supply will operate satisfactorily on any 115 volt supply, having any frequency of 25 cycles or higher. It is not possible, however, to operate a receiver intended for 115 volt, 50 to 60 cycle supply, on 25 cycles. Therefore, it can be seen that it is essential that the frequency and voltage of the service in the particular location in which the receiver is to be used should be known, and this should be identical with the line voltage and line frequency for which the receiver is intended, except in the case of the interchange between the 25 and the 50 cycles as just mentioned. When the user of the receiver has made certain that the line voltage available and its frequency coincides with the voltage and frequency or just before the time at which the service cord is plugged into the receptacle, it should be made certain that the line switch control "A" (Figure 2) should be turned in the maximum counter-clockwise position which is the turn-off position of the receiver.

When this has been done, arrangements should be made for connecting the proper speaker to the receiver. Reference to Figure 3 will give details for proper connection and will suggest the proper method and the place to connect the speaker. As indicated, two output impedances are available. One 4,000 ohm for use with ordinary speaker output transformers and the other 600 ohm for use in feeding low impedance lines. The speaker which is supplied on order by Radio Manufacturing Engineers, is designed to work out of the 4,000 ohm supply connection. This speaker is designed to give the best possible results in conjunction with an RME-69 Receiver audio system. The speaker itself is an eight inch dynamic type of reproducer which has its own field supply in the form of a large permanent magnet. This speaker is supplied with a cord and plug properly wired so that it is necessary only to plug it into the speaker socket provided on the receiver. Receivers supplied without speakers are shipped with a suitable plug for making proper speaker connections to other types of speakers. When this speaker is supplied in the flare baffle of small dimensions for use in communication work in connection with the receiver, the reproduction is not intended to be wide range and of the type called high fidelity. It will, however, be found to be an excellent reproducer of the human voice and in communication work this is the most requisite feature of the reproduction. If it is desired to obtain wide range fidelity, the speaker can be mounted in a large baffle made up of dead material such as fibre board or Celotex or the equivalent and it should be at least four feet square with the speaker mounted in the center. With such a device, the audio reproduction possible with the RME-69 Receiver will be fully realized and the maximum of audio fidelity will be obtained.

When the speaker circuit has been taken care of, it would be well to examine the receiver to see that all the tubes are in their places and that the auxiliary packing material inserted within the cabinet of the receiver to pad up various shields and parts of the chassis is carefully removed.

A glance at the photograph (Figure 4) will show the position of the various tubes required in the receiver. If the receiver has been ordered without the tubes and they are to be installed at the same time the receiver is connected for use, the line drawing in connection with photograph in Figure 4 will indicate the socket locations of the respective tubes. The person who installs the tubes should make sure that they are well down in the sockets, that the grid connectors, if used, are snugly placed on the grid cap, and that the shields for the various tubes are tightly in place and have their caps properly placed. We recommend that whenever possible the purchaser of a receiver should order the instrument with tubes so that maximum possible results are assured.

After the most economical and suitable arrangement insofar as an antenna is concerned has been selected it should be connected to the receiver in the fashion indicated in Figure 1.

Control "B" should be set to a position equivalent to "O" as indicated in Figure 2A. The switch "I" which controls the beat frequency oscillator for telegraph reception should be set in the "off" position as indicated.

The receiver is now ready to turn on. The indicators on Knob "C" and "E" should be placed in an upright position so that they point directly to the knob above them. The knob "G" is used to select the frequency range through which it is desired to tune. The full range of the receiver (550 to 32,000 KC) is tuned in six steps. The common broadcast band or frequency range from 550 to 1500 KC is covered on Tap No. 1 of the range switch "G". Designation given just above may be used by referring to the photograph in Figure 2A. The table below gives the taps in consecutive order as indicated on the escutcheon plate of the Range switch "G", and opposite number is the frequency range which may be covered by setting this range switch to the number indicated.

SWITCH POSITIONS	TUNING RANGE IN MEGACYCLES
1	.55--1.5
2	1.5--3.1
3	3.1--6.8
4	6.8--13.0
5	13.0--20
6	20--32

Note: Actually these figures do not represent the complete range of each band since there is a generous over-lap between the stopping of one band & the starting of another.

It will be seen from a glance at the main tuning control marked "Main Tuning Dial No. 1" (Figure 2A) that the frequency range is divided up frequently so that very accurate calibration can be utilized to the fullest extent. For a preliminary test of the receiver and in order to familiarize the operator with the operation and performance of the device, it might be well to set the band switch "G" to position marked "No. 1" on the position plate of this switch. Following this, the band-spread control so marked on the scale and designated on the layout of the panel in Figure 2A as Dial No. 2 may be set to a reading of 180 on the band-spread dial. When dial No. 2 is so set, the calibration as indicated on the scale of Dial No. 1 is correct.

After making this setting just described, snap on the Line Switch "A" and turn to a maximum clockwise position. This will require approximately 270 degrees of rotation after the snap of the switch is heard. This operation connects the power supply of the receiver to the 110 volt line or whatever supply it is and also rotates the tone control to a position of natural reproduction. If the switch control "A" is left in a position just beyond that of the snap of the line switch it will be set for maximum bass response and minimum high frequency response. During operation of the receiver, if it is desired to decrease the high frequency response of the audio system of the receiver, it is only necessary to rotate the control "A" counter-clockwise from the maximum clock-wise position to a point where the reproduction meets with the approval of the listener.

It will take ten or fifteen seconds for the heaters of the various tubes to come to the operating temperature. While this is being awaited, the control "F" should be examined and tested for its position. This control for the initial check of the receiver should be placed in a maximum clock-wise position which is in the "off" position insofar as the snap switch in tandem with it is concerned.

It is also well during the warm-up period to pull the control "H" outward. This removes the plate voltage from the RF and IF amplifier tubes and the R meter. During the warm-up period the meter will real off-scale if the control "H" is permitted to remain pushed in toward panel. While no damage or any bad effects whatsoever can occur so far as the meter is concerned by reading off-scale, it is well not to allow it to rapidly swing with an impact against the pegs to the right off-scale when the receiver is first warming up and the tubes are not drawing any current whatsoever. The pulling of the control "H" outward and leaving it there during the warm-up period permits the meter to rest out of the circuit until the components of the receiver come to a stable operating condition. In fact, the normal operation of the receiver or rather its readiness for functioning are indicated to a great degree by the return of the meter indicator to zero with no signal coming in.

Control "H" may now be rotated in a clockwise direction after it has been pushed in toward the panel as far as it will go. This increases the input to the audio amplifier, and therefore allows reproduction should a signal be coming in on the antenna. By turning the control marked "Dial No. 1" to the various frequencies indicated on Scale No. 1 of Dial No. 1 (it will be remembered that the switch "G" was set to No. 1 as an initial setting) various broadcast stations may be received, depending upon their signal strength at the particular time and in the location in which the receiver is being used. In order to convert the calibration numbers in this scale to kilocycles it is necessary only to move the decimal point three places to the right in each case. Example: Pointer is set to the calibration number marked .7 on Scale No. 1 of No. 1 control dial. By moving the decimal point three places to the right we get 700 which is a frequency in kilocycles of a broadcast station. In other words, .7 megacycles is equivalent to 700 kilocycles. One megacycle is equivalent to 1,000 kilocycles and 3.5 megacycles is equivalent to 3,500 kilocycles. These examples are stated in case the listener is accustomed to determining frequencies in terms of kilocycles. It may make it more simple for him in the case of this receiver where the calibration is indicated in the terms of megacycles. The calibration of radio receivers has been standardized and the standard calibration is in terms of megacycles. As a general rule if the former method for changing megacycles to kilocycles does not appear convenient, a simple fact may be remembered, and it will materially assist in the conversion. This fact is that 1,000 kilocycles are equal to one megacycle.

The control "D" should be adjusted following the selection of a station on Dial No. 1 to a point where the signal strength as indicated on the carrier level meter is a maximum. This adjustment should preferrably be made on a station in the high frequency end of the broadcast band since here the control adjustment is most critical and will therefore be most satisfactory over the entire range. It may also be well to make certain that the control "E" is adjusted to peak efficiency. This fact can be determined by turning it slightly from one side of the vertical to the other side, noting the reading of the "R" meter on a steady signal. All adjustments should be left so that they provide the maximum possible "R" meter reading provided by their respective adjustments.

The volume control "H" has no effect whatsoever on the level reading of the meter. However, if it is pulled out, it removes the meter from the circuit. The meter indicates continuously the average level of the carrier being received. A paragraph will be presented later in which the action of the meter and some of its uses will be fully described.

The various portions of the receiver circuit will be taken up in the following paragraphs separately. Their function, method of control, and results to be expected will be fully set forth in these paragraphs to follow.

BAND-SPREAD

The band-spread control on the R.E-69 receiver is a very valuable feature. Band-spreading in the RE-69 is accomplished by control of Dial No. 2. The scale is calibrated in uniform units from zero to 180. When the indicator is at the designation 180 on the scale, the band-spread condenser is at a minimum capacity or a highest frequency position. As before mentioned, when the band-spread indicator is in position indicating 180 on the scale, the calibration of the receiver is correct as indicated on Dial No. 1. If the band-spread indicator is set to a lower number on the band-spread scale than 180, the actual tune of the receiver is somewhat lower than that indicated by the calibrated scale of Dial No. 1.

Band-spreading is used chiefly in communication work where it is desired to continuously scan a rather narrow range of frequencies,--for instance, one amateur band. This can be accomplished easily and effectively by setting the indicator of Dial No. 1 to the high frequency limit of the band through which it is desired to tune. Leaving Dial No. 1 set at this high frequency limit of the desired band, the band-spread indicator of Dial No. 2 may be varied and as the indicator rotates to indicate the lower numbers on the scale, the frequency of tune of the receiver lowers. In other words, the numbers as indicated on the band-spread scale of Dial No. 2 are somewhat indicative of the correct of t... ... frequency is concerned ...

the indicator is passing from the lower numbers to the higher numbers, the frequency is increasing, and when the indicator is being rotated so that it passes from a higher reading on the scale to a lower reading, the frequency of the receiver is being lowered. The following example as a suggestion for setting the band-spread indicator may be of some assistance in illustrating the statements made just above: Let us assume that it is desired to cover the so-called 75 meter amateur band. This band is bounded in frequency by 3.5 megacycles on the low end and by 4 megacycles on the high end. In order to effectively band-spread this region, it is necessary to set Dial No. 1 to 4 megacycles. When the band-spread scale is set to 180, the frequency to which the receiver is tuned is then four megacycles. As the knob of Dial No. 2 is rotated so that the indicator passes to the lower numbers on the band-spread scale, the frequency of tune of the receiver is lowered so that when the indicator reaches the region of ten or zero on the scale, the low frequency limit of the 75 meter amateur band has been reached, and the band has been covered in the sweep of the bandspread indicator.

On certain of the high frequencies, the coverage is greater than one amateur band. It is therefore satisfactory in the case of the amateur 40 meter band and the amateur 20 meter band to set the indicator of Dial No. 1 to a frequency slightly higher than the upper limit of the respective amateur band just mentioned. In the case of the 7 megacycle amateur band, or what is familiarly known as the 40 meter band, it is satisfactory to set the indicator of Dial No. 1 to a reading of 7.4 megacycles. Passage of the indicator of Dial No. 2 from a reading of 130 to zero will then pass into and cover the entire 7 megacycle amateur band.

In the case of the 20 meter amateur band or what is called the 14 megacycle band, it is satisfactory to set the indicator of Dia l No. 1 to a reading of 14.5 megacycles which is slightly higher and outside on the high end of the amateur band. By rotating the knob of Dial No. 2 and causing the indicator to pass from 180 to zero on the band-spread scale, the amateur band is approached on the high end as the numbers lower on the band-spread scale and the actual frequency of tune will pass to a frequency outside the amateur band on the low end. Various methods of setting the Dial No. 1 can be used. That which appeals most to the operator of course is the most advisable to use. It happens that certain definite broadcast frequencies coincide in a position insofar as the indicator on Dial No. 1 is concerned with certain of the band limits or do so approximately. For instance, the frequency of broadcast stations around 680 to 720 kilocycles sometimes provide very effective marker signals for setting the Dial No. 1 for band-spreading amateur bands. Some operators use this system. However, it will be found that the control of Dial No. 1 can be set so that the indicator is either set to one side or the other of a given line on the calibrated scale and the band-spread control will be found to be within a half or one division of the signal which it was desired to set to.

It will be found that the receiver warms up slightly as operation continues. This causes a slight change in the frequency of calibration. This may amount to approximately 8 kilocycles at 15 megacycles during the first twenty minutes. Receiver calibration is correct after the receiver has warmed up to the point just mentioned. All logging therefore should be done at the stable operating temperature. A radio receiver, the same as any other device which encounters variable temperature, changes its mechanical dimensions to a certain degree and also some of its electrical dimensions when changing from the cold condition to the normal operating temperature. In view of the fact that these receivers are not kept at constant temperature, this change will produce certain changes in the tuned frequencies. However, due to proper selection of component parts and adequate ventilation and rigid construction, the drift in the RME-69 Receiver has been kept to a very practical minimum. There is no such thing as a receiver incorporating a heterodyne oscillator which does not drift to some degree or other.

THE QUARTZ CRYSTAL FILTER FOR RECEIVING

The quartz filter is used to great advantage in a specially designed circuit in the RME-69 Receiver. Before describing the procedure for correct operation of the receiver with the crystal filter switched into the circuit, it is advisable to make some comments regarding the quartz filter in general.

The quartz filter is in effect a very selective tuned electro-mechanical circuit. Due to its extreme merit as a selective circuit, it produces frequency discrimination of marked degree over a very narrow range of frequency. When this filter is used in communication work in receivers with which it is intended to receive continuous wave telegraph signals, the apparent signal output of the receiver so far as the ear is concerned is not diminished when the receiver is so adjusted that the intermediate frequency produced by the signal and the heterodyne oscillator is in exact tune with the crystal frequency. In the case of CW reception, we are dealing only with one frequency. That is the carrier, which in a succession of selective circuits is finally changed to a lower frequency, generally the intermediate frequency of the receiver.

It still, however, retains its original identity insofar as the single frequency nature is concerned. The quartz filter deals very effectively with such a single frequency, permitting it to pass unattenuated through the intermediate frequency amplifier. Frequencies slightly different, say 400 cycles different than this frequency, are materially reduced. In congested amateur bands the merit of such a system is quickly realized. Communication, however, is carried on by other means, principally telephone. The use of the crystal filter in telephone reception is again very valuable. Although in general the audio output of the receiver is greatly reduced when using the crystal filter with the quartz filter in the series position in the bridge, it is usually possible to bring through signals otherwise entirely masked by heavy interference.

... amateur reception today the principal object may be called a desirability for intelligence, not how perfect or how strong the signal can be brought in. This is of course with reference to highly congested frequency bands. If it is desired only to get the intelligibility of a signal which it is in the case of extreme QRM and it is not necessary to get high fidelity, the quartz filter can be used to great advantage on telephone reception. The carrier itself during reception with the crystal filter is not reduced as can be demonstrated easily by reading the "R" meter on a given carrier with the crystal filter in and then with the crystal filter switched out of the circuit. Further reference to this fact will be made later in this discussion.

In view of the uses to which the series crystal may be put and which are outlined in the preceding paragraphs, it can be seen that the incorporation of the characteristics of the series crystal circuit in a communication receiver is highly desirable. The RME-69 receiver includes an improved crystal bridge circuit which provides smooth control of selectivity and phasing adjustment at all times. Position "O" indicates the "off" position of the crystal filter. In other words, when the pointer on the phasing control knob "B" is set to position "O", the crystal filter is not operating, and the receiver intermediate frequency amplifier possesses a normal transformer selectivity.

By turning the knob "B" slightly clockwise from the position "O" the crystal filter is switched into the circuit and variable degrees of phasing are obtained. The selectivity of the pass band of the crystal filter can be somewhat broadened by variation of the control "E". The use of both the phasing and the selectivity control is due to the nature of the quartz crystal. The quartz crystal is an electro-mechanical resonating device which has an electrical equivalent equal to two arms of a parallel circuit.

One of these arms is a series circuit, and the other arm is a single reactance. Such a network has two distinct frequencies of resonance--one which provides anti-resonance or acts in effect like a parallel circuit and the other arm consisting of two reactances of opposite signs in series which in effect produce a series resonance circuit. The frequencies of resonance of the two circuits are very closely placed with respect to each other, and by varying the parallel reactance of the network, the anti-resonant frequency can be slightly altered by a few cycles either way from normal anti-resonance frequency. Due to the fact that the phasing control not only balances the bridge but when it unbalances it reflects a slight amount of reactance across the parallel equivalent circuit of the crystal, phasing control can also perform the duties of shifting the anti-resonant frequency of the crystal bridge so that it may be possible to use it for rejection purposes in the case of closely adjacent interfering heterodynes.

For an example, let us switch the receiver on and turn the crystal phasing condenser control "B" slightly to a clockwise position of the position marked "O" or "off", and with the selectivity control "E" allowed to remain in its peak condition as indicated by maximum response on the meter with the crystal in the off position, tune to a signal in one of the crowded amateur bands so that this signal produces a peak meter reading on the meter indicating exact tune to the crystal.

If this is made at one of the higher frequencies it will be absolutely necessary to use the band-spread control because of the exactness required in tuning.

There will probably be a heterodyne faintly audible due to the presence of a station close to the station being received. By continuing rotation of the phasing control "B" on in a clockwise direction, a minimum in background noise and in interference from adjacent channels will be noticed as the signal afore-mentioned is kept in exact tune, a condition which can be maintained by proper adjustment of the band-spread tuning control of the receiver.

If, under these conditions, a slight heterodyne is audible, rotation of the phasing control one way or the other (whichever may be required) will cause a noticeable drop in the intensity of the heterodyne signal. The phasing control should be left at a point where this heterodyne signal or whistle due to an interference on the carrier selected is a minimum.

If, however, there are two stations causing heterodynes, --in other words, two distinct heterodynes interfering with the desired signal,--it will be impossible of course to eliminate both of them since each one of them will probably require slightly different adjustment of the phasing control, and, obviously, only one setting of the phasing control can be made at a time. Sometimes if these two frequencies causing the heterodyne interference are close to each other, a compromise setting of the phasing control may be possible to reduce both of them.

Theoretically, of course, it is impossible to absolutely eliminate all interference since attenuation quantitatively has a finite value. Therefore, it is possible only to reduce the interference by a certain amount. Therefore, depending on the strength of the signal, some of the interfering signal is bound to reproduce in the speaker. When it is, however, caused to be lowered to such a low value that it is insiginificant insofar as interference is concerned, and if it is possible to bring the desired signal to a point 100 times that in intelligibility and sound intensity as compared to an interfering signal, the performance of the crystal filter may be said to be satisfactory.

In telegraph reception it is possible to make even a greater distinction between the desired and the interfering signal than that value just mentioned. With particular reference to the crystal filter of the receiver being described, one fact may be mentioned as of prime importance:

IT IS VERY SELDOM POSSIBLE TO TUNE IN A SIGNAL, EVEN THOUGH IT IS ADJUSTED TO PEAK METER READING, AND THEN SWITCH THE CRYSTAL FILTER INTO THE RECEIVER CIRCUIT AND HAVE THE SIGNAL RESONANT OR RESPOND AT A MAXIMUM THROUGH THE CRYSTAL FILTER. THIS IS DUE TO THE FACT THAT THE NARROW ACCEPTANCE RANGE OF THE CRYSTAL FILTER IS SO SMALL AS COMPARED WITH THE TOTAL CHARACTERISTIC RESONANCE OF THE RECEIVER THAT THE PROBABILITY OF BEING ABLE TO LAND EXACTLY ON THE CRYSTAL RESONANCE REGION IS VERY REMOTE. IT CANNOT, THEREFORE, BE STRESSED TOO STRONGLY THAT IT IS NECESSARY WHEN USING THE CRYSTAL FILTER FOR SELECTIVE PURPOSES TO TUNE THE RECEIVER WITH THE CRYSTAL [illegible] THE CIRCUIT [illegible] PROPERLY MADE.

FACT IS NOT GENERALLY APPRECI[illegible] ECTED WILL NOT PRODUCE THE PROPER DEGREE OF SELECTIVI[illegible] ACCURACY OF ADJUSTMENT WHICH IS NECESSARY FOR PROPER OPERATION OF THE CRYSTAL FILTER.

Below control "B" control "E" controls the selectivity of the crystal filter. In other words, it is possible to broaden out the pass band of the crystal filter by as much as four or five times by a slight variation of the control "E". The effects of this broadening can easily be noted by tuning in on a signal and setting the control "B" for maximum selectivity and varying the control "E". An increase and a decrease in adjacent channel noise will be noticed as the control "E" varies the width of the pass band of the crystal filter. It is possible to broaden out the crystal characteristics so that at a point it may be four times as broad as it is in the maximum selective position. This sometimes is valuable in phone reception for providing a maximum of intelligence when interference conditions will permit.

After a period when the crystal filter has been used, and especially after the control "E" has been varied for changing the selectivity of the crystal, when the crystal circuit is again switched to the "off" position and the receiver is used in normal fashion, control "E" might well be checked for correct adjustment indicated by maximum meter reading on a given signal.

THE RESONATOR CONTROL

The resonator control provided on the RME-69 (Figure 2A, Control "D") is very valuable in that it allows the operator to continually peak the receiver insofar as the alignment of the RF and detector tuned circuits are concerned. It is advisable to check the position of this resonator for any band of frequencies being tuned so that maximum meter reading on a given signal is provided. It has no effect on the tuning of the receiver insofar as changing the frequency or calibration of the receiver is concerned.

The control "D" has an aluminum indicator pointer mounted on it and when the receiver leaves the factory this pointer is set so that when the condensers which compose the resonator assembly are set at half mesh, the pointer is exactly vertical and points toward the bearings of the carrier level meter. It will be found in the broadcast band that this pointer will read considerably to the right of center, and for the most part almost horizontal to the right. This same position over a sector approximating 45 degrees in the right hand quadrant will be found to be the correct area of variation for Band 2, and 3, and 4. On band 5, it will be found that the indicator will read in the left quadrant or with the indicator of control "D" close to the left hand horizontal position. It will also be found that on switch position 5, this resonator can be set almost horizontally to the right, a false setting, so that another apparent reception point of maximum signal strength is reached. This is due to the fact that at the frequency used when the switch is set to position 5 the resonator can almost approach the tune of the image frequency, and the build-up in background noise as well as signal when the resonator control "D" is set horizontally to the right is almost the exact resonance point for the image. It is set in the position indicated in the above sentences which is in the position to the left of vertical, and almost horizontal or within an angular variation of zero to 45 degrees up from the left horizontal position when tuning band 5.

For switch position No. 6 it will be found that the indicator pointer has its optimum setting approximately 45 degrees to the right. Since it is possible also on switch position No. 6 to tune to the image by use of the resonator knob, it should be set so that the calibration of band No. 6 is correct. This is always the stand to take regarding the resonator control. If for instance a high frequency broadcast station is received in the 14 megacycle region with considerable signal strength, the resonator is not set right since it should not occur there because of its misplaced frequency. The calibration of the RME-69 will remain very close to its correct calibration over long periods of time. Even then, when it shifts it shifts very little. It is always safe therefore to assume that the calibration is very close to being correct.

All settings of control "D" should be left so that they provide maximum signal as indicated by the reading of the carrier level meter and that at the true frequency. Figure 5 shows control "D" and approximate region of variation for various frequencies.

THE BEAT FREQUENCY OSCILLATOR FOR TELEGRAPH RECEPTION

The beat frequency oscillator in the RME-69 is an electron coupled oscillator and the circuit employs a separate tube for generating the beat frequency. The control of the beat oscillator insofar as placing it in operation is concerned is vested in control "I" which is a toggle switch located on the lower right hand corner of the panel (Figure 2"A"). Its panel position on special model receivers varies. (See Figures 2B, 2C, and 2D)

An escutcheon plate marks the "on" and "off" position. It can easily be placed into operation by placing the toggle lever to the position marked "on". Its use for telegraph reception need not be discussed since it is the only method of converting the continuous wave telegraph signal to an audible note. It further has the advantage of being able to locate very weak carriers that otherwise may not be audible by producing a beat note at the frequencies at which they are being received.

When the receiver leaves the factory, the control "C" which controls the pitch of the CW beat oscillator has an aluminum indicator pointer set in a vertical position pointing directly to control "A". This is the zero beat position or approximately so. Turning this control to the right or clockwise 90 degrees raises the beat frequency 4,000 cycles. Changing it to the left or counter-clockwise 90 degrees from the vertical lowers the frequency an approximately similar amount. It is therefore possible by merely changing the control "C" to vary the pitch of the beat note and do it on either side of the frequency of the signal. It will be found that judicious use of control "C" will provide sometimes effective means for providing the most suitable tone of the signal being received for breaking through disagreeable QRM. It is possible when using the beat oscillator to use either the automatic volume control or the manual volume control.

It will be found that for ordinary speeds of keying the automatic volume control will operate satisfactorily. However, it is recommended that the manual gain control be used in order to keep the receiver free from surging, especially if the keying frequency approximates the time constant of the automatic volume control circuit.

The manual gain control can be placed in operation by turning the control "F" slightly counter-clockwise. This operation operates a switch which removes the automatic volume control from the circuit. Continued rotation counter-clockwise of the control "F" reduces the gain of the receiver manually. Since the meter is controlled by the gain of the receiver, anything which changes the gain of the receiver will make the meter change its reading. Therefore, counter-clockwise rotation of the manual gain control "F" is productive of increased carrier level meter reading, indicating lower receiver gain.

The control "F" in conjunction with control "H" will provide the optimum value of RF signal as compared to audio output and provides a very smooth and efficient means of getting a full-bodied audio tone with a given telegraph signal. The control "F" can also be used of course in telephone reception when a strong telegraph signal is a few cycles displaced from a desired telephone signal and produces the effect that the keying chops up the voice due to the varying sensitivity of the receiver caused by the strong telegraph signal operating the automatic volume control. Such a condition will usually bring out the full intelligence of the phone signal if the beat note caused by the telegraph signal heterodyning the phone signal is not too objectionable. This is another important use of the manual gain control.

THE HEADPHONE JACK

During certain periods it is oftentimes desirable to dispense with the loud-speaker reproduction. During such periods the insertion of a pair of headphones with a suitable plug will eliminate the loud-speaker reproduction and provide reception on headphones. The jack for this purpose is located in the lower left corner of the front panel of the receiver. Any good pair of headphones is recommended for this use.

A loading resistor is provided across the jack so that most of the power is absorbed in the resistor. It will be found that the headphone reception on the RME-69 is of very excellent quality and can oftentimes be used to great advantage in the location of weak DX signals.

THE MONITOR CIRCUIT

An audio frequency monitoring circuit of rather good fidelity has been built into the RME-69 Receiver. The operation of this circuit is obtained by pulling the knob

"H" outward from the panel. The input for the monitor circuit is supplied by connection of a small piece of wire to a terminal marked on the illustrated photograph (Figure 3). The length of this wire is determined by the relative power of amount of radio frequency energy circulating in the immediate vicinity due to the local transmitter. It will usually be found that ten or twelve feet of wire lying over close to the transmitter in the room will be quite sufficient for proper operation of this monitor circuit. It must be stated here that the monitor is unsuitable for monitoring CW signals unless an external oscillating monitor is provided. (For constructional details see any amateur radio handbook on the subject.) For method of connection see Figures 3 and 6. The rotation clockwise of the control "H" while it is pulled out in the monitoring position determines the audio level of the monitor. It must be realized that if a microphone is being used to modulate the transmitter headphones are necessary for listening to the monitor output since a loudspeaker will produce acoustic feedback.

If, however, modulation originates in a phonograph disc or in another receiver a loudspeaker can be used. Any acoustic device, however, will require the use of headphones for listening purposes. It may be found that if the receiver is set to a switch position which places in the circuit the band in which the frequency of the transmitter is located, the antenna picking up considerable transmitter energy will produce a blocking of the radio frequency stages and hence of the diode used as a rectifier for monitoring purposes so that it will be necessary to switch the control "G" to some other switch point. This can be determined if by listening to the local modulation a muffling occurs or a lack of modulation is evident in the audio reproduced by means of the monitor circuit. A procedure which will always permit operation when any doubt occurs as to whether or not this is taking place consis ts of turning the control "G" to the position No. 1 or the broadcast band, or switching on the manual gain switch operated by control "F".

ADDITIONAL INSTRUCTIONS FOR OPERATION OF RME-69 RECEIVERS WITH LS-1 NOISE SUPPRESSORS BUILT IN.

Radio Manufacturing Engineers have designed and are manufacturing a unit which is especially dimensioned for direct installation in the RME-69 Receiver. This unit is a small sub-chassis which is arranged to plug into the sockets formerly occupied by two 6D6 intermediate frequency amplifier tubes. Their removal permits the installation of the accessory unit.

These units may be installed in the receiver when it is being fabricated from the original order or it may be installed at the factory for a nominal charge. It is not supplied separately as a unit since it has been found that for careful readjustment of the receiver with the unit installed definite experience and a certain amount of equipment is required and these are not usually found in the possession of the average operator of the receiver.

This suppressor unit is of the ultra rapid automatic volume control type which operates on the pulses of short duration. In view of this fact, it is quite effective in combatting the staccato interference of automobile ignition and of atmospheric static whose response is of the same type as automobile ignition interference. Several other types of interference can also be dealt with but in the main those are the principal types of interference which yield to treatment insofar as the suppressor is concerned.

It can in no way be inferred that the noise suppressor or anything similar to it can be used to eliminate all types of noise. In fact, it is not intended to eliminate the noise, but merely to reduce it. In this respect it is quite effective on the very high frequencies where automobile ignition interference is sometimes quite heavy. One noticeable feature is the fact that during the suppression of the high rough peaks of noise a constant high frequency hiss is produced. It is generally acknowledged that this high frequency hiss resultant from the suppressor action is considerably less objectionable than the rough blanketing staccato response of automobile ignition interference or atmospheric static.

In cases of extremely strong signals, the suppressor will not be necessary since usually in such cases the ratio of signal to noise is such that the noise is pushed into the background. Due to the nature of the circuit a wide range is usually not satisfactory so that on the strong signals peculiar results may be observed if it is attempted to place the suppressor in the circuit.

General instructions for the control and operation of the receiver with the suppressor built in are far from being involved. Reference to controls may be easily followed by a glance at Figure 2B which shows the front panel of an RME-69 Receiver with the LS-1 noise suppressor built in. It will be noticed that the CW beat oscillator switch "I" has been changed from the lower right hand corner to a position just under the headphone jack. In place of the control "I" a control designated "J" has been installed which is a knob bearing a pointer behind which is a scale marked in units from 0 to 100 over 270 degrees of arc. This control adjusts the threshold at which suppression begins.

When it is set at a reading of 100, the receiver operates in an entirely normal fashion and the suppressor is not active. As the scale reading is reduced toward the zero end of the scale, or counter-clockwise rotation, the threshold at which suppression begins is lowered. Depending upon the signal strength and the intensity of the noise, suppression will occur at a very low number for very weak or low noise and at a high noise level suppression may begin at a reading of approximately twenty or twenty-five on the scale.

There will be found a considerable difference between the operation of the suppressor when using telephone as compared with the operation of the suppressor when the receiver is used in connection with telegraph reception. For telegraph reception, the operator is dealing with one frequency which is the carrier of the telegraph station.

When receiving telephone reception, the operator is not only dealing with the carrier, but he is also dealing with modulation peaks which represent instantaneous carriers of twice the average value.

In order to permit undistorted and unattenuated signal response it is necessary to set the suppressor control so that it does not chop off the modulation peaks which in effect are quite similar to the high noise peaks. If the suppressor is set too low, positive modulation peaks will be entirely removed from the incoming signal, producing an unintelligible speaker response. It is therefore seen that if the threshold must be set for twice the average carrier, approximately somewhat more noise will be received when using it on telephone reception as compared to that experienced when using it for telegraph reception. Some skill will be required in determining the proper setting when using the suppressor in connection with telephone reception.

However, in all cases it will be found to be well worth the patience required when heavy periods of static and automobile ignition interference are present. It is like the crystal filter and other parts of the receiver. It requires some skill on the part of the operator. This is true of any good receiver which has many of its controls variable. The fact that they are variable infers that there must be an optimum combination of adjustment for any particular receiving conditions. It is often said that the successful amateur station is due fifty percent to the equipment and fifty percent to the skill of the operator. Impatient and hasty decisions insofar as adjustments are concerned will result in slip-shod operation.

THE CARRIER LEVEL INDICATOR METER

The RME-69 Receiver is equipped with a sensitive meter called the carrier level indicator for indicating continuously the average value of the carrier being received. This carrier is not affected by side-bands or other variations accompanying the modulation. It reads only the average value of the carrier as the signal passes through the receiver. Its operation is closely tied up with the functioning of the automatic volume control since the meter is an indicator of variations in the balance of a simple Wheatstone bridge, one leg of which (the variable leg) is composed of the static plate resistances of the several controlled tubes. The static plate impedance of the several controlled tubes varies with the signal strength due to the action of the automatic volume control circuit. This variation disturbs the balance of the Wheatstone bridge afore-mentioned causing various indications on the meter. These indications vary with the signal strength.

On the rear apron of the receiver chassis (Figure 3) a small screw-driver adjustment will be seen. This screw-driver adjustment is placed there to balance the bridge when line voltages considerably different than 115 volts are encountered. This adjustment should be made so that the carrier level indicator reads at the zero mark with

...nna disconnected and the crystal ... ...ed in the series position and the receiver should not be tuned to any station, local or otherwise, so that the zero indication of the meter is entirely a static indication of the receiver circuit.

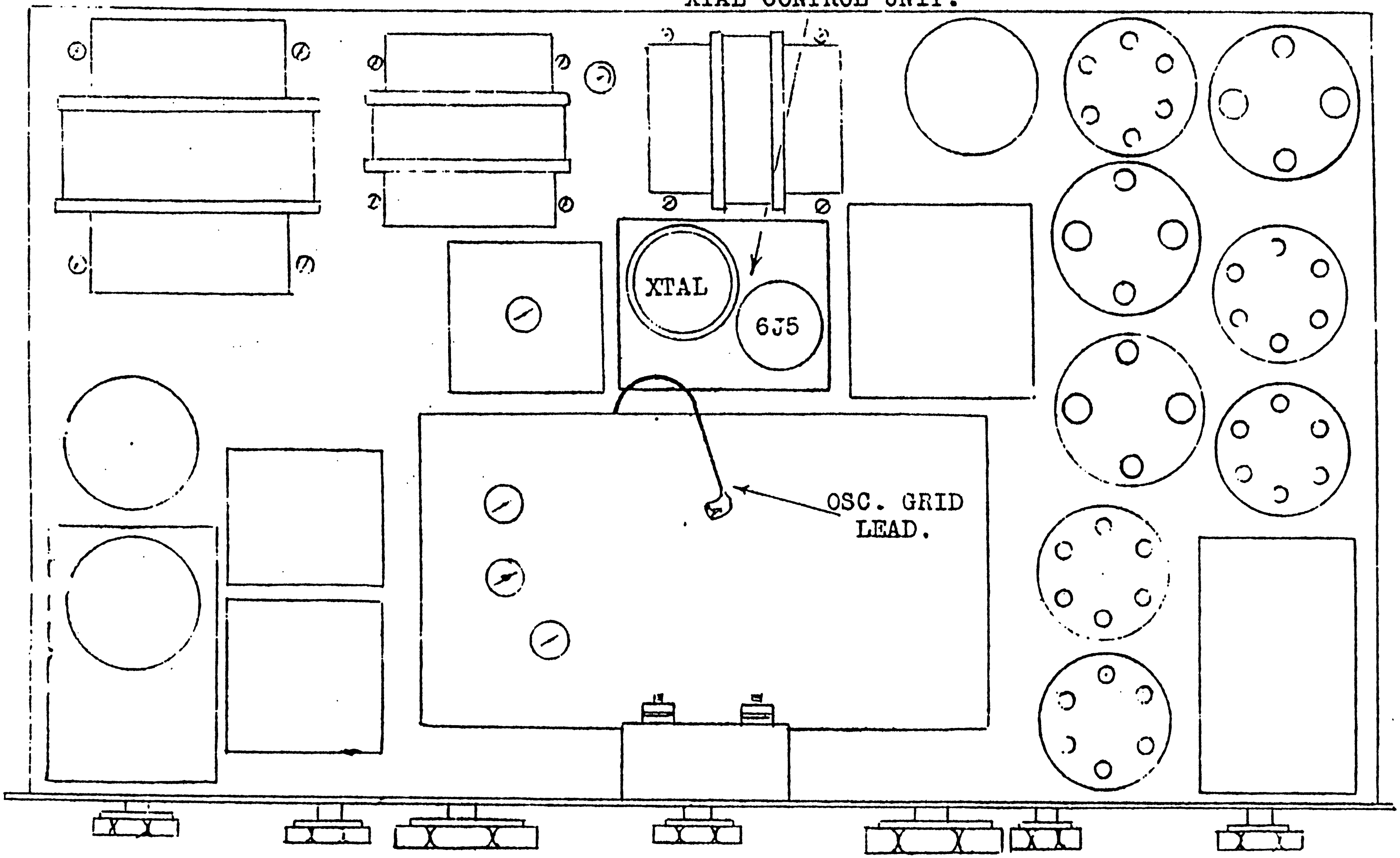
The receiver has been calibrated in RME "R" units. The Radio Manufacturing Engineers have decided after a survey of practical operating tests and considerable inquiry into the matter of signal strength that the variation between one "R" and another can be suitably stated as 6 db. Since one hundred microvolts input to the receiver will produce maximum audio output (all signals greater in strength than 100 microvolts tend to be held at the same audio volume due to AVC action) one hundred microvolts input was chosen as the R9 value for the carrier level indicator scale. This value on input signal voltage is an average for the frequency range of the receiver.

Therefore, successive Rs lower than 9 were calibrated in steps of 6db., zero level being .4 of a microvolt input, approximately. R9 therefore is 48 db. above .4 of a microvolt. It was further convenient to calibrate stronger signals than R9 since R9 was somewhat determined by the audio response of the receiver so that it is possible to measure carrier up to and including 78 db. on the scale of the meter.

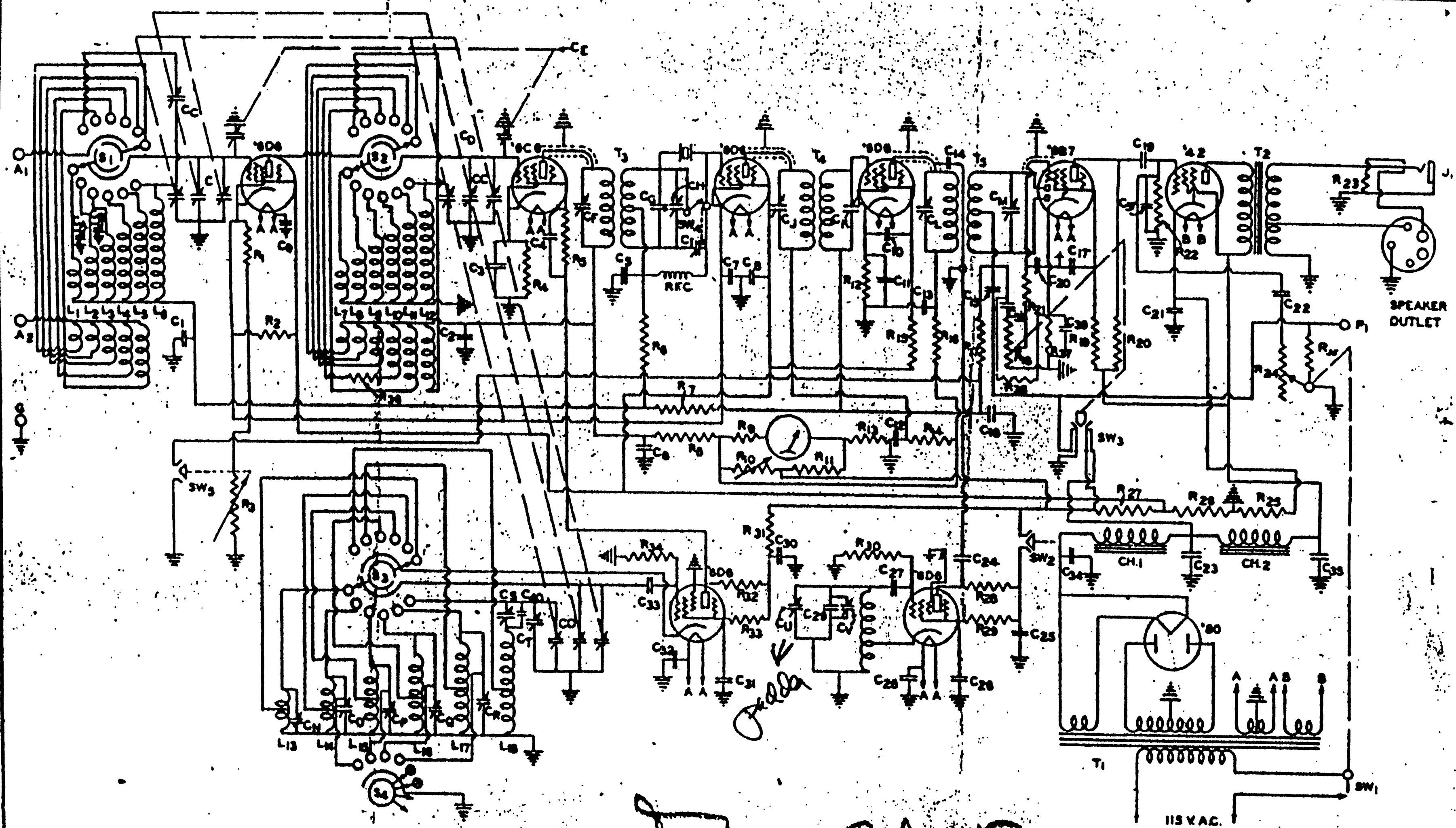
The usefulness of such an accurately calibrated scale is quite obvious, especially in this day of extensive antenna research and numerous experimental projects being carried on in the amateur fraternity. The operator of an RME-69 Receiver has, in effect, a comparative signal strength or field strength measuring device very accurately calibrated so that with any given antenna exact quantitative variations in signal strength can be exactly recorded by observations of the reading of the carrier level indicator meter on the receiver.

This meter as was before mentioned, operates in conjunction with the functioning of the automatic volume control. Since the operation of the manual volume control operates a switch which removes automatic volume control, the meter will not automatically indicate signal strength when the receiver has its gain manually controlled. However, various settings of the manual gain control of the receiver produce corresponding variations in R meter reading. In other words, when the manual gain control is set for low gain, the R meter reading reads to a high value indicating that if a signal is coming through at that particular setting of the manual gain control, it must be of considerable strength as approximately indicated by the fixed setting of the carrier level indicator for that manual gain control setting.

Numerous other uses can be easily imagined and considerable use will be found in other fields for the accurate calibrated carrier level indicator meter on the RME-69 Receiver. In case it is desired to interpret various signal strengths other than in the logarithmic sequence such as decibels, it may be well to remember



TOP VIEW OF CHASSIS
--R M E 69--



RME-69

RADIO MFG. ENGINEERS, Inc.
111 HARRISON STREET PEORIA, ILLINOIS

R.M.E. 69 SCHEMATIC CIRCUIT	C-23

19

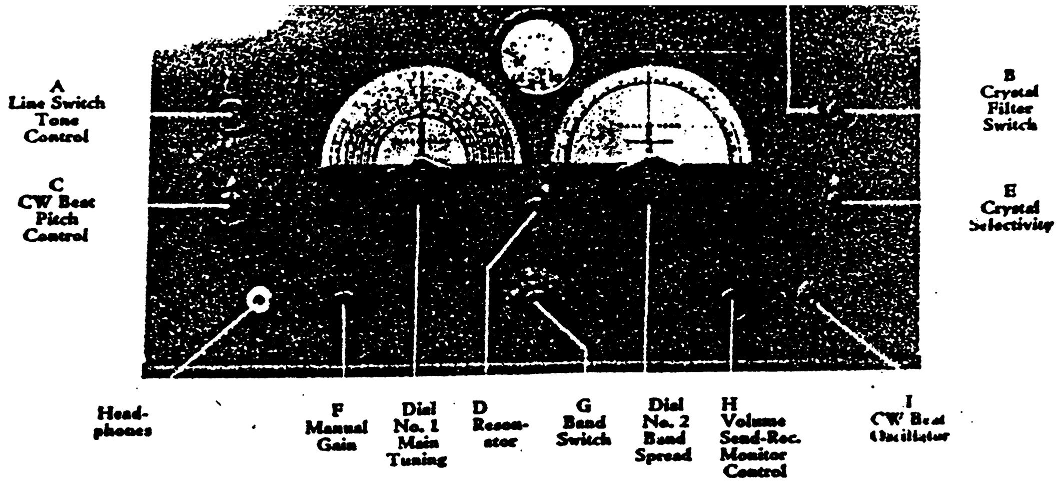


Fig. 2A. Front Panel Layout of the Standard RME-69, AC Model.

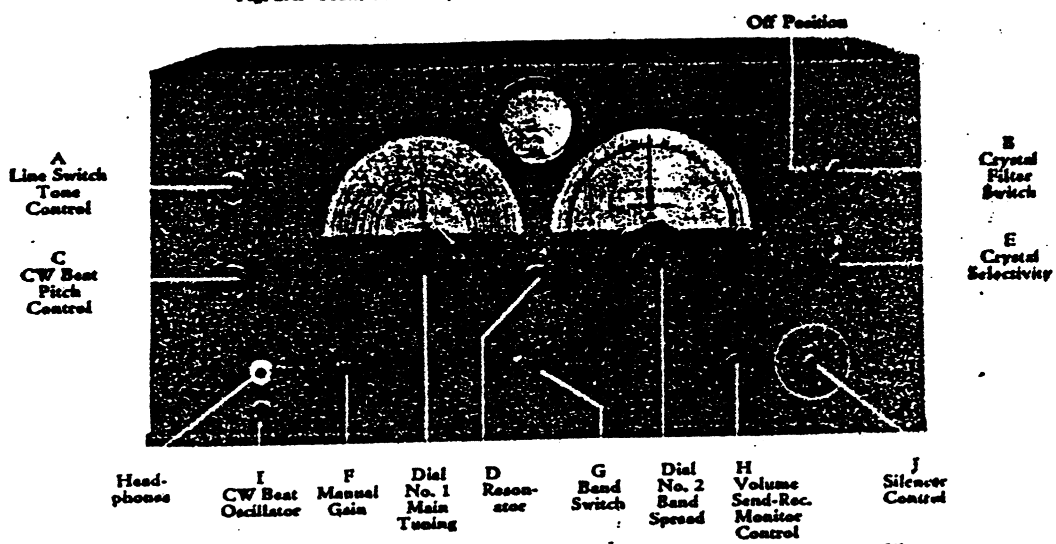


Fig. 2B. Front Panel Layout of the Standard RME-69, AC Model with Built-in Noise Silencer.

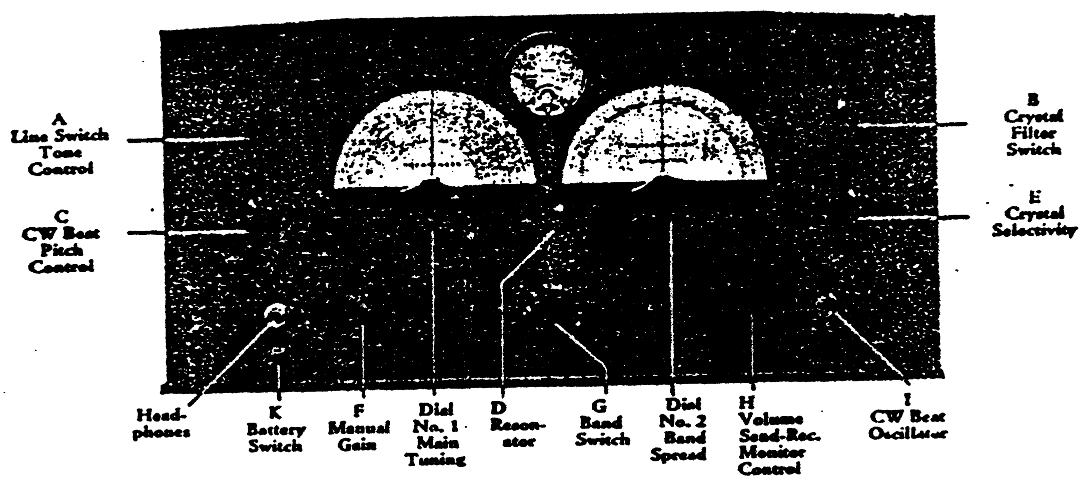
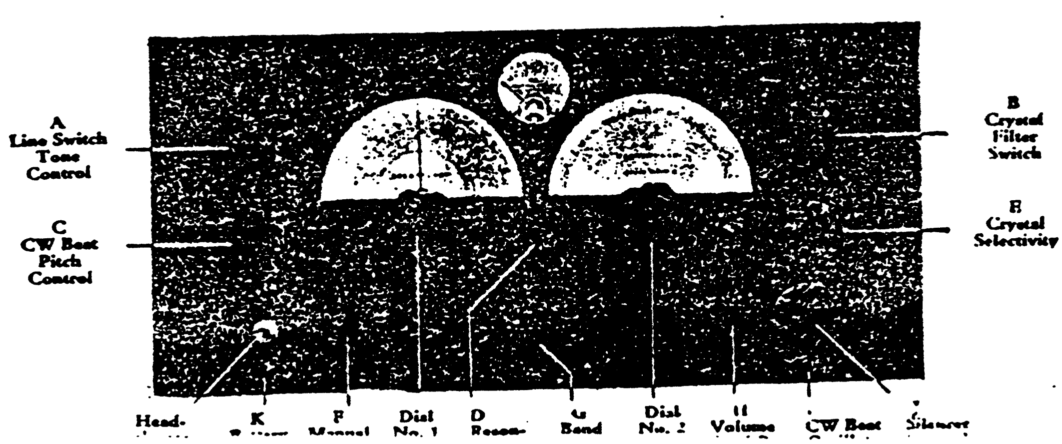


Fig. 2C. Front Panel Layout of the Combination Standard AC and Battery Model RME-69.



(21)

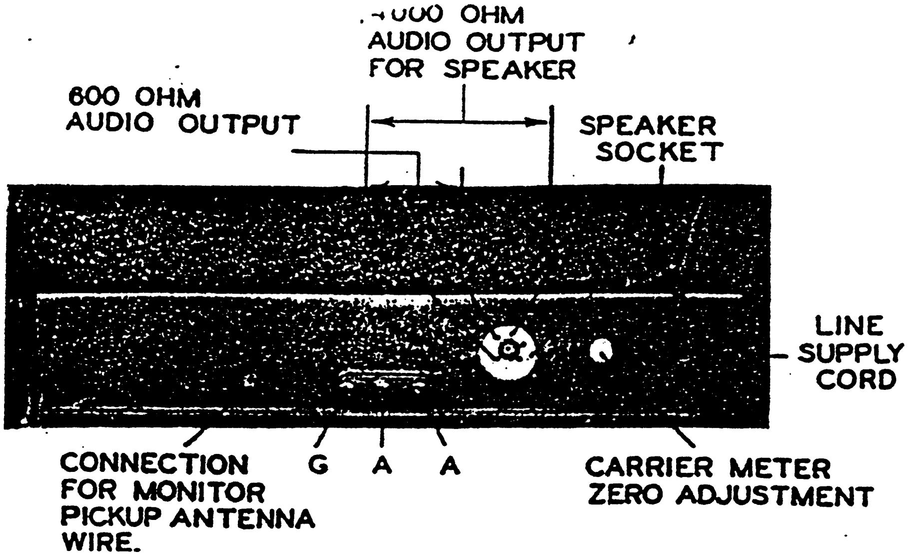


Fig. 3

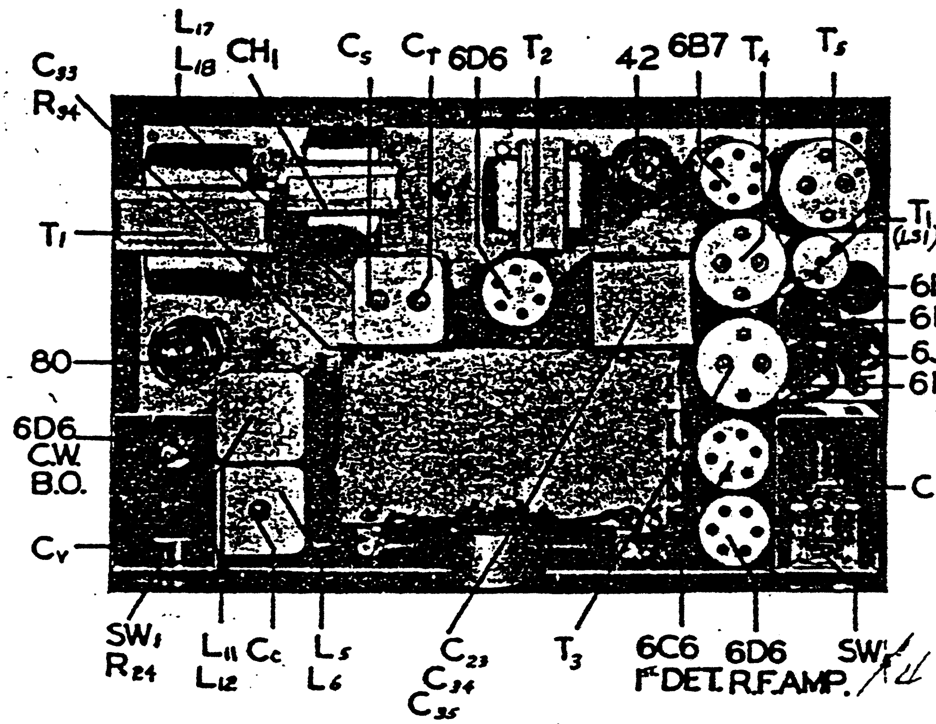


Fig. 4A

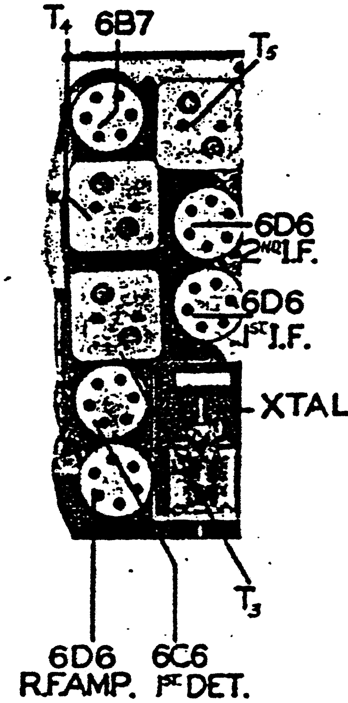


Fig. 4B

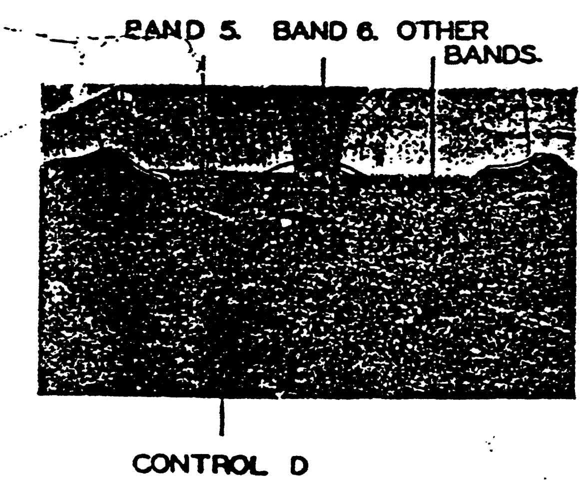


Fig. 5

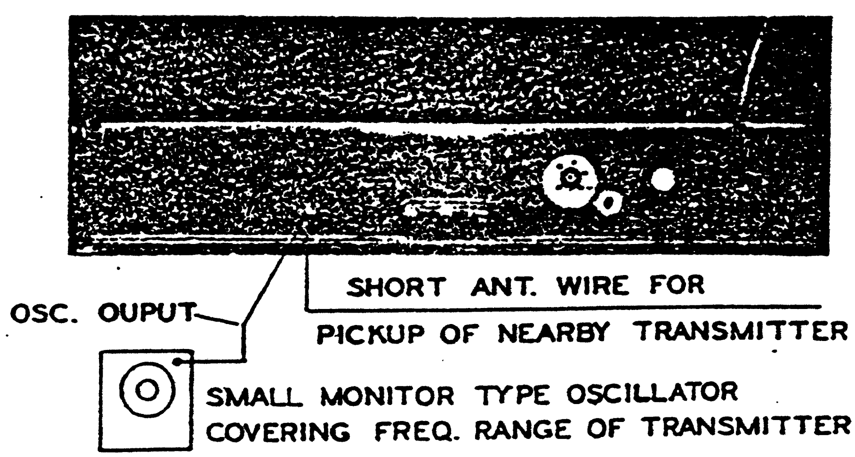


Fig. 6

RM-69

INSTRUCTIONS FOR THE INSTALLATION OF THE RME XC-1 QUARTZ FREQUENCY CONTROL UNIT IN THE RME-69 RECEIVER

It is possible, by the insertion of the XC-1 Quartz Frequency Control unit in a standard RME-69 Receiver, to maintain fixed frequency operation of that receiver at any specified frequency. The unit is easily installed and for proper installation please follow the subsequent instructions carefully with reference to the enclosed sketch.

In order to install the XC-1 unit it is necessary only to remove the oscillator grid lead from the 6D6 oscillator tube, and remove this tube and its shield from the socket which it normally occupies. The XC-1 unit is then placed in the vacated socket, as indicated on the sketch, and the oscillator grid lead is then unused. It can be either curled up and taped, or kept out of the way in any manner convenient.

The crystal supplied in the Frequency Control unit is one of exact frequency; 465 KC higher or lower than the specified signal frequency to be received in normal operation. Sometimes the intermediate frequency amplifier is slightly off of the correct frequency; and since it is impossible to change the frequency of the crystal, if there is a slight mistuning due to the fact that the I.F. is not exactly right, full compensation can be achieved by trimming the intermediate frequency amplifier on the given signal. In all cases it will be quite close, but final adjustment should be made of the intermediate frequency amplifiers with the signal being received and the Quartz Frequency Control unit installed.

Of course, in order to receive the signal, under these conditions, it is essential that the tuning dial of the receiver be set to the frequency of the incoming signal. This correct position is determined, in addition to the frequency indication on the calibrated dial with the band spread pointer set at 180, by the maximum signal response as indicated by the R meter. Adjustment of the tuning dial of the receiver and the intermediate frequency amplifier are made so that the meter reading is a maximum on a given signal.

The unit will plug-in in only one position, and that is--as the panel is faced with the crystal on the left side and the 6J5 tube on the right side. Without taking the cover off, it is simple to ascertain this position by the fact that the ventilating perforations in the cover of the unit are over the 6J5 tube.

These units have been thoroughly tested for sensitivity and for correct frequency at the factory. Any question regarding their performance should be addressed to the Radio Mfg. Engineers, Inc. Peoria, Illinois.

IMPORTANT NOTE:

IN SHIPMENT, THE CRYSTAL AND THE TUBE ARE IN POSITION IN THE UNIT. IN ORDER TO PREVENT THEIR BECOMING DISLODGED FROM THEIR RESPECTIVE SOCKETS CONSIDERABLE PADDING IS PROVIDED TO KEEP THEM IN PLACE. IT IS NECESSARY, FOR SAFE OPERATION, TO REMOVE THIS PADDING BEFORE OPERATING THE UNIT, DUE TO HEAT DEVELOPED BY THE TUBE. THIS IS EASILY ACHIEVED BY REMOVAL OF THE COVER OF THE UNIT, WHICH MAKES THE PADDING ACCESSIBLE.

X[redacted]

RADIO MFG. ENGINEERS, INC.

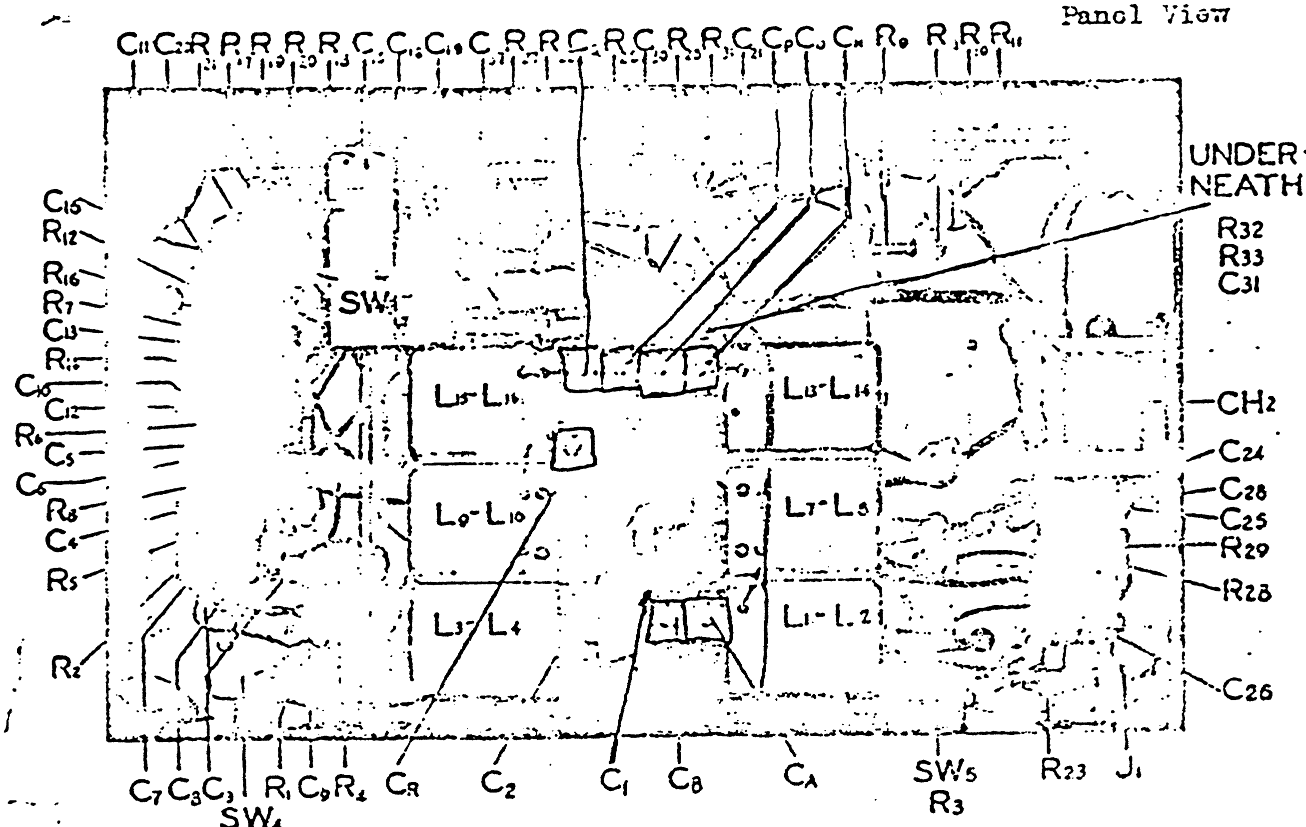


Fig. 11A

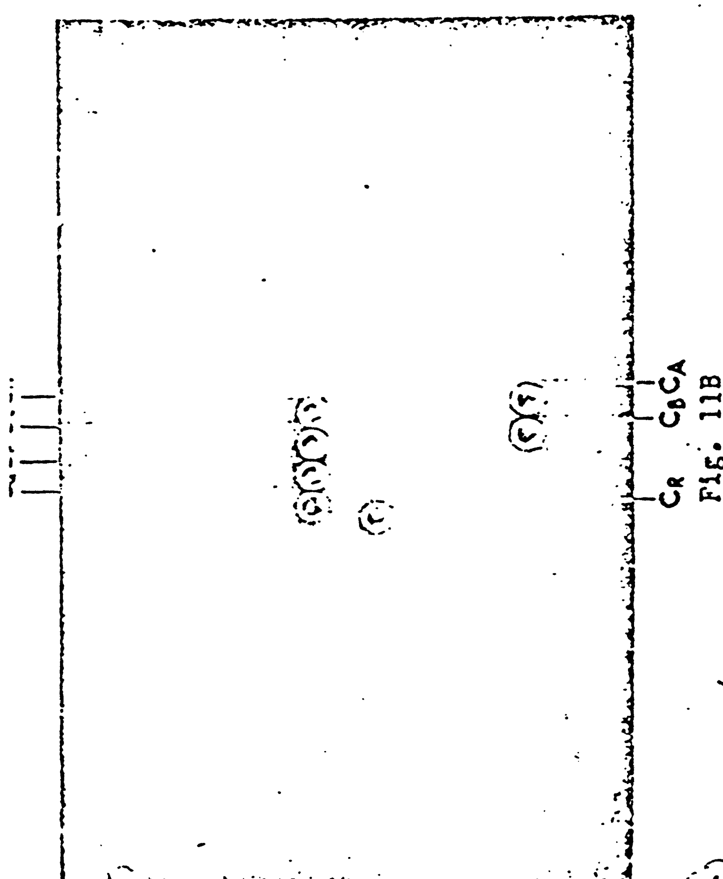


Fig. 11B

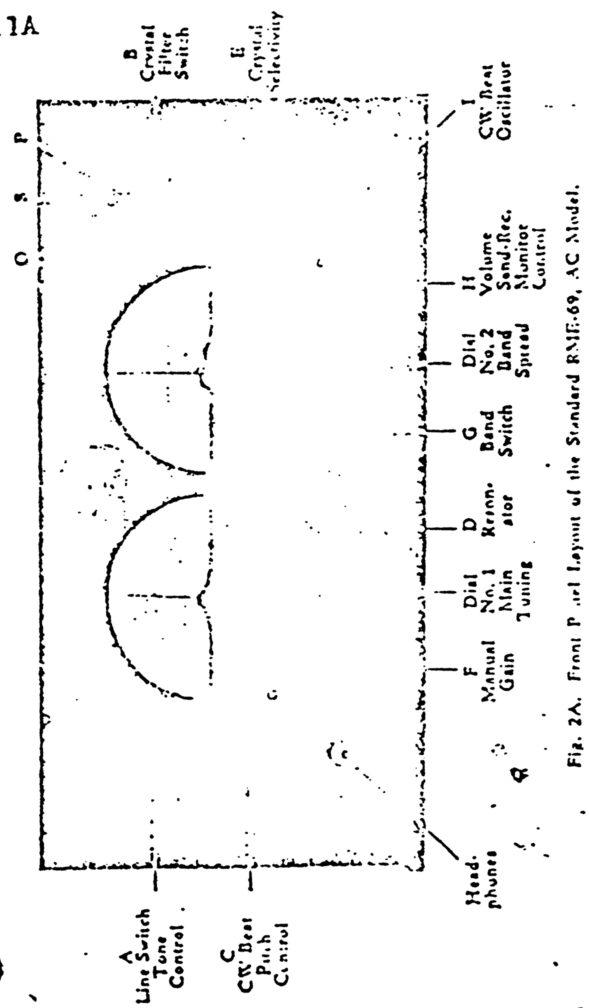


Fig. 2A. Front Panel Layout of the Standard RME-69, AC Model.

LEGEND OF RESISTORS, CONDENSERS, CHOKES, AND TRANSFORMERS OF RME-69 RECEIVER
SCHEMATIC DIAGRAM

DESIGNATION	SPECIFICATION
Ca and Cb	30 μμfd. adjustable mica padders.
Cc	30 μμfd. mica padder.
Cd	deleted.
Ce	Dual section resonator control, 4 μμfd minimum, 30 μμfd maximum.
Cf, Cg, Cj, Ck, Cl, Cm.	Adjustable trimming condensers in the intermediate frequency transformers.
Ch	25 μμfd midget air padder.
Ci	30 μμfd mica adjustable phasing condenser.
Cn, Co, Cp, Cr	30 μμfd adjustable padders.
Cq	70 μμfd adjustable padder.
Cs	.0004 mica condenser shunted by 70 μμfd. mica adjustable trimmer.
Ct	Mica trimmer on the oscillator section of the main tuning condenser.
Cu	70 μμfd adjustable mica padder.
Cv	25 μμfd variable air condenser
C1	.01 μfd 400 volts
C2	.01 μfd 400 volts
C3	.01 μfd 400 volts
C4	.01 μfd 400 volts
C5	.01 μfd 400 volts
C6	.1 μfd 400 volts
C7	.1 μfd 400 volts
C8	.1 μfd 400 volts
C9	.002 moulded mica condenser
C10	.01 μfd 400 volts
C11	.1 μfd 400 volts
C12	.1 μfd 400 volts
C13	.1 μfd 400 volts
C14	1" of shielded braid wrapped around plate lead of second intermediate frequency amplifier tube. Approximate capacity 10 μμfds.
C15	.00025 μfd.
C16	.01 μfd. 400 volts
C17	.1 μfd. 400 volts
C19	.01 μfd 400 volts
C20	.00025 μfd moulded mica condenser.
C21	20 μfd 25 volt electrolytic
C22	.01 μfd 400 volts
C23	12 μfd 450 volt electrolytic
C24	.0001 moulded mica condenser
C25	.01 μfd 400 volt electrolytic
C26	.01 μfd 400 volts
C27	.0001 μfd moulded mica
C28	.01 μfd 400 volt
C29	.00025 moulded ±5%
C30	.1 μfd 400 volts
C31	.01 μfd. 400 volts
C32	.01 μfd 400 volts
C33	.0001 μfd moulded ±5%
C34	8 μfd 450 volt electrolytic
C35	8 μfd 450 volt electrolytic
C37	.00025 μfd moulded condenser

CONTINUITY CHECKS

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

MEASUREMENT 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%
First detector grid to ground............................	Band 1 3.5 ohms Band 2 1.6 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 ohms, ±20%
Beat oscillator grid to ground...........................	100,000 ohms, ±20%
6B7 grid to ground.......................................	Should vary from 50,000 to 350,000 ohms between minimum and maximum rotation of the control "H "
Monitro post to ground...................................	0 resistance (control "H" in.)
Do	Infinite resistance (con. "h" out.)
Oscillator section of bandspread condenser and ground.	Band 1 infininite; band 2 .8 ohms; band 3 .5 ohms band 4 .2 ohms band 5 less than .2 ohms band 6 less than .2 ohms;
Cathode of 6D6 oscillator to ground......................	Band 1 .75 ohms; band 2 .3 ohms; band 3 .2 ohms; bands 4 &5&6 less than .2 ohms

(24)

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE
Oscillator plate and ground......................	135 volts
Voltage regulator plate and ground.............	150 volts
(With stand-by switch on CW).	
B.O. plate and ground..........................	11 volts

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

CONTINUITY CHECKS

(Receiver turned off. No jumper between A-2 and ground on antenna terminal strip.)

PLACE TEST PRODS BETWEEN		RESISTANCE VALUE
A-1 and ground..		Infinite
A-2 and ground..		Infinite
RF amplifier grid to ground........................		1.2 Megohm
First detector grid to ground...............	Band 1	3.5 Ohms
	Band 2	1.5 Ohms
	Band 3	.3 Ohm
	Band 4	.2 Ohm
	Band 5	.1 Ohm
	Band 6	.1 Ohm
First I.F. Transformer Section....................		3.5 Ohms ±20%
Second I.F. Transformer Section..................		3.5 Ohms ±20%
Third I.F. Transformer Section....................		3.5 Ohms ±20%
Fourth I.F. Transformer Section..................		3.5 Ohms ±20%
Oscillator grid to ground..........................		50,000 ohms ±20%
Beat Oscillator grid to ground....................		105,000 ohms ±20%
First Audio grid and ground........................		250,000 ohms to 0 ohms (as audio gain control is rotated)
7C5 grid to ground..................................		250,000 ohms ±20%
Oscillator section of main tuning condenser and ground........................		Bands 1,2,3,4, and 5 Infinite Band 6 .1 ohm

****

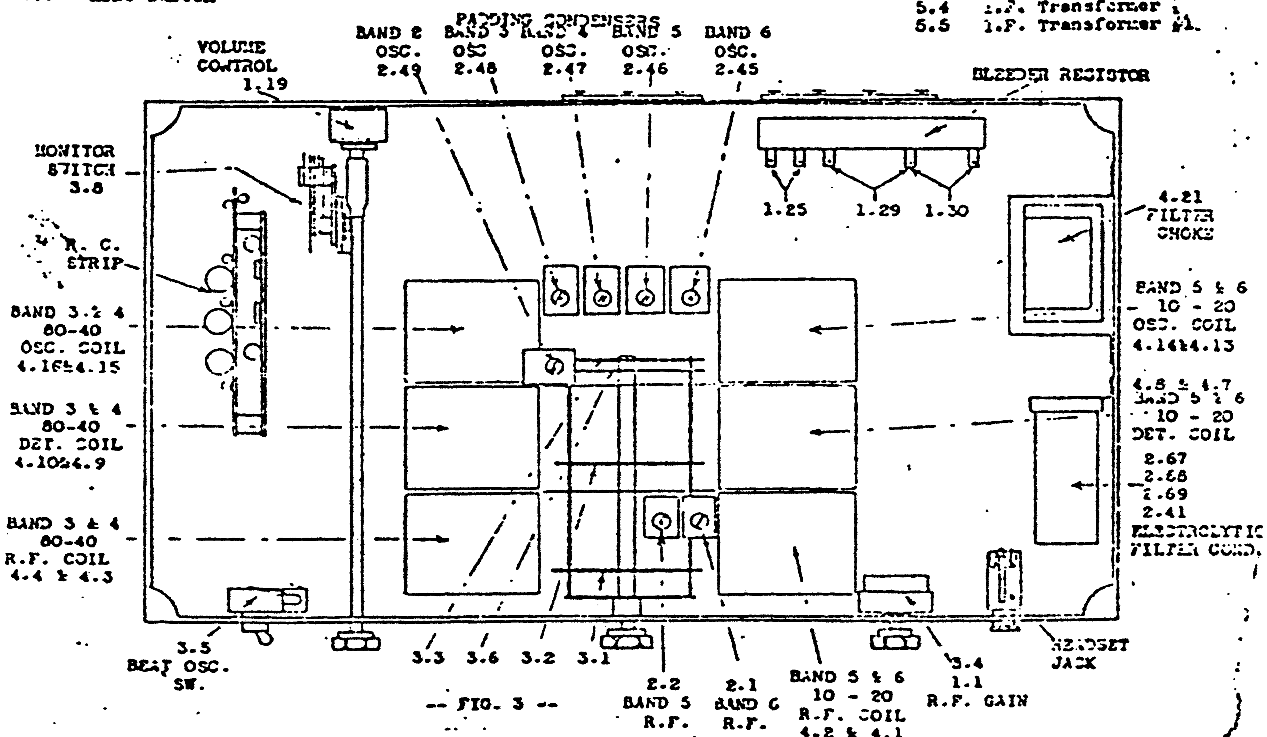
If any additional specific test data or information is desired it may be obtained by writing to the Engineering Department of the Radio Mfg. Engineers, 305-306 First Avenue, Peoria, Illinois

DESIGNATION	SPECIFICATION
C38	.1 µfd, 400 volts
C39	20 µfd, 25 volt
C40	400 µfd, moulded mica
S1, S2, S3, S4,	Band Change Switch
SW1	115 volt line switch
SW2	Beat oscillator on and off switch
SW3	Switch operated by control "H" for connecting monitor circuit and opening B supply to amplifier stage.
SW4	Crystal switch for series of for parallel
SW5	Cut-off switch for removing AVC action (operated in tandem with R)
L1	Band 6 RF grid coil
L2	Band 5 RF grid coil
L3	Band 4 RF grid coil
L4	Band 3 RF grid coil
L5	Band 2 RF grid coil
L6	Band 1 RF grid coil
L7	Band 6 first detector grid coil
L8	Band 5 first detector grid coil
L9	Band 4 first detector grid coil
L10	Band 3 first detector grid coil
L11	Band 2 first detector grid coil
L12	Band 1 first detector grid coil
L13	Band 6 oscillator coil
L14	Band 5 oscillator coil
L15	Band 4 oscillator coil
L16	Band 3 oscillator coil
L17	Band 2 oscillator coil
L18	Band 1 oscillator coil
RFC	16 millhenries
CH1	30 henries, 100 ma.
CH2	30 henries, 50 ma.
T1	Main power transformer
T2	Audio output transformer to 4,000 ohms and 600 ohms.
T3	First intermediate frequency amplifier transformer.
T4	Second intermediate frequency amplifier transformer.
T5	Third intermediate frequency amplifier transformer.
R1	200 ohms, 1/2 watt
R2	20,000 ohms, 1 watt
R3	30,000 ohms, variable
R4	5,000 ohms, 1/2 watt
R5	1 megohm, 1/2 watt
R6	250,000 ohms, 1/2 watt
R7	100,000 ohms, 1/2 watt
R8	2,000 ohms, 1/2 watt
R9	500 ohms, 1/2 watt ±5%
R10	200 ohms wire wound var. R meter balance
R11	1,000 ohms, 1/2 watt
R12	800 ohms, 1/2 watt
R13	100,000 ohms, 2 watts
R14	2,000 ohms, 1/2 watt
R15	10,000 ohms, 1/2 watt
R16	2,000 ohms, 1/2 watt

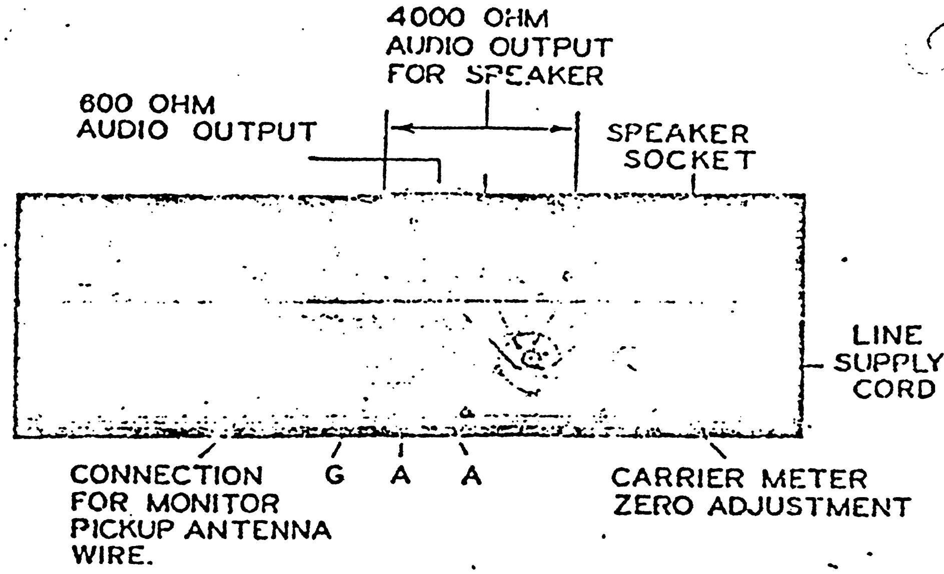
LEGEND (Cont.)

DESIGNATION	SPECIFICATION
R_{17}	1 megohm, 1/2 watt
R_{18}	250,000 ohm potentiometer audio level control
R_{19}	1 megohm, 1/2 watt
R_{20}	100,000 ohms, 1/2 watt
R_{21}	50,000 ohms, 1/2 watt
R_{22}	250,000 ohms, 1/2 watt
R_{23}	5,000 ohms, 1/2 watt
R_{24}	1,000,000 ohms potentiometer
R_{25}	410 ohms bleeder section
R_{26}	7200 ohms, bleeder section
R_{27}	6800 ohms, bleeder section
R_{28}	10,000 ohms, 1/2 watt
R_{29}	100,000 ohms, 1/2 watt
R_{30}	100,000 ohms, 1/2 watt
R_{31}	2,000 ohms, 1/2 watt
R_{32}	2,000 ohms, 1/2 watt
R_{33}	50,000 ohms, 1/2 watt
R_{35}	10,000 ohms, 1/2 watt
R_{36}	5,000 ohms, 1/2 watt
R_{37}	1,000 ohms, 1/2 watt
R_{38}	100,000 ohms, 1/2 watt
R_{34}	50,000 ohms, 1/2 watt
J_1	Headphone Jack

[illegible]	Band change switch	[illegible]	Band 6 R.F. Grid coil	4.10	Band 3 1st Det. coil	4.19	Beat Osc[illegible]
3.2	Band change switch	4.2	Band 5 R.F. Grid coil	4.11	Band 2 1st Det. coil	4.20	30H 100[illegible]
3.3	Band change switch	4.3	Band 4 R.F. Grid coil	4.12	Band 1 1st Det. coil	4.21	30H 50 Ma
3.4	AVC On-Off	4.4	Band 3 R.F. Grid coil	4.13	Band 6 Osc. coil	RFC	10MH R.F. [illegible]
3.5	Beat Oscillator	4.5	Band 2 R.F. Grid coil	4.14	Band 5 Osc. coil		TRANSFORMERS
3.6	Band change switch	4.5	Band 1 R.F. Grid coil	4.15	Band 4 Osc. coil		
[illegible].7	Crystal switch	4.7	Band 6 1st Det. coil	4.16	Band 3 Osc. coil	5.1	Power transform
o.8	Noise suppressor and stand-by.	4.8	Band 5 1st Det. coil	4.17	Band 2 Osc. coil	5.2	Audio transforme
3.9	Line switch	4.9	Band 4 1st Det. coil	4.18	Band 1 Osc. coil	5.3	I.F. Transformer
						5.4	I.F. Transformer
						5.5	I.F. Transformer #1.



-- FIG. 3 --



FIG

FOR SCHEMATIC SEE VOLUME

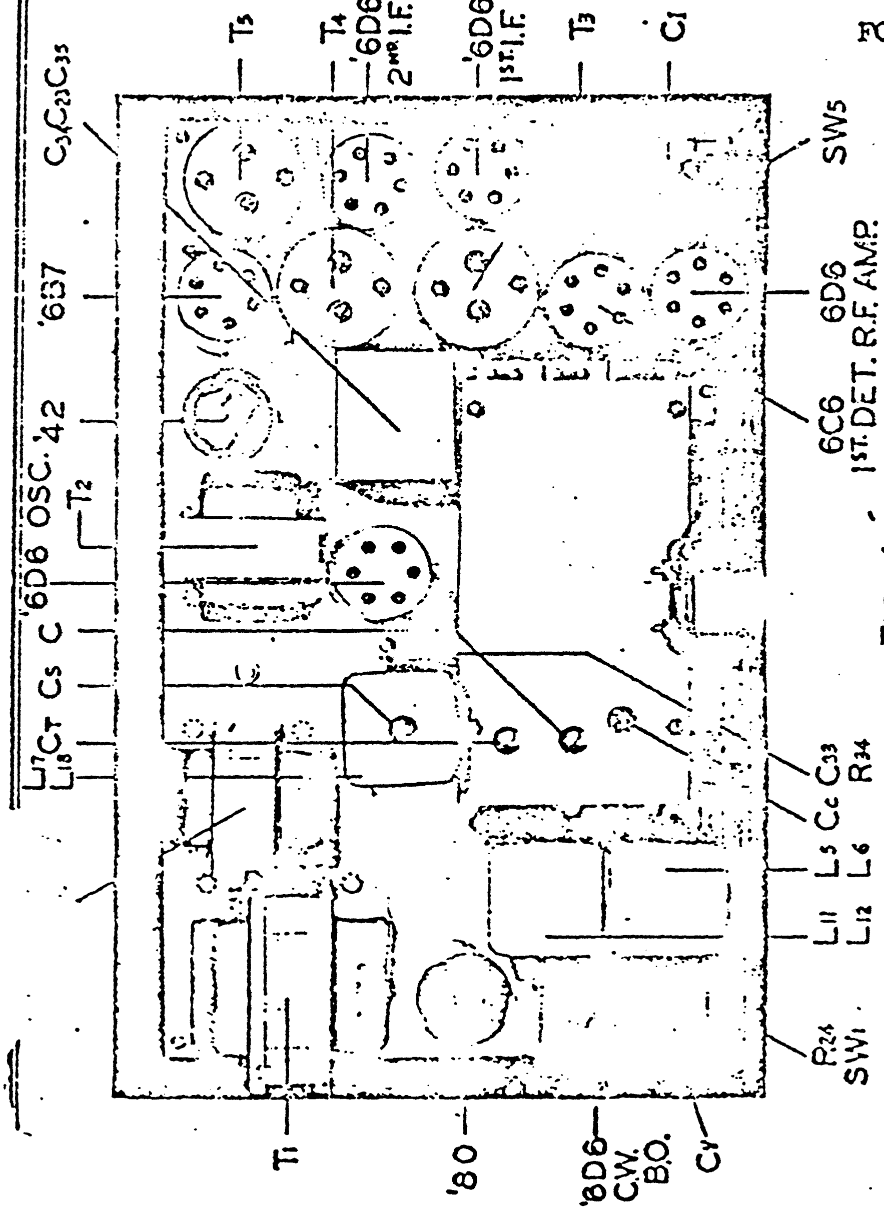
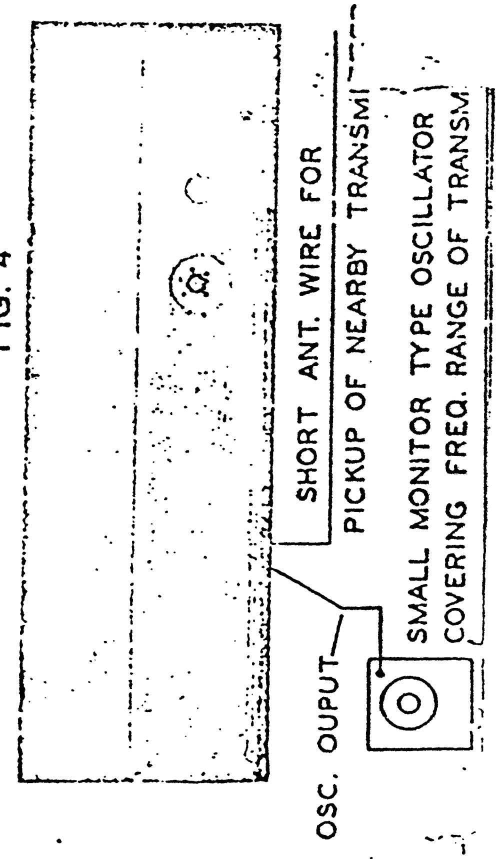


FIG. 4

FIG. 6



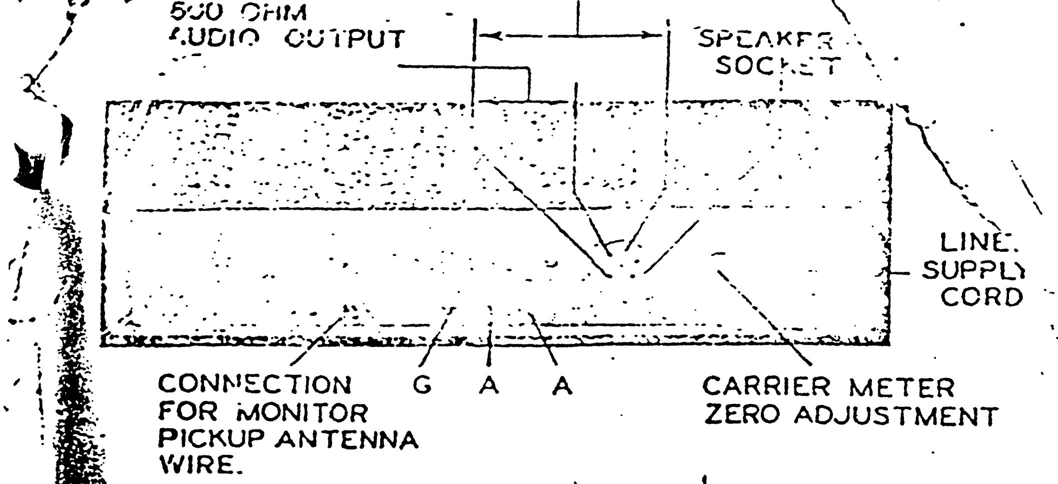

600 OHM
AUDIO OUTPUT
SPEAKER SOCKET
LINE SUPPLY CORD
CONNECTION FOR MONITOR PICKUP ANTENNA WIRE.
G
A
A
CARRIER METER ZERO ADJUSTMENT

FIG. 3

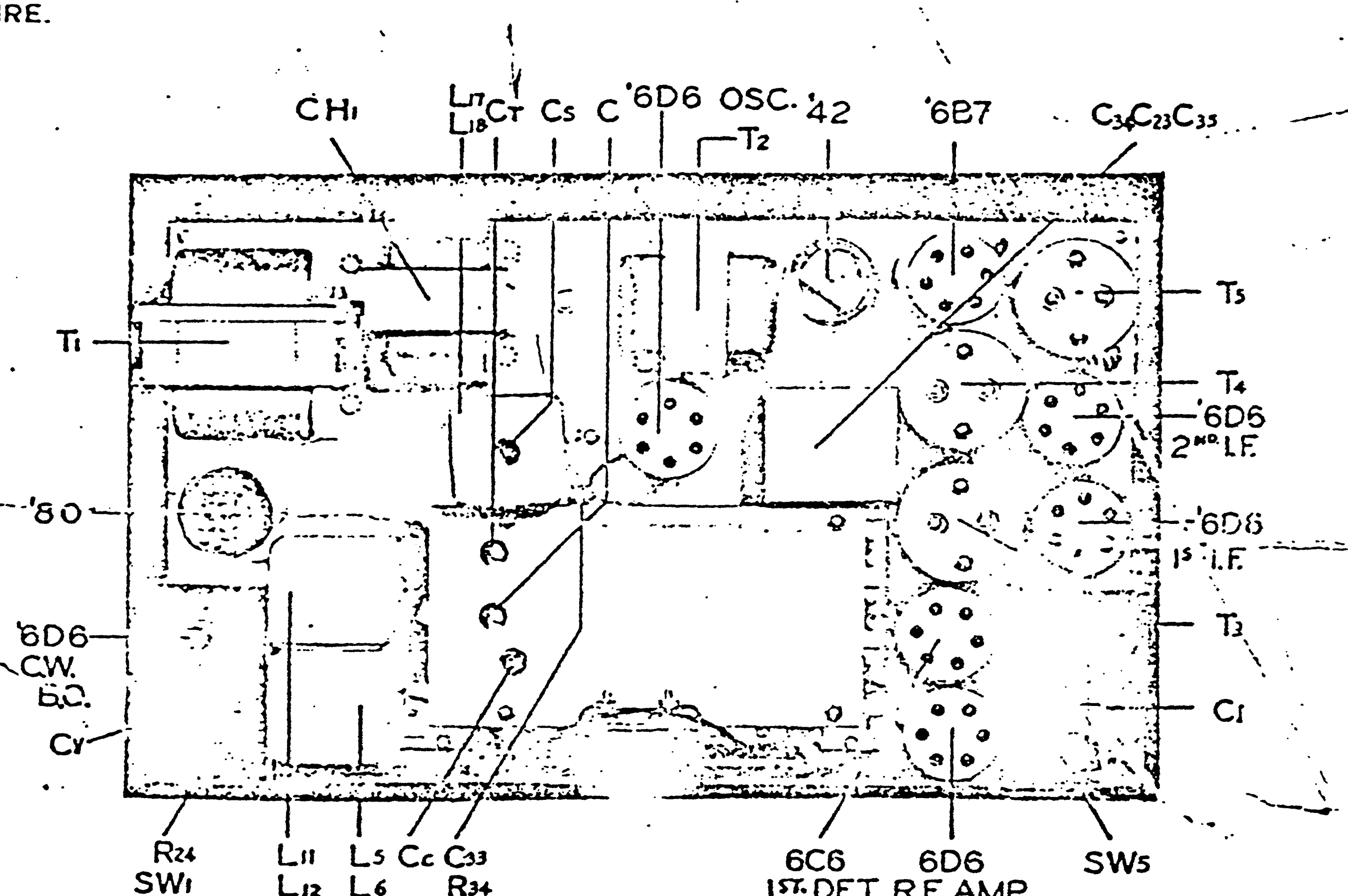
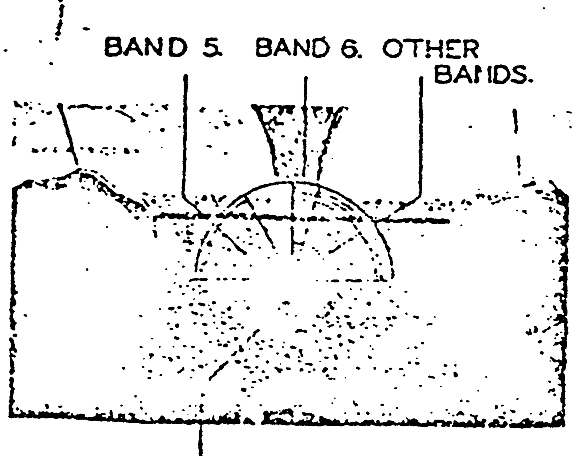
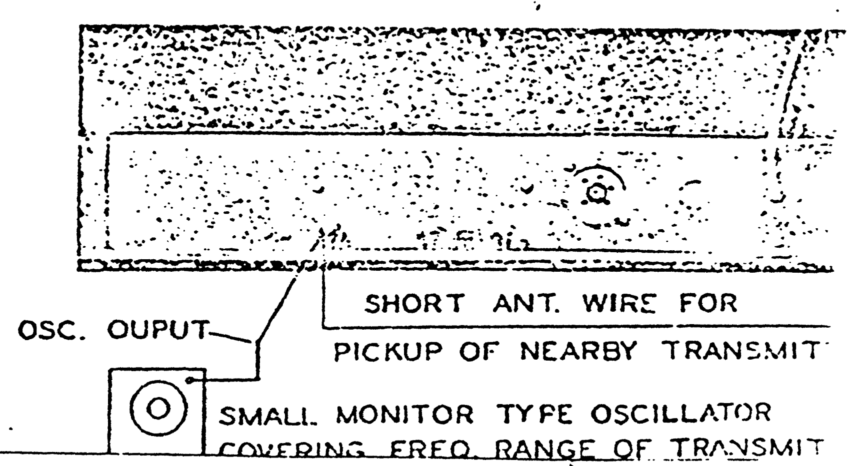

CH1
L17 L18
CT
CS
C
6D6 OSC.
T2
42
6B7
C34 C23 C35
T5
T4
6D6 2ND I.F.
6D6 1ST I.F.
T3
C1
T1
80
6D6 C.W. B.O.
CY
R24 SW1
L11 L12
L5 L6
CC
C33 R34
6C6 1ST DET.
6D6 R.F. AMP.
SW5

FIG. 4


BAND 5.
BAND 6.
OTHER BANDS.


OSC. OUPUT
SHORT ANT. WIRE FOR PICKUP OF NEARBY TRANSMIT
SMALL MONITOR TYPE OSCILLATOR COVERING FREQ. RANGE OF TRANSMIT

SERVICE NOTES FOR THE
RME-69 RECEIVER

CHAPTER 1

ALIGNMENT

One of the first evidences of misalignment in a receiver is low over-all gain of the receiver. In the RME-69 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-69 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 affect the circuits of the audio amplifier and has solely to do with the intermediate frequency amplifier and, to some extent, 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) is the control of the receiver calibration. This also is susceptible to certain outside influences which can sause 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 occuring 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 occuring 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 IF frequency as indicated in the following procedure.

The meter on the RME-69 receiver affords an excellent method of indicating the peak alignment of each of the transformers. The location of the three intermediate frequency amplifier transformers, T-3, T-4, and T-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.

OUTLINE OF PROCEDURE FOR CORRECT ALIGNMENT OF THE INTERMEDIATE FREQUENCY AMPLIFIER TRANSFORMERS OF THE RME-69 RECEIVER.

The intermediate frequency amplifiers in the RME-69 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 RME-69 to a set frequency of 465, it is essential that the alignment be done in conjunction with the quartz filter so that 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, ma imum 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 to the series position which is the middle position of the three available. 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 to be made regarding the intermediate frequency amplifier.

2

When this 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 control "E", Figure 2A, 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 No. 1 transformer and align in sequence No. 2 and No. 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 re eiver is in peak adjustment and the crystal aligned with it for maximum effectiveness in filter action.

RME-69 RECEIVER INTERMEDIATE FREQUENCY AMPLIFIER ALIGNMENT WITH SILENCER INSTALLED

The general procedure for alignment of the intermediate frequency amplifier as described above also applies to receivers in which the LS-1 silencer has been installed. Preliminary adjustment as above described should be made with the silencer threshold control set at maximum clockwise position, of rotation. When the intermediate frequency transformers have been aligned as outlined, the silencer transformer may be peaked by turning the band switch to No. 6 band on the receiver and tuning in and resonating the frequency band around 30 megacycles so that the receiver is sensitive at that point. Then under conditions of automobile ignition interference the silencer control should be set to maximum counter-clockwise rotation position and the small screw accessible through the hol in the noise rectifier transformer located on the silencer auxiliary chassis should be adjusted for a minimum response, of the interference noise. This insures accurate alignment of the noise amplifying system with that of the intermediate frequency, a condition which must necessarily exist for efficient silencer action.

After the intermediate frequency amplifier has been aligned as per the instructions under the article concerning intermediate frequency transformer alignment, a check of the phasing of the crystal filter should be made. Tune in a broadcast station, preferrably on the low frequency end of Band 1. Then tune the main tuning control slightly to the high frequency side of it, say 10 KC or more higher in frequency than the selected station.

Then resonate the station again by means of the band-spread control. Next set the crystal switch to the series position as indicated on Figure 2A by the position "S" on control "B". Now vary the band-spread control as may be required to produce peak reading of the signal on the R meter by resonating with the crystal resonance peak.

With this setting achieved, vary the dial Number 1 slightly higher and slightly lower by five kilocycles as can be approximated by the calibration of the dial (one half division each way since one division is representative of 10 kilocylces) and notice the drop in the R meter reading. The drop so achieved by varying the setting of Dial 1 five kilocycles above and below the selected signal should be productive of an R meter drop of 40 db. or greater. In other words, if the signal when resonated produces an R meter reading of 60 db. on the R meter scale, setting the dial Number 1 five kilocylces higher in frequency than the frequency of the signal being used should make the R meter fall to 20 db. or less. Similarly, setting the dial Number 1 five kilocycles lower in frequency than the station being used, the R meter should again fall from 60 db. on the scale to 20 db. or less. Should it fail to do this, the phasing condenser (C-1, figure 4) should be adjusted and a test made as just described by five kilocycles above and below adjustment of Dial 1 until the proper variation in the R meter is achieved.

It will be found that the condenser C-1 will usually run at a very low value of capacity, very close to its minimum capacity adjustment. Therefore only slight turning of this condenser will be productive of changes which materially affect the attenuation of the crystal filter. It is usually found that this condenser is not required to be adjusted since it holds it setting very well over long periods of time. The procedure just outlined gives the proper method for checking the phasing and adjusting when necessary.

NOTE: The above paragraph applies only to receivers built prior to February 1, 1938. The design of the crystal filter has been changed to a variable phasing type of filter. There is, therefore, no parallel position of the control "B". The crystal is either off or it is in the circuit. It is off when it is against the stop in the maximum counter-clockwise position.

CHAPTER II

ALIGNMENT OF RADIO FREQUENCY SECTION OF THE RME-69 RECEIVER

Alignment of the radio frequency section of the receiver will affect principally the calibration of the receiver. Within certain limits this of course will also affect the sensitivity. A small variation 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 in calibration can be made by following the suggestions outlined below.

Band 1 includes the frequencies between 550 and 1500 KC. For band one there are two frequency adjustments for adjusting the indicator to proper calibration. One of these, C_s, is adjusted as indicated on Figure 4 through the top of the shield and just in the rear of the main tuning condenser assembly. Just in front of this aperture and on the main tuning condenser assembly is C_t which is used to adjust the frequency 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 meshed. 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 numberals indicating the different tuning bands on this scale. In other words, the line which boarders 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 accruately the frequency of setting.

Then by means of condenser C_2 (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 frequency setting of 700 KC to make sure that the variation of C_t has not made some slight change in the setting for the lower frequency calibration point and it may be necessary to readjust C_s 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 C_t 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 C_r, C_q, C_p, C_o, C_n, (Figure 11-B) respectively. High side beat is used on all frequencies in the RME-69 Receiver which means that all of the condensers C_r, C_q, C_p, C_o, C_n, 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 megacyles, 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 C_b and C_a 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 onbetween 14 and 15 megacycles and the most effective setting of the control "D" for signal in that region, and with the antenna connected, the condenser C_b 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, C_a is adjusted for maximum response on a given steady signal. All other trimming and adjusting is done manually by means of control "D", Figure 2-A, and is 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 C_c (Figure 4). This is the antenna coupling condenser used when the receiver is set to Band 1. It as well as condenser "C" (Figure 4) 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 C_c 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. Excessive capacity on C will somewhat contribute to the same result but will, more than that, reduce the sensitivity on the broadcast band. When the receiver leaves the factory, they are 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.

Whenever the receiver is gone over for alignment, it is well to remove the dust cover from the condenser assembly and inspect the permanence of position of the rotor plates of the ganged condenser controlled by the knob "D". This is located between the two main variable condensers and is located underneath the dust cover which is removable by unscrewing the four acorn nuts holding it down on the condenser assembly. Some times the rotors become loosened and misplaced angularly with respect to each other. They should always be adjusted so that the rotors are at full mesh at the same time. Any slight angular displacement of one rotor with respect to the other will materially reduce the sensitivity of the receiver and destroy the preselection, thereby reducing the image frequency rejection and also the sensitivity, especially on the high frequency bands.

The padders C_b and C_a (Figure 11-B) 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.

CHAPTER III

ADJUSTMENT OF THE BEAT OSCILLATOR
(Control C, Figure 2A)

The beat oscillator has its frequency adjustable on the panel by means of control "C", Figure 2A. This control is normallyset for zero beat with the condenser C_u 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 beat oscillator switch "I" (Figure 2A) or in the case of a receiver with built-in noise silencer, the switch "I" is at the left under the headphone jack. (See Figures 2A and 2B). Then by making certain that the condenser C_u is set to 50% mesh, the condenser C_v on the diagram (Figure 16 and Figure 4) and located in the beat oscillator compartment just below C_u (Figure 4) near the top plate of the chassis in front of the beat oscillator tube should be adjustedby 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.)

CHAPTER 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 the 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 overall 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 given 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 loads have been disconnected so that it is made certain that the noise, if is 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 frequency amplifier, the detector, the two intermediate frequency amplifier tubes, the 6B7 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 .1mfd 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 the grid cap of the first radio frequency amplifier, then to the grid cap of the first detector, then the first IF, then the second IF, and so forth, until the noise is stopped. When it is place 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 frequency amplifier tube, and it is found that by tapping the receiver of the main condenser cover, the noise is readily produced and continued. By continued tapping of this part of the receiver (even with several fingers of the hand) the first grid is bypassed to ground by means of a .1 mfd condenser. However, the noise continues. This indicates that the noise is probably not being caused in the grid circuits of the radio frequency amplifier tube. The condenser free lead 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 but not preceding the grid of the radio frequency amplifier tube since by-passing the grid of the radio frequency amplifier tube to ground 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 frequency 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 the heterodyne 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 noise in themselves.

In this connection, it might also be well to say here that often times 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 ground plate on top of a test 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 short check which can be given immediately upon finding the receiver dead is to remove the shield cover from the 6B7 tube and without touching any metal part with the body, apply a finger to the grid cap. It should be made certain that when this is done the volume control H (Figure 2A) should be turned to the 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 difficulty lies ahead of the audio system, and routing 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 μfd. 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 frequency 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 kilocycles or one megacycles 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 readings are subject to a variation of plus or minus 5%. These readings are given only for use when service work is carried on by means of an accurately attentuated 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 voltage 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 frequency and radio frequency amplifiers. A defective tube which loses its heater continuity, in other words, which burns out, or a tube which loses its omission, will reduce the load 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 the socket connections, principally the plate, cathode, and screen connection, will also sometimes open up the plate, 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 cannot be compensated for by normal adjustment of the carrier level motor 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.

CHAPTER VI
CONDITIONS INDICATING LOSS OF AUTOMATIC VOLUME CONTROL

The principle result of loss of automatic volume control will be the garbled output of the overloaded blocking condition caused on strong signals when they are tuned to exact frequency. 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 T-5. Since proper adjustment of this transformer T5 is necessary in order to provide the diode elements of the 6B7 tube 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 T-5 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 garbled will be noticed. Similarly, as before 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 leakage 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 snaps 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 frequency 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 stages of the amplifier is not excessive and will not cause rectification or grid current to flow in the respective grid circuits of these tubes.

Distorted output can also be caused by a defective 6B7 tube or a 42 amplifier tube. Loss of bias on the 42 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 42 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 R-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 the ground of the 42 tube, it has little 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 42 grid and ground, the receiver audio characteristic is cut off rather abruptly around between 1,000 and 2,000 cycles.

CHAPTER VII
HUM

Hum can be 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 condenser and can be remedied of course by replacing the filter block 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 circulating and which is by some non-linear characteristic of the ground system modulating the radio frequency circulating in that ground will actually modulate the carrier before it is impressed on the receiver.

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

CHAPTER VIII
NOISE CAUSED BY FAULTY VARIABLE CONDENSER

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. In the rotation of control "H", (See Figure 2A) one other factor may enter in with age to cause noise during rotation of the shaft. This noise may not be due to the rotation of the resistor itself, but due to some slight eccentricity in the control shaft which produces a variable contact on the jack switch. The contacts of the jack switch should be closed when the control "H" is in toward the panel, and they should be open when pulled outward from the panel. There is one exception to this and that is in a receiver with a special jack switch for the operation of an external relay. In this case, there will be one center contact on the switch which is connected to the grounding blade of the switch when the rod is pulled out. These conditions can be guaranteed by observation of the switch and adjustment of the blades by means of pliers and screw-drivers so that they operate as described.

CHAPTER IX
FREQUENCY INSTABILITY

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 on, principally, the main tuning condenser. If these bearings are so tight that during normal heating of the instrument, causing expansion of the metal parts, the shaft is warped, it will cause excessive drift. The normal frequency drift of the received in the first thirty minutes of warming up is between 8 and 10 kilocycles at fifteen megacycles. At lower frequencies the drift is proportionately less and at higher frequencies it is proportionately greater. Values greatly in excess of this are not normal and are caused 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 (C-33, Figure 4) which is a small mica condenser mounted on the bakelite terminal strip on the end of the main tuning condenser. 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 tuning condenser so that the condenser has freedom 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 bearings of the condenser can also cause backlash in that it will produce an excessive lead 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 frequency shift, usually of the rapid type which will produce a wavering of the signal to the point of a flutter. The effect of the band switch on calibration can be checked by rapidly switching 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 sauses a shift in frequency, it is probably due to the switch contacts themselves and can be improved upon by increasing the pressure of the collector ring which presses 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 inor setting up a howl under the same conditions it is more or less microphonics. 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 frequencies, 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 reduced 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 frequency. The action is dependent again as before upon the tightness of coupling acoustically between the speaker and the cabinet of the receiver. Usually breaking a stiff physical contact between the cabinet of the speaker and the receiver will reduce the howl and it is almost certain to stop if the sound from the speaker is made to emerge in a direction which will not impinge upon the speaker housing iself. These effects are noticeable more with the crystal in the series position where the selectivity is very high and also at the high frequencies where a possible frequency 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 axactly at resonance. Therefore, by not providing positive tuning adjustment on the carrier the howling will be set up quite easily. Experience in accurate tuning is productive of the a very minimum of acoustic coupling as evidenced in the form of a microphonic howl.

CHAPTER XI

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 115 v.

PLACE TEST PRODS BETWEEN –	CORRECT VOLTAGE (Switch "H" in toward panel)	CORRECT VOLTAGE (Switch "H" pulled outward fm. 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 plate and ground	250 volts	0 volts
First intermediate frequency amplifier screen and ground	100 volts	0 volts
Intermediate frequency amplifier cathode and ground	3.2 volts	0 volts
(The same voltages apply to the second intermediate frequency amplifier tube elements)		
6B7 plate and ground	115 volts	145 volts
6B7 screen and ground	25 volts	35 volts
42 plate and ground	244 volts	280 volts
42 screen and ground	248 volts	220 volts
42 cathode and ground	16 volts	18 volts
80 rectifier filament and ground	258 volts	335 volts
Oscillator plate and ground	248 volts	0 volts
Oscillator screen and ground	115 volts	0 volts

TEST VOLTAGES (contd.)

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE (Switch "H" in toward panel)	CORRECT VOLTAGE (Switch "H" pulled outward from panel)
Beat oscillator plate and ground	180 volts	210 volts
Beat oscillator screen and ground	100 volts	130 volts
The voltage across R-31	14 volts	0 volts

These voltages are subject to a fluctuation 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.)

MEASUREMENT 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%
First detector grid to ground	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 ohms ±20%
Beat oscillator grid to ground	100,000 ohms ±20%
6B7 grid to ground	Should vary from 50,000 to 300,000 ohms between minimum and maximum rotation of the control "H"
Monitor post to ground	O resistance (Control "H" in.) Infinite resistance (Control "H" out.)
Oscillator section of band-spread condenser and ground	Band 1 -- Infinite Band 2 -- .8 ohms Band 3 -- .5 ohms Band 4 -- .2 ohms Band 5 -- Less than .2 ohms Band 6 -- Less than .2 ohms
Cathode of 6D6 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

LEGEND OF RESISTORS, CONDENSERS, CHOKES, AND TRANSFORMERS OF RME-69 RECEIVER SCHEMATIC DIAGRAM. (See Figure 12)

DESIGNATION	SPECIFICATION
Ca and Cb	30 mmfd, adjustable mica padders
Cc	30 mmfd, mica padder
Cd	Mica trimming condenser on center section of main tuning condenser. 50 mmfd. maximum.
Ce	Dual section resonator control. 4 mmfd. min. 30 mmfd. max.
Cf, Cg, Cj, Ck Cl, Cm	Adjustable trimming condensers in the intermediate frequency transformers.
Ch	25 mmfd. midget air padder
Ci	30 mmfd. mica adjustable phasing consenser.
Cn, Co, Cp, Cr	30 mmfd. adjustable padders.
Cq	70 mmfd. adjustable padder.
Cs	.0004 mica condenser shunted by 70 mmfd mica adjustable trimmer.
Ct	Mica trimmer on the oscillator section of the main tuning condenser.
Cu	70 mmfd. adjustable mica padder.
Cv	25 mmfd. variable air condenser.
C1	.01 mfd. 400 volts
C2	.01 mfd. 400 volts
C3	.01 mfd. 400 volts
C4	.01 mfd. 400 volts
C5	.01 mfd. 400 volts
C6	.1 mfd. 400 volts
C7	.1 mfd. 400 volts
C8	.1 mfd. 400 volts
C9	.002 moulded mica condenser.
C10	.01 mfd. 400 volts
C11	.1 mfd. 400 volts
C12	.1 mfd. 400 volts
C13	.1 mfd. 400 volts
C14	1" of shielded braid wrapped around plate lead of second intermediate frequency amplifier tube. Approximate capacity 10 mmfds.
C15	.00025 mmfd.
C16	.01 mfd. 400 volts
C17	.1 mfd. 400 volts
C19	.01 mfd. 400 volts
C20	.00025 mfd. moulded mica condenser.
C21	20 mfd. 25 volt electrolytic
C22	.01 mfd. 400 volts
C23	12 mfd. 450 volt electrolytic.
C24	.0001 moulded mica condenser
C25	.01 400 volt electrolytic
C26	.01 mfd. 400 volt

LEGEND (contd.)

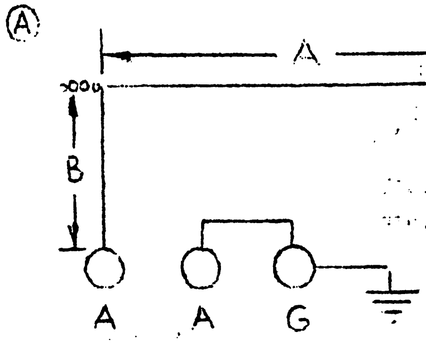
DESIGNATION	SPECIFICATION
C27	.0001 mfd. moulded mica.
C28	.01 mfd. 400 volt.
C29	.00025 moulded ±5%
C30	.1 mfd. 400 volts
C31	.01 mfd. 400 volts
C32	.01 mfd. 400 volts
C33	.0001 mfd. moulded ±5%
C34	8 mfd. 450 volt electrolytic
C35	8 mfd. 450 volt electrolytic
C37	.00025 mfd. moulded condenser
S1, S2, S3, S4	Band change switch
SW1	115 volt line switch
SW2	Beat oscillator on and off switch
SW3	Switch operated by control "H" for connecting monitor circuit and opening B supply to amplifier stages.
SW4	Crystal switch for series or for parallel control
SW5	Cut-off switch for removing AVC action (operated in tandem with R3)
L1	Band 6 RF grid coil
L2	Band 5 RF grid coil
L3	Band 4 RF grid coil
L4	Band 3 RF grid coil
L5	Band 2 RF grid coil
L6	Band 1 RF grid coil
L7	Band 6 first detector grid coil
L8	Band 5 first detector grid coil
L9	Band 4 first detector grid coil
L10	Band 3 first detector grid coil
L11	Band 2 first detector grid coil
L12	Band 1 first detector grid coil
L13	Band 6 oscillator coil
L14	Band 5 oscillator coil
L15	Band 4 oscillator coil
L16	Band 3 oscillator coil
L17	Band 2 oscillator coil
L18	Band 1 oscillator coil
RFC	16 millhenries
CH1	30 henries, 100 ma.
CH2	30 henries, 50 ma.
T1	Main power transformer
T2	Audio output transformer to 4000 ohms and 600 ohms
T3	First intermediate frequency amplifier transformer
T4	Second intermediate frequency amplifier transformer
T5	Third intermediate frequency amplifier transformer

LEGEND (contd.)

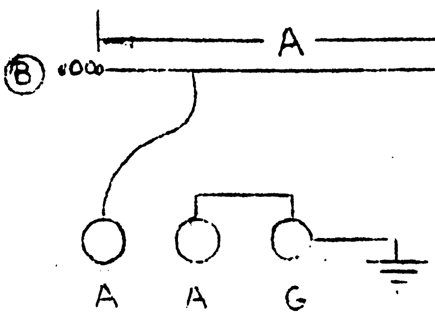
DESIGNATION	SPECIFICATION
R1	150 ohms, 1/2 watt
R2	20,000 ohms, 1 watt
R3	30,000 ohms, variable
R4	5,000 ohms, 1/2 watt
R5	1 megohm, 1/2 watt
R6	250,000 ohms, 1/2 watt
R7	100,000 ohms, 1/2 watt
R8	2000 ohms, 1/2 watt
R9	500 ohms, 1/2 watt ±5%
R10	200 ohms, wire wound var. R meter balance
R11	1000 ohms, 1/2 watt
R12	500 ohms, 1/2 watt
R13	100,000 ohms, 2 watts
R14	2000 ohms, 1/2 watt
R15	10,000 ohms, 1/2 watt
R16	2000 ohms, 1/2 watt
R17	1 megohm, 1/2 watt
R18	250,000 ohm potentiometer audio level control
R19	1 megohm, 1/2 watt
R20	100,000 ohms, 1/2 watt
R21	50,000 ohm, 1/2 watt
R22	250,000 ohms, 1/2 watt
R23	5000 ohms, 1/2 watt
R24	1,000,000 ohms potentiometer
R25	410 ohms bleeder section
R26	7200 ohms, bleeder section
R27	6800 ohms, bleeder section
R28	10,000 ohms, 1/2 watt
R29	100,000 ohms, 1/2 watt
R30	100,000 ohms, 1/2 watt
R31	2000 ohms, 1/2 watt
R32	2000 ohms, 1/2 watt
R33	50,000 ohms, 1/2 watt
R34	50,000 ohms, 1/2 watt
J1	Headphone jack.

RME OPERATING INSTRUCTIONS

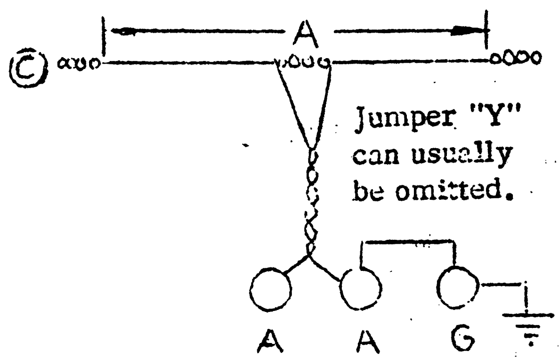
FIG. 1.



General Marconi connection. Optimum condition exists when a plus b = $\frac{\lambda}{4}$, $\frac{3}{4}\lambda$, $\frac{5}{4}\lambda$ etc.

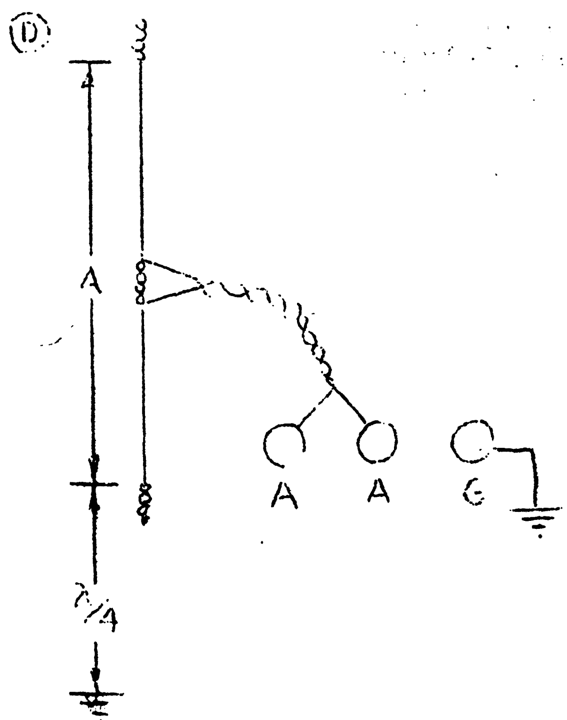


Optimum signal input to receiver when a = $\frac{\lambda}{2}$ and feeder is tapped at proper distance from center. This antenna works quite well usually on even harmonics also.



Optimum condition when a = $\frac{\lambda}{2}$.

Not satisfactory for wide range frequency. Excellent for any amateur band if a = $\frac{\lambda}{2}$ is in the middle of the band. For example: For 20 meter band antenna should be de designed for 14,200 KC. A approximately 33 feet. Directional at right angle from line of wire.



Dimensions same as those of C. Antenna good for one narrow band. (For example: Amateur band). Is not directional.

MODEL RME 69
Socket, Trimmers
Controls

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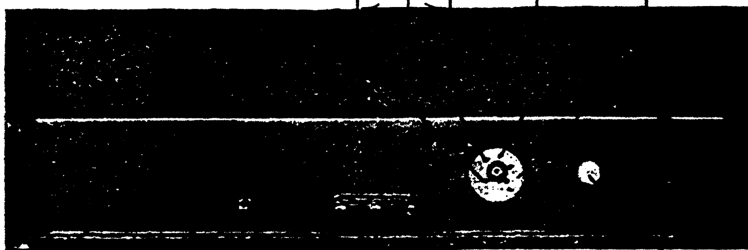

FIG. 3

FOR SCHEMATIC SEE VOLUME VII.

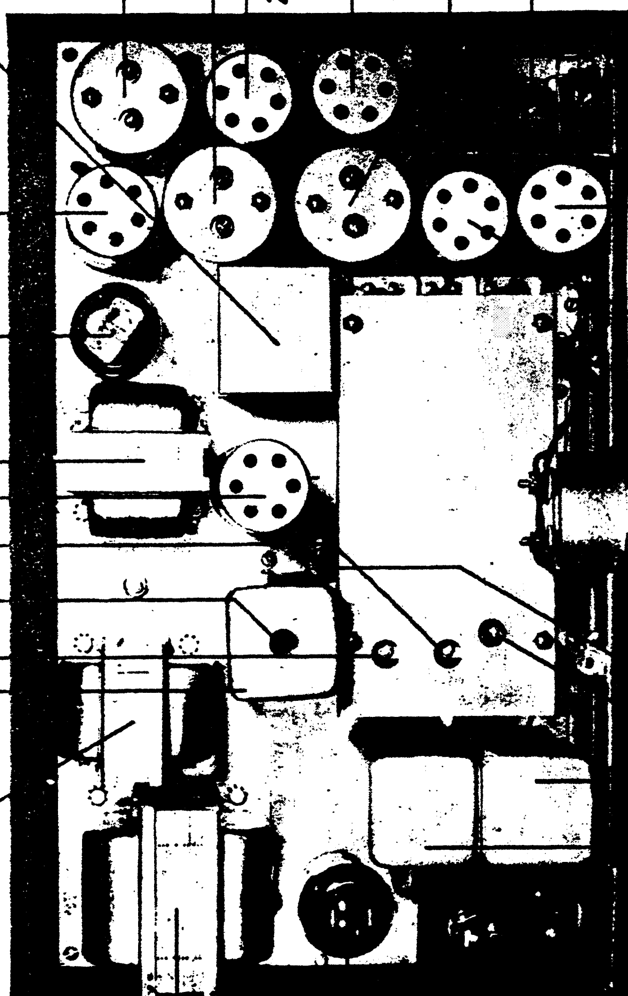

FIG. 4


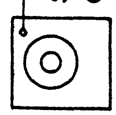

FIG. 6

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MODEL RME 69
Chassis, Trimmers
Panel View

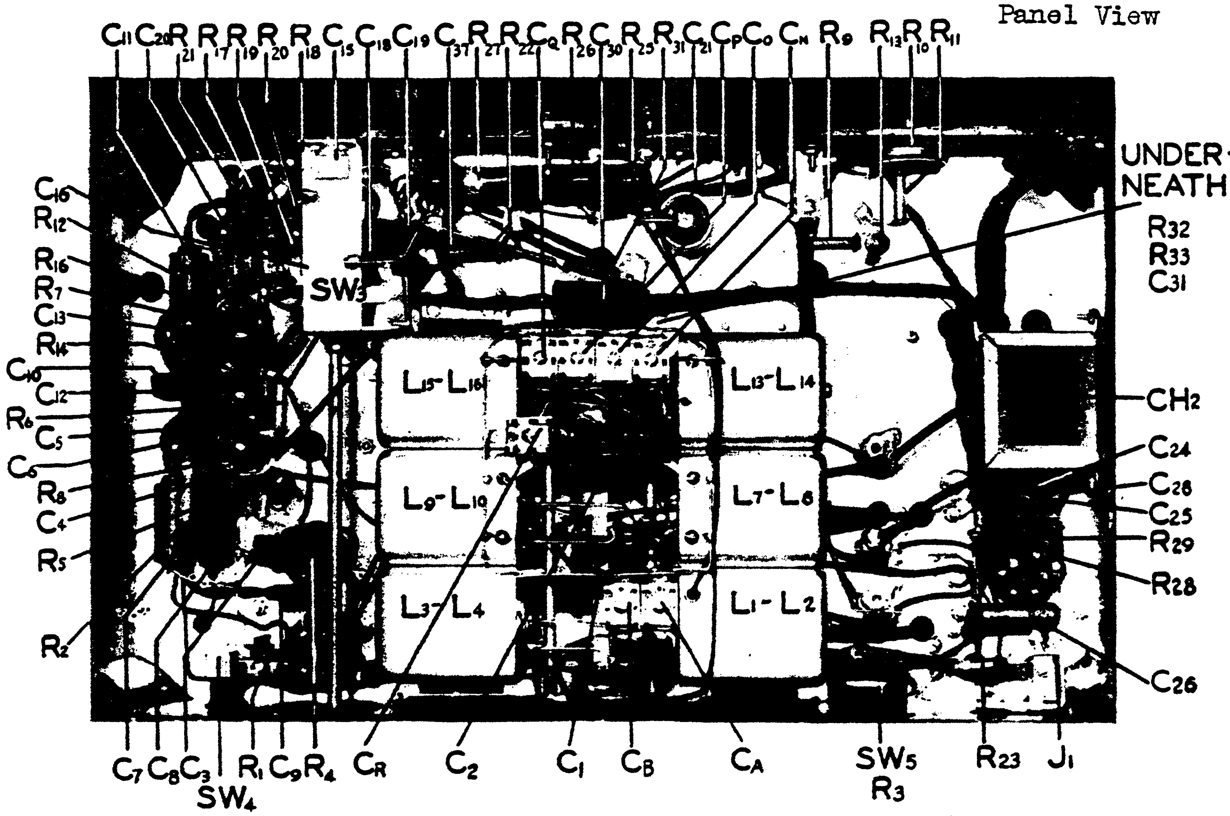


Fig. 11A

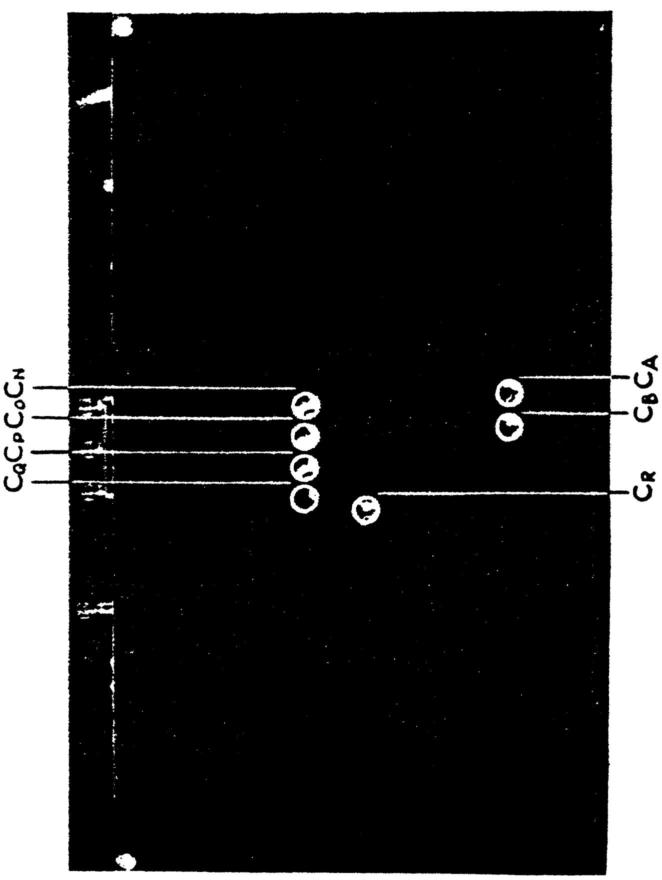


Fig. 11B

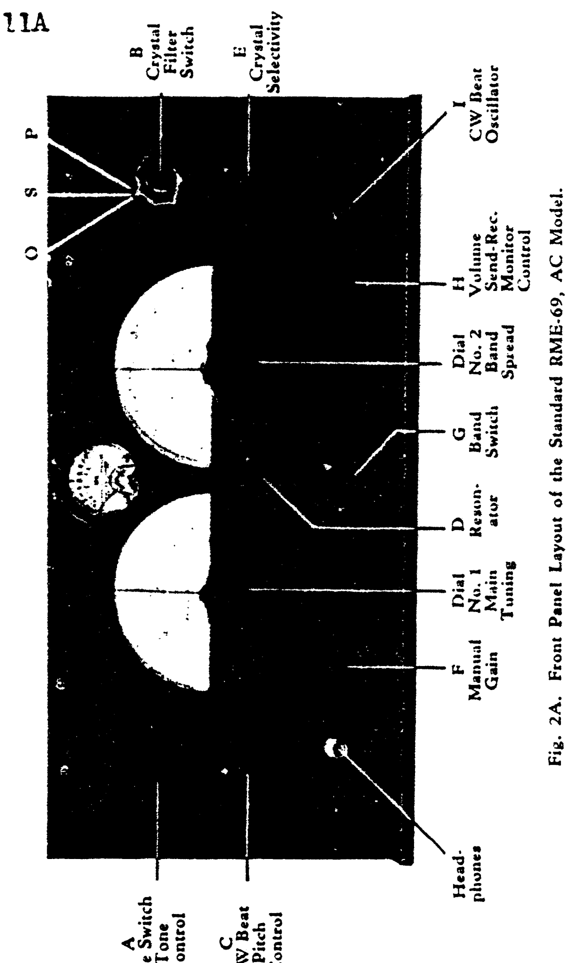


Fig. 2A. Front Panel Layout of the Standard RME-69, AC Model.

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 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. 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 2.59 (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).

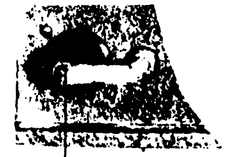


FIG. 7

MODEL
69 (late)

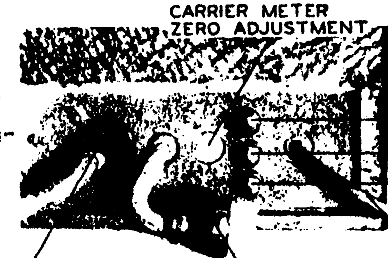


FIG. 8

Fig. 4B

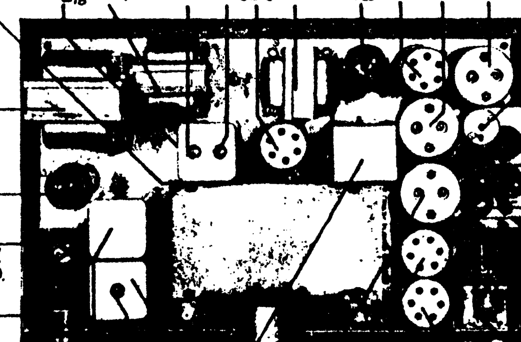
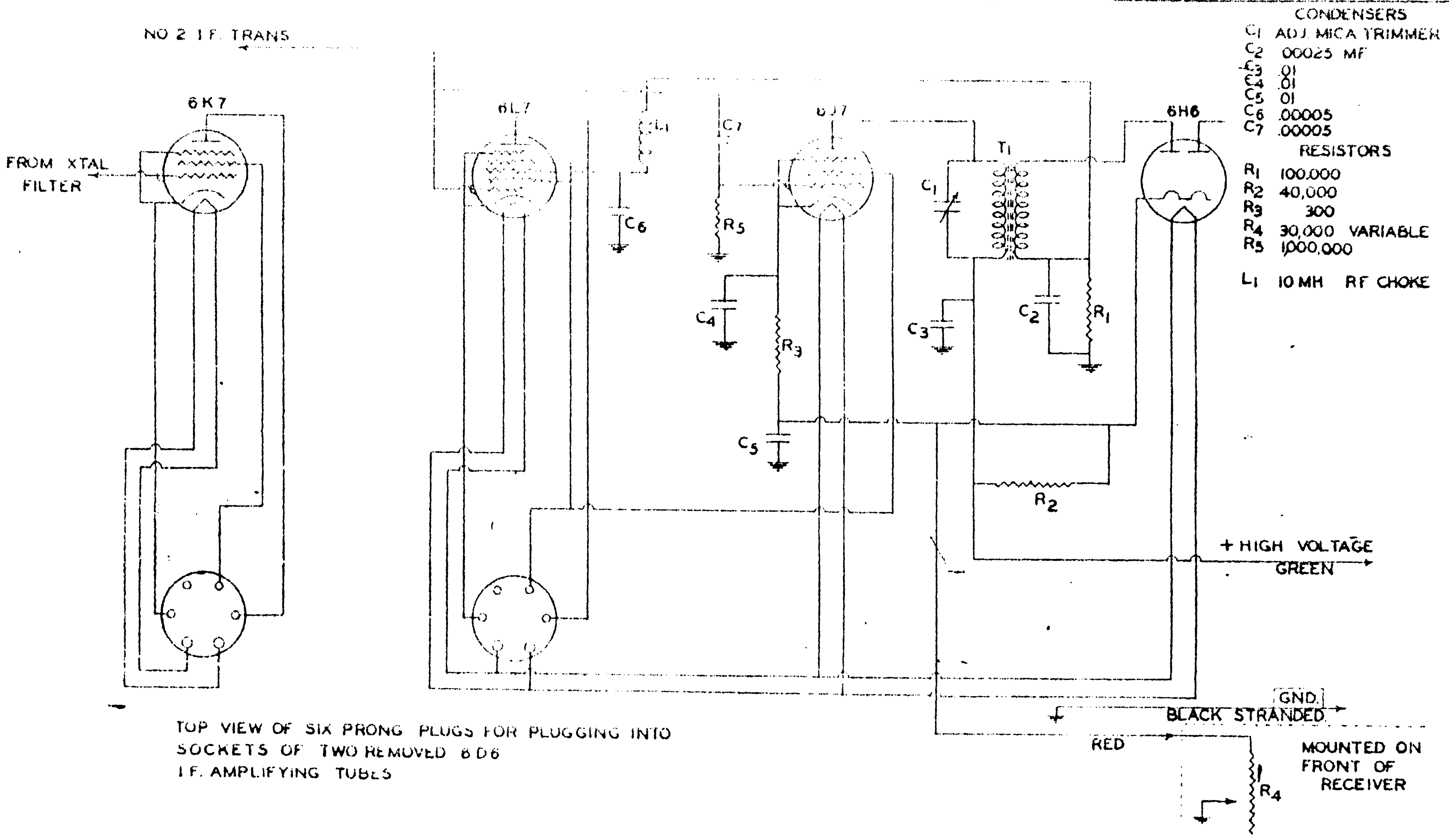


Fig. 4A

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.



LS-1
NOISE SUPPRESSOR

B-76

MODEL RME 69
Socket, Trimmers
Controls

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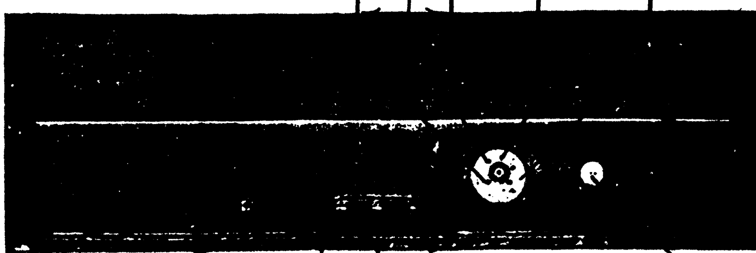

FIG. 3

FOR SCHEMATIC SEE VOLUME VII.

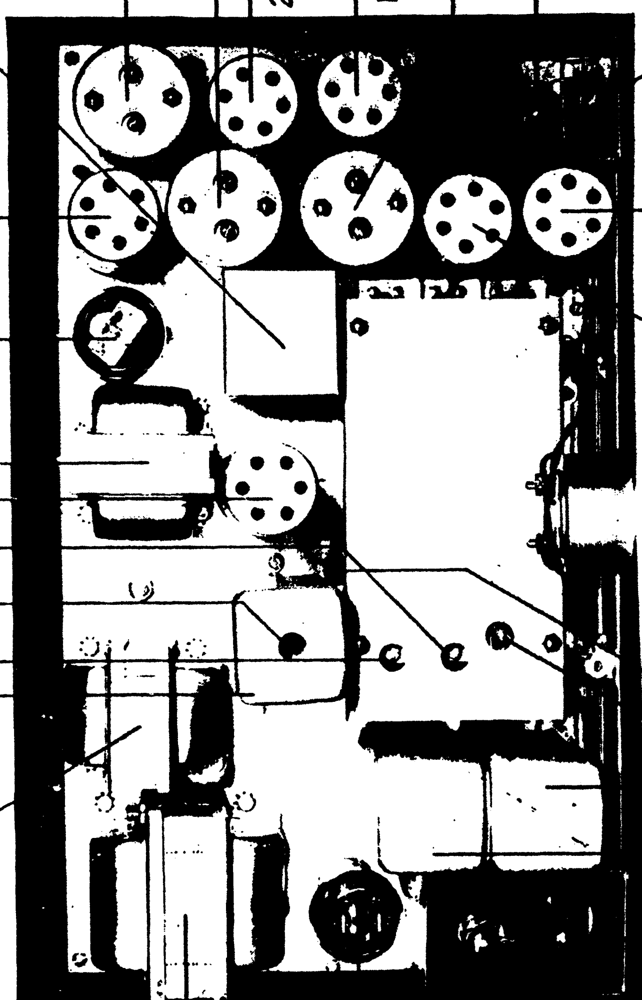

FIG. 4

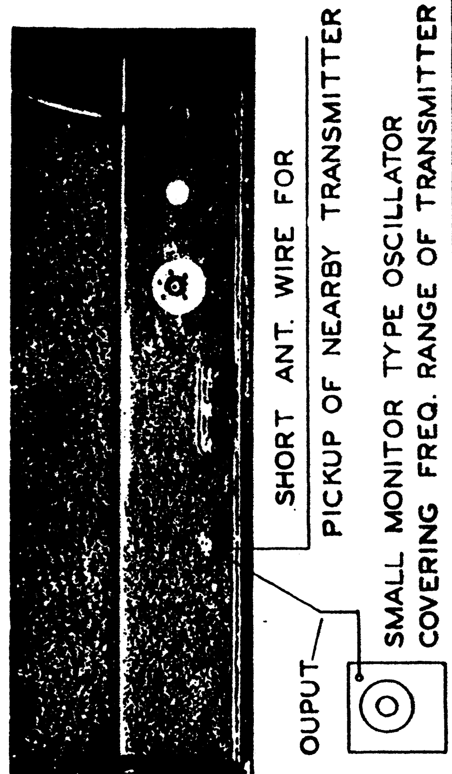

FIG. 6

MODEL RME 69
Chassis, Trimmers
Panel View

RADIO MFG. ENGINEERS, INC.

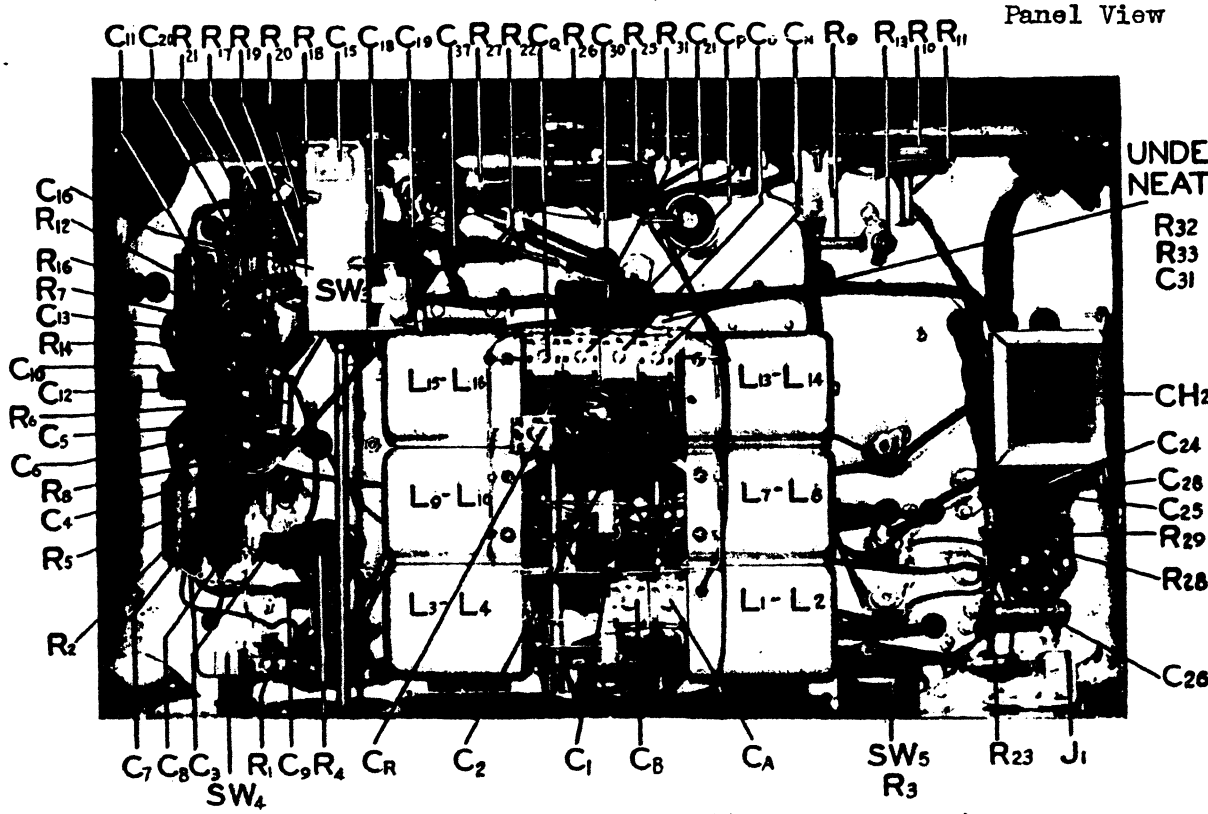

Fig. 11A

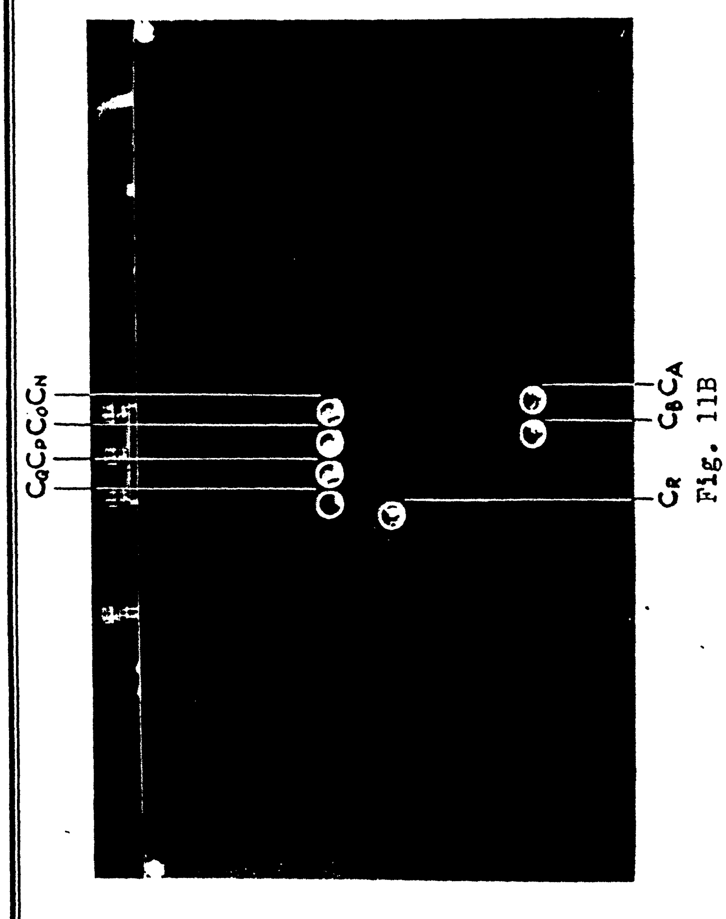

Fig. 11B

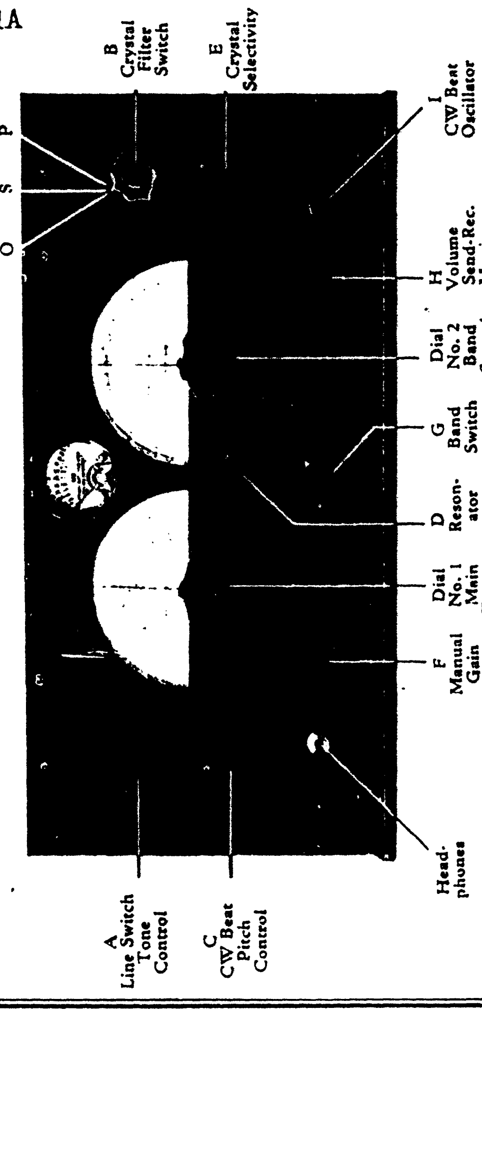

Fig. 2A. Front Panel Layout of the Standard RME-69, AC Model.

RADIO MFG. ENGINEERS, INC.

SERVICE NOTES FOR THE
RME-69 RECEIVER

ALIGNMENT

One of the first evidences of misalignment in a receiver is low over-all gain of the receiver. In the RME-69 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-69 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 affect the circuits of the audio amplifier and has solely to do with the intermediate frequency amplifier and, to some extent, 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) is the control of the receiver calibration. This 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 IF frequency as indicated in the following procedure.

The meter on the RME-69 receiver affords an excellent method of indicating the peak alignment of each of the transformers. The location of the three intermediate frequency amplifier transformers, T-3, T-4, and T-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.

OUTLINE OF PROCEDURE FOR CORRECT ALIGNMENT OF THE INTERMEDIATE FREQUENCY AMPLIFIER TRANSFORMERS OF THE RME-69 RECEIVER.

The intermediate frequency amplifiers in the RME-69 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 RME-69 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, preferably 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 to the series position which is the middle position of the three available. The band-spread scale is then adjusted with respect to the signal so

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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 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 screw-driver type should be used. Then the control "E", Figure 2A, 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 No. 1 transformer and align in sequence No. 2 and No. 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.

RME-69 RECEIVER INTERMEDIATE FREQUENCY AMPLIFIER ALIGNMENT WITH SILENCER INSTALLED

The general procedure for alignment of the intermediate frequency amplifier as described above also applies to receivers in which the LS-1 silencer has been installed. Preliminary adjustment as above described should be made with the silencer threshold control set at maximum clockwise position, of rotation. When the intermediate frequency transformers have been aligned as outlined, the silencer transformer may be peaked by turning the band switch to No. 6 band on the receiver and tuning in and resonating the frequency band around 30 megacycles so that the receiver is sensitive at that point. Then under conditions of automobile ignition interference the silencer control should be set to maximum counter-clockwise rotation position and the small screw accessible through the hole in the noise rectifier transformer located on the silencer auxiliary chassis should be adjusted for a minimum response, of the interference noise. This insures accurate alignment of the noise amplifying system with that of the intermediate frequency, a condition which must necessarily exist for efficient silencer action.

After the intermediate frequency amplifidr has been aligned as per the instructions under the article concerning intermediate frequency transformer alignment, a check of the phasing of the crystal filter should be made. Tune in a broadcast station, preferrably on the low frequency end of Band 1. Then tune the main tuning control slightly to the high frequency side of it, say 10 KC or more higher in frequency than the selected station.

Then resonate the station again by means of the band-spread control. Next set the crystal switch to the series position as indicated on Figure 2A by the position "S" on control "B". Now vary the band-spread control as may be required to produce peak reading of the signal on the R meter by resonating with the crystal resonance peak.

With this setting achieved, vary the dial Number 1 slightly higher and slightly lower by five kilocycles as can be approximated by the calibration of the dial (one half division each way since one division is representative of 10 kilocycles) and notice the drop in the R meter reading. The drop so achieved by varying the setting of Dial 1 five kilocycles above and below the selected signal should be productive of an R meter drop of 40 db. or greater. In other words, if the signal when resonated produces an R meter reading of 60 db. on the R meter scale, setting the dial Number 1 five kilocycles higher in frequency than the frequency of the signal being used should make the R meter fall to 20 db. or less. Similarly, setting the dial Number 1 five kilocycles. lower in frequency than the station being used, the R meter should again fall from 60 db. on the scale to 20 db. or less. Should it fail to do this, the phasing condenser (C-1, figure 4) should be adjusted and a test made as just described by five kilocycle above and below adjustment of Dial 1 until the proper variation in the R meter is achieved.

It will be found that the condenser C-1 will usually run at a very low value of capacity, very close to its minimum capacity adjustment. Therefore only slight turning of this condenser will be productive of changes which materially affect the attenuation of the crystal filter. It is usually found that this condenser is not required to be adjusted since it holds its setting very well over long periods of time. The procedure just outlined gives the proper method for checking the phasing and adjusting when necessary.

ALIGNMENT OF RADIO FREQUENCY SECTION OF THE RME-69 RECEIVER

Alignment of the radio frequency section of the receiver will affect principally the calibration of the receiver. Within certain limits this of course will also affect the sensitivity. A small variation 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 in calibration can be made by following the suggestions outlined below.

Band 1 includes the frequencies between 550 and 1500 KC. For band one there are two frequency adjustments for adjusting the indicator to proper calibration. One of these, C_s, is adjusted as indicated on Figure 4 through the top of the shield can just in the rear of the main tuning condenser assembly. Just in front of this aperture and on the main tuning condenser assembly is C_t which is used to adjust the

RADIO MFG. ENGINEERS, INC.

frequency 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 meshed. 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 C_s (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 C_t. It will then be necessary to return to the former frequency setting of 700 KC to make sure that the variation of C_t has not made some slight change in the setting for the lower frequency calibration point and it may be necessary to readjust C_s 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 C_t 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 trimmors C_r, C_q, C_p, C_o, C_n, (Figure 11-B) respectively. High side beat is used on all frequencies in the RME-69 Receiver which means that all of the condensers C_r, C_q, C_p, C_o, C_n, 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 C_b and C_a 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 control "D" for signal in that region, and with the antenna connected, the condensor C_b 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, C_a is adjusted for maximum response on a given steady signal. All other trimming and adjusting is done manually by means of control "D", Figure 2-A, and is 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 C_c (Figure 4). This is the antenna coupling condenser used when the receiver is set to Band 1. It as well as condenser "C" (Figure 4) 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 C_c 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. Excessive capacity on C will somewhat contribute to the same result but will, more than that, reduce the sensitivity on the broadcast band. When the receiver leaves the factory, they are 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.

Whenever the receiver is gone over for alignment, it is well to remove the dust cover from the condenser assembly and inspect the permanence of position of the rotor plates of the ganged condenser controlled by the knob "D". This is located between the two main variable condensers and is located underneath the dust cover which is removable by unscrewing the four acorn nuts holding it down on the condenser assembly. Some times the rotors become loosened and misplaced angularly with respect to each other. They should always be adjusted so that the rotors are at full mesh at the same time. Any slight angular displacement of one rotor with respect to the other will materially reduce the sensitivity of the receiver and destroy the preselection, thereby reducing the image frequency rejection and also the sensitivity, especially on the high frequency bands.

The padders C_b and C_a (Figure 11-B) 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.

MODEL 69 AC Late
MODEL 69AC Late Revised
Schematics

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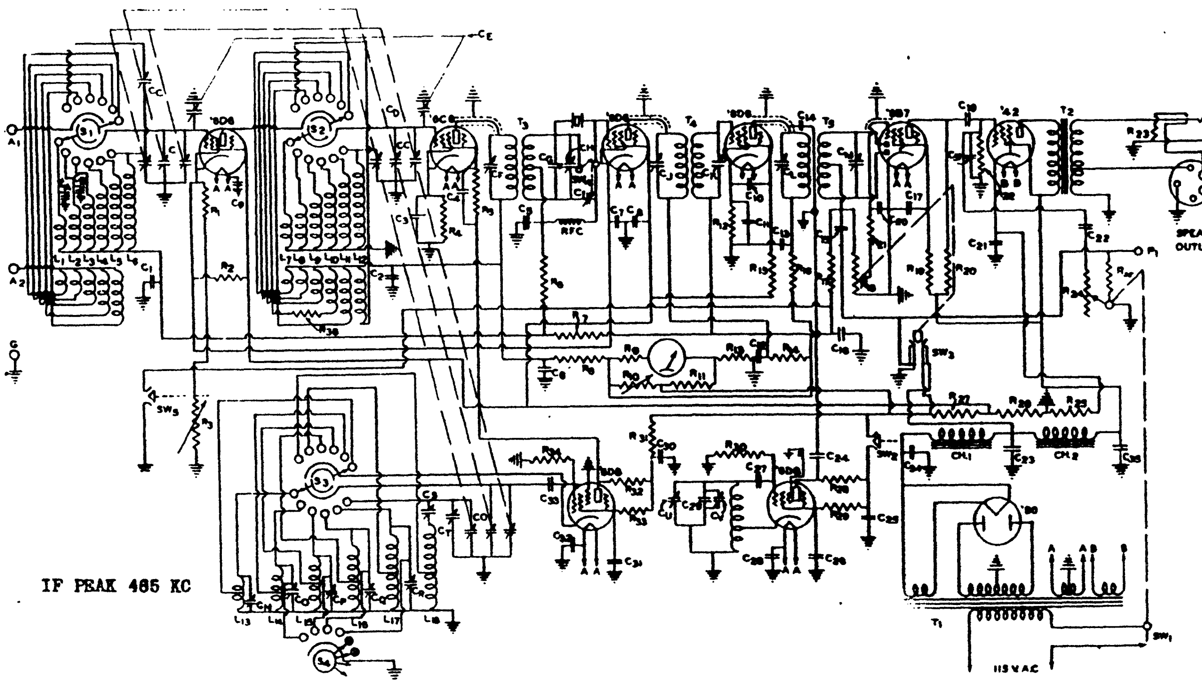
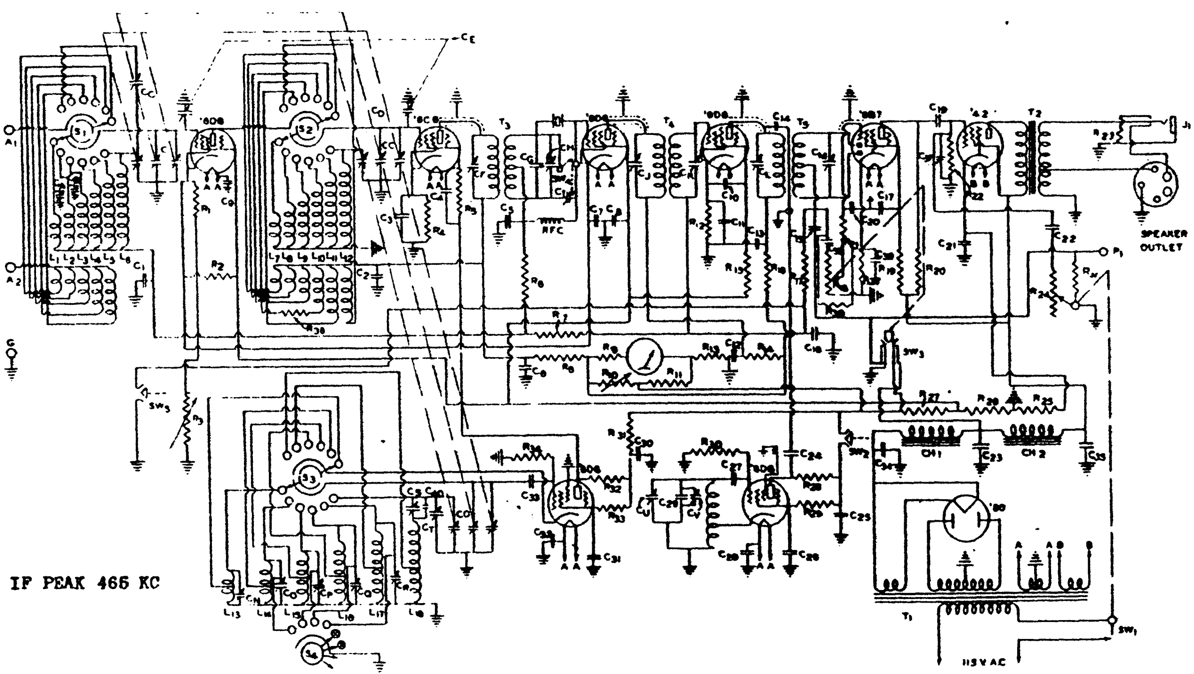


R.M.E. 69 SCHEMATIC CIRCUIT AC-LATE C-23

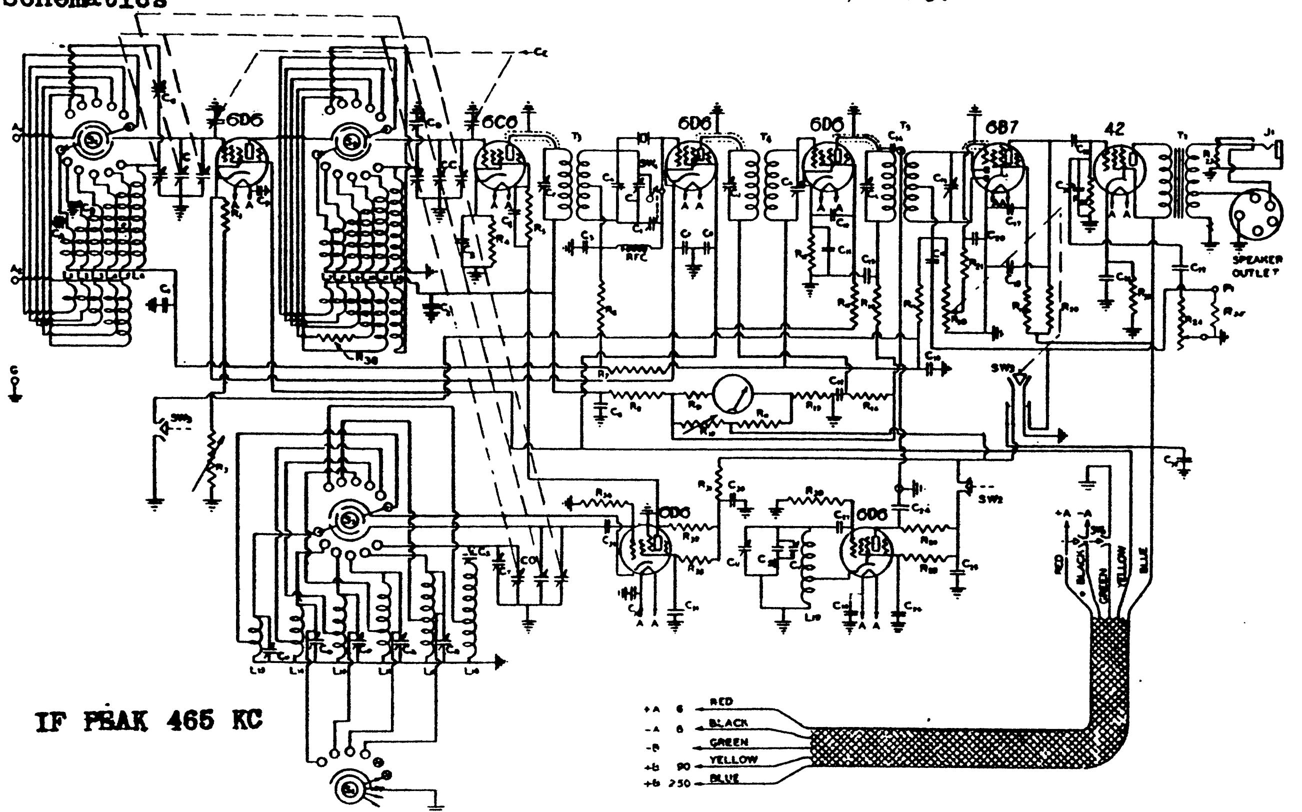


R.M.E. 69 SCHEMATIC CIRCUIT AC-LATE REVISED C-23

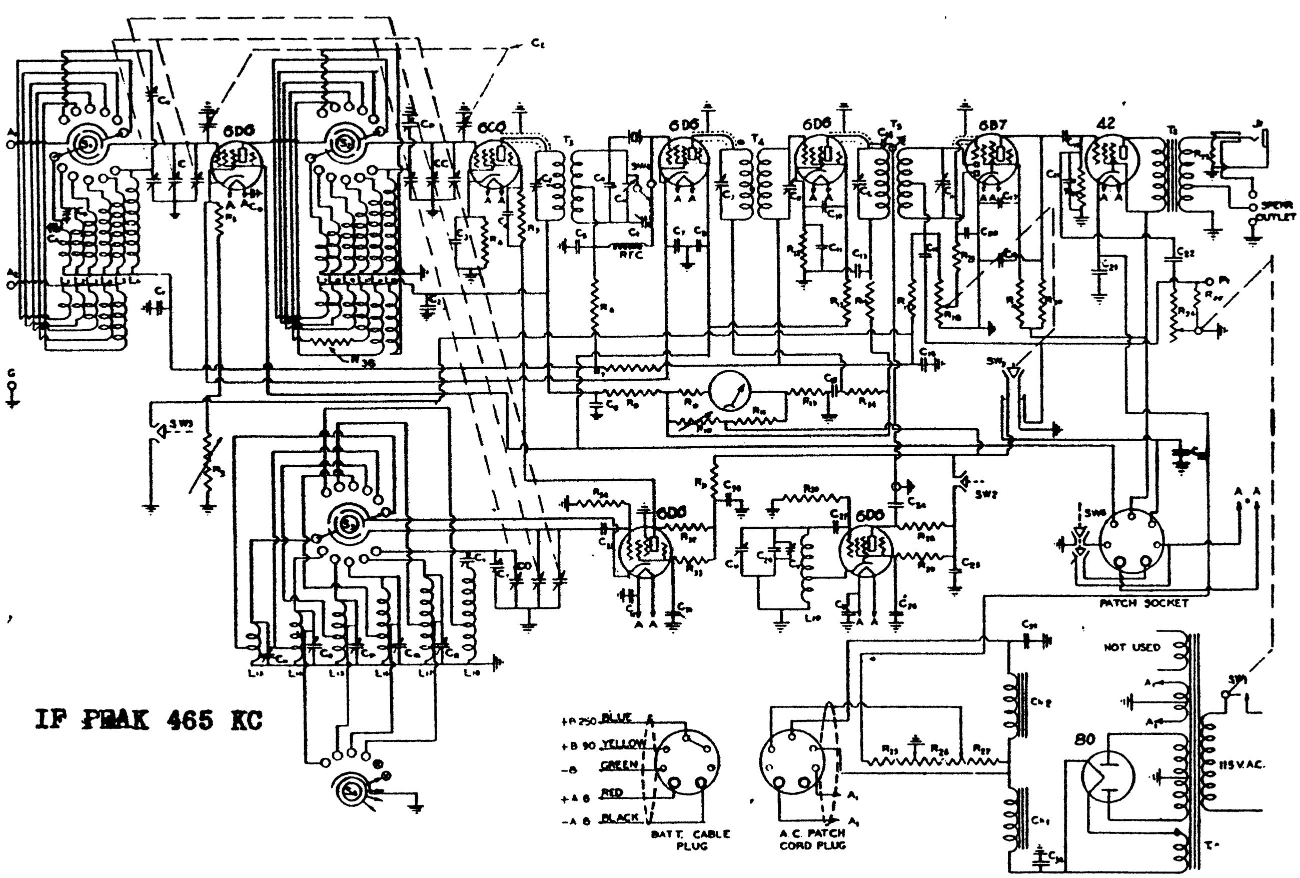
RADIO MFG. ENGINEERS, Inc.

MODEL 69A
MODEL 69B
Schematics

RADIO MFG. ENGINEERS, INC.



Schematic Diagram of RME 69-B for Battery Operation



Schematic Diagram of RME 69-A for AC or Battery Operation

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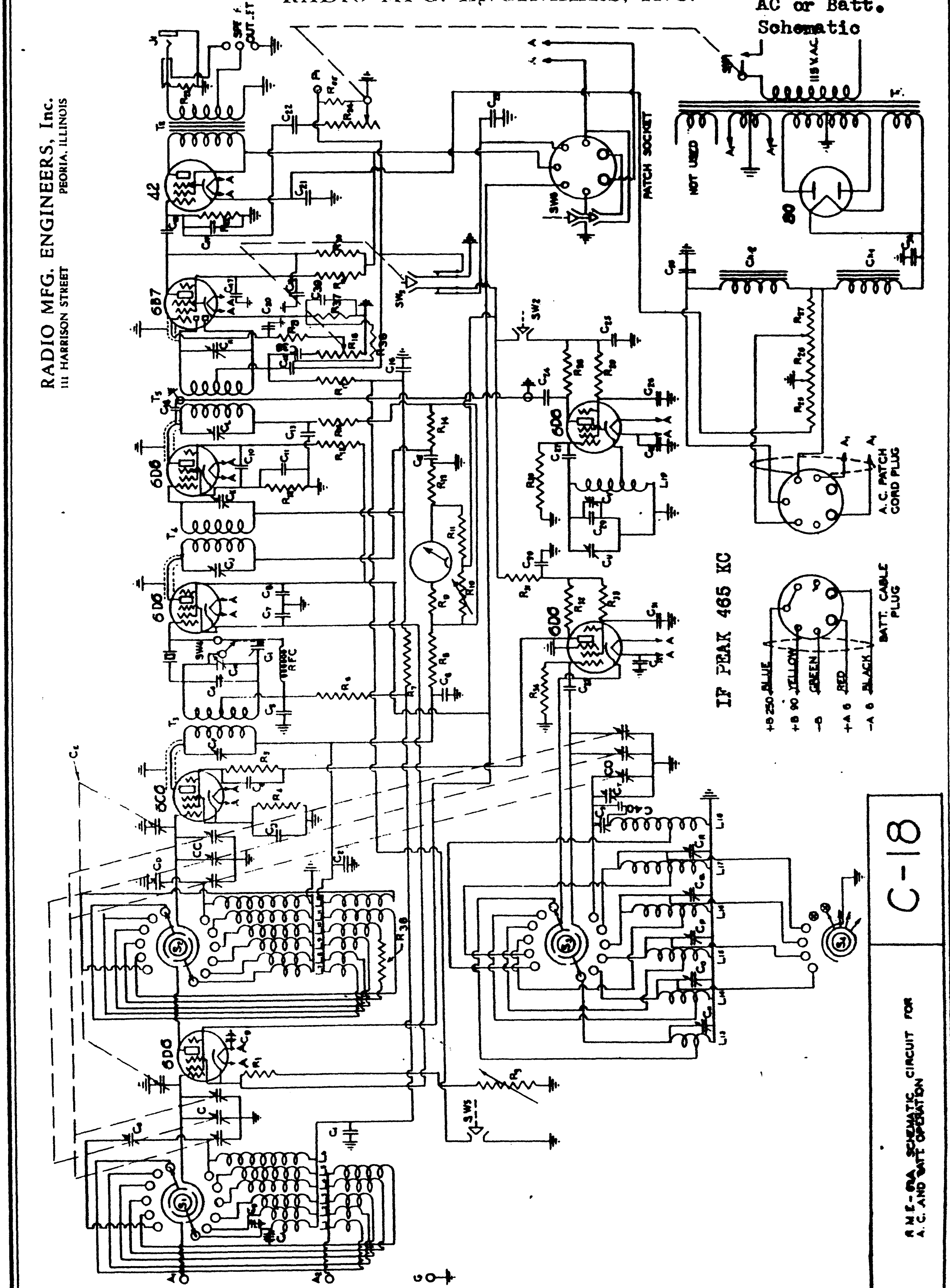
MODEL 69 Revised AC or Batt. Schematic



MODEL 69
Notes, Parts

RADIO MFG. ENGINEERS, INC.

LEGEND OF RESISTORS, CONDENSERS, CHOKES, AND TRANSFORMERS OF RME-69 RECEIVER SCHEMATIC DIAGRAM.

SPECIFICATION

C_a and C_b 30 μμfd. adjustable mica padders.
C_c 30 μμfd. mica padder.
C_d deleted.
C_e Dual section resonator control, 4 μμfd minimum, 30 μμfd maximum.
C_f, C_g, C_j, C_k, C_l, C_m. Adjustable trimming condensers in the intermediate frequency transformers.
C_h 25 μμfd midget air padder.
C_i 30 μμfd mica adjustable phasing condenser.
C_n, C_o, C_p, C_r 30 μμfd adjustable padders.
C_q 70 μμfd adjustable padder.
C_s .0004 mica condenser shunted by 70 μμfd. mica adjustable trimmer.
C_t Mica trimmer on the oscillator section of the main tuning condenser.
C_u 70 μμfd adjustable mica padder.
C_v 25 μμfd variable air condenser

C_1 .01 μfd 400 volts.
C_2 .01 μfd 400 volts.
C_3 .01 μfd 400 volts.
C_4 .01 μfd 400 volts.
C_5 .01 μfd 400 volts.
C_6 .1 μfd 400 volts.
C_7 .1 μfd 400 volts.
C_8 .1 μfd 400 volts.
C_9 .002 moulded mica condenser.
C_{10} .01 μfd 400 volts.
C_{11} .1 μfd 400 volts.
C_{12} .1 μfd 400 volts.
C_{13} .1 μfd 400 volts.
C_{14} 1" of shielded braid wrapped around plate lead of second intermediate frequency amplifier tube. Approximate capacity 10 μμfds.
C_{15} .00025 μμfd.
C_{16} .01 μfd. 400 volts.
C_{17} .1 μfd. 400 volts.
C_{19} .01 μfd 400 volts.
C_{20} .00025 μfd moulded mica condenser.
C_{21} 20 μfd 25 volt electrolytic.
C_{22} .01 μfd 400 volts.
C_{23} 12 μfd 450 volt electrolytic.
C_{24} .0001 moulded mica condenser.
C_{25} .01 μfd 400 volt electrolytic.
C_{26} .01 μfd 400 volts.
C_{27} .0001 μfd moulded mica.
C_{28} .01 μfd 400 volt.
C_{29} .00025 moulded ± 5%.
C_{30} .1 μfd 400 volts.
C_{31} .01 μfd. 400 volts.
C_{32} .01 μfd. 400 volts.
C_{33} .0001 μfd moulded ± 5%.
C_{34} 8 μfd 450 volt electrolytic.
C_{35} 8 μfd 450 volt electrolytic.
C_{37} .00025 μfd moulded condenser
C_{38} .1 μfd, 400 volts
C_{39} 20 μfd, 25 volt
C_{40} 400 μμfd, moulded mica

RFC 16 millhenries
CH_1 30 henries, 100 ma.
CH_2 30 henries, 50 ma.

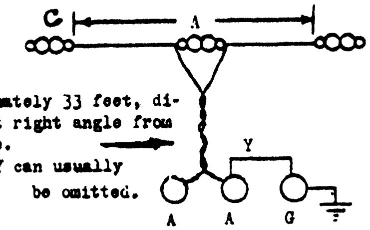
L_1 Band 6 RF grid coil
L_2 Band 5 RF grid coil
L_3 Band 4 RF grid coil
L_4 Band 3 RF grid coil
L_5 Band 2 RF grid coil
L_6 Band 1 RF grid coil

S_1, S_2, S_3, S_4, Band Change Switch
SW_1 115 volt line switch
SW_2 Beat oscillator on and off switch
SW_3 Switch operated by control "H" for connecting monitor circuit and opening B supply to amplifier stage.
SW_4 Crystal switch for series of for parallel
SW_5 Cut-off switch for removing AVC action (operated in tandem with R)
T_1 Main power transformer
T_2 Audio output transformer to 4,000 ohms and 600 ohms.
T_3 First intermediate frequency amplifier transformer.
T_4 Second intermediate frequency amplifier transformer.
T_5 Third intermediate frequency amplifier transformer.

R_1 200 ohms, 1/2 watt
R_2 20,000 ohms, 1 watt
R_3 30,000 ohms, variable
R_4 5,000 ohms, 1/2 watt
R_5 1 megohm, 1/2 watt
R_6 250,000 ohms, 1/2 watt
R_7 100,000 ohms, 1/2 watt
R_8 2,000 ohms, 1/2 watt
R_9 500 ohms, 1/2 watt ±5%
R_{10} 200 ohms wire wound var. R meter balance
R_{11} 1,000 ohms, 1/2 watt
R_{12} 800 ohms, 1/2 watt
R_{13} 100,000 ohms, 2 watts
R_{14} 2,000 ohms, 1/2 watt
R_{15} 10,000 ohms, 1/2 watt
R_{16} 2,000 ohms, 1/2 watt
R_{17} 1 megohm, 1/2 watt
R_{18} 250,000 ohm potentiometer audio level control
R_{19} 1 megohm, 1/2 watt
R_{20} 100,000 ohms, 1/2 watt
R_{21} 50,000 ohms, 1/2 watt
R_{22} 250,000 ohms, 1/2 watt
R_{23} 5,000 ohms, 1/2 watt
R_{24} 1,000,000 ohms potentiometer
R_{25} 410 ohms bleeder section
R_{26} 7200 ohms, bleeder section
R_{27} 6800 ohms, bleeder section
R_{28} 10,000 ohms, 1/2 watt
R_{29} 100,000 ohms, 1/2 watt
R_{30} 100,000 ohms, 1/2 watt
R_{31} 2,000 ohms, 1/2 watt
R_{32} 2,000 ohms, 1/2 watt
R_{33} 50,000 ohms, 1/2 watt
R_{35} 10,000 ohms, 1/2 watt
R_{36} 5,000 ohms, 1/2 watt
R_{37} 1,000 ohms, 1/2 watt
R_{38} 100,000 ohms, 1/2 watt
R_{34} 50,000 ohms, 1/2 watt

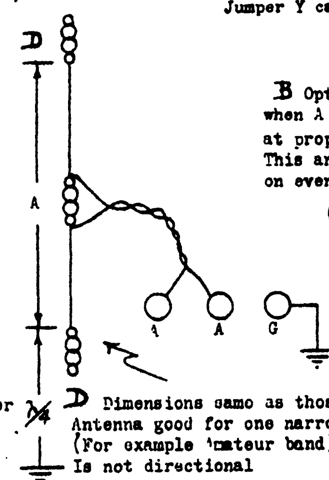
L_7 Band 6 first detector grid coil
L_8 Band 5 first detector grid coil
L_9 Band 4 first detector grid coil
L_{10} Band 3 first detector grid coil
L_{11} Band 2 first detector grid coil
L_{12} Band 1 first detector grid coil
L_{13} Band 6 oscillator coil
L_{14} Band 5 oscillator coil
L_{15} Band 4 oscillator coil
L_{16} Band 3 oscillator coil
L_{17} Band 2 oscillator coil
L_{18} Band 1 oscillator coil

The antenna input impedance to an RME-69 Receiver varies in the vicinity of 250 to 350 ohms. The antenna supply should therefore be of the Marconi type which is fed at current maximum to the receiver or of the twisted pair type where impedances of lines involved are in the vicinity of the 250 ohms previously mentioned. For maximum selectivity insofar as the input circuit is concerned, the value of this impedance should be taken into account. Antennae which are supplying signal to the receiver at a high potential point should not be used in conjunction with the RME-69 Receiver because of the great loss in voltage transfer encountered in such a combination. The half-wave doublet type of antenna providing a tuned antenna system for a certain range of frequencies has certain marked directional characteristics. These directional characteristics are evident in the fact that the greatest pick-up occurs in a direction at right angles to the axis of the antenna, forming in effect a Figure 8 pattern in which the lobes are located off the sides of the antenna instead of off the ends.

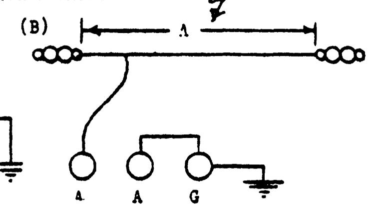


C—Optimum condition when A = $\frac{\lambda}{2}$. Not satisfactory for wide range freq. Excellent for any amateur band if A = $\frac{\lambda}{2}$ is in the middle of the band. For example: For 20 meter band antenna should be designed for 14,200 KC.

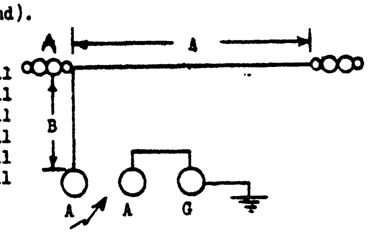
A = approximately 33 feet, directional at right angle from line of wire.
Jumper Y can usually be omitted.



D Dimensions same as those of C. Antenna good for one narrow band. (For example amateur band). Is not directional



B Optimum signal input to receiver when A = $\frac{\lambda}{2}$ and feeder is tapped at proper distance from center. This antenna works quite well usually on even harmonics also.



A General Marconi connection. Optimum condition exists when A plus B = $\frac{\lambda}{4}$ $\frac{\lambda}{4}$ $\frac{\lambda}{4}$ etc.

RADIO MFG. ENGINEERS, INC.

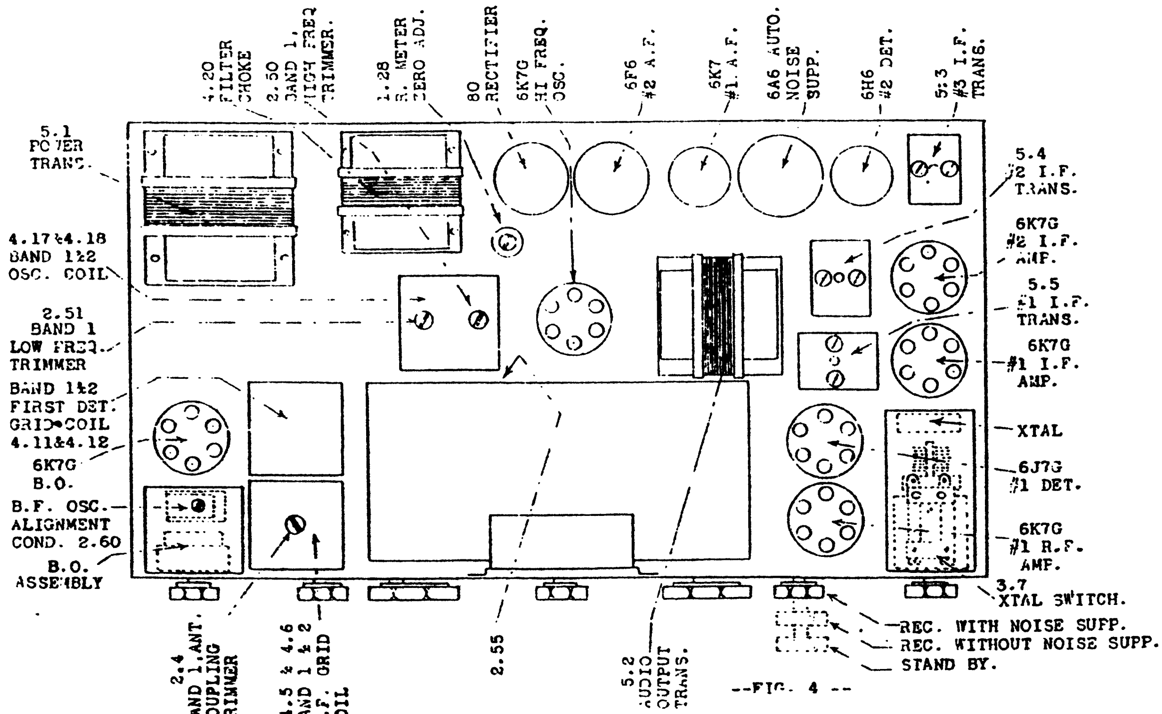
TEST VOLTAGES OBTAINED AT VARIOUS POINTS IN THE RECEIVER CIRCUIT (Measurements made with voltmeter having internal resistance of 1,000 ohms per volt. Instruments with other internal resistances give entirely different readings) Note: Line voltage should be 115 v.

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE (Switch "H" in toward panel)	CORRECT VOLTAGE (Switch "H" pulled outward fm.panel)
Radio frequency amplifier plate and ground	240 volts	0 volts
Radio frequency amplifier screen and ground	100 "	0 "
Radio frequency amplifier cathode and ground	3.2 "	0 "
First detector plates	240 "	0 "
First detector screen and ground	75 "	0 "
First detector cathode and ground	3.5 "	0 "
First intermediate frequency amplifier plate and ground	250 "	0 "
First intermediate frequency amplifier screen and ground	100 "	0 "
Intermediate frequency amplifier cathode and ground	3.2 "	0 "
(The same voltages apply to the second intermediate frequency amplifier tube elements)		
6B7 plate and ground	115 "	145 "
6B7 screen and ground	25 "	35 "
42 plate and ground	244 "	280 "
42 screen and ground	248 "	290 "
42 cathode and ground	16 "	18 "
80 rectifier filament and ground	258 "	335 "
Oscillator plate and ground	248 "	0 "
Oscillator screen and ground	115 "	0 "
Beat oscillator plate and ground	180 "	210 "
Beat oscillator screen and ground	100 "	130 "
The voltage across R-31	14 "	0 "

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

MODEL 70
Chassis, Socket,
Trimmers,
Switch Data

RADIO MFG. ENGINEERS, INC.



--FIG. 4 --

SWITCHES

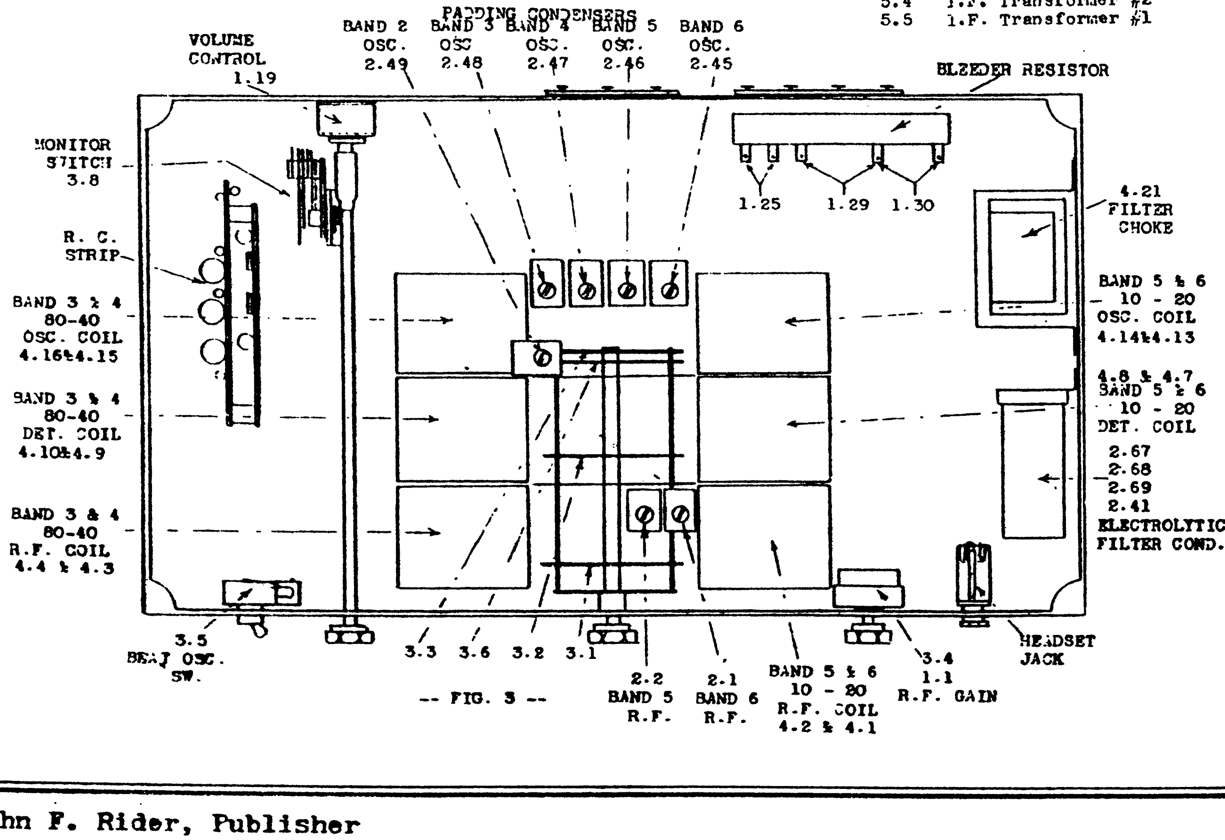
3.1	Band change switch
3.2	Band change switch
3.3	Band change switch
3.4	AVC On-Off
3.5	Beat Oscillator
3.6	Band change switch
3.7	Crystal switch
3.8	Noise suppressor and stand-by.
3.9	Line switch

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 --

MODEL 70
Schematic

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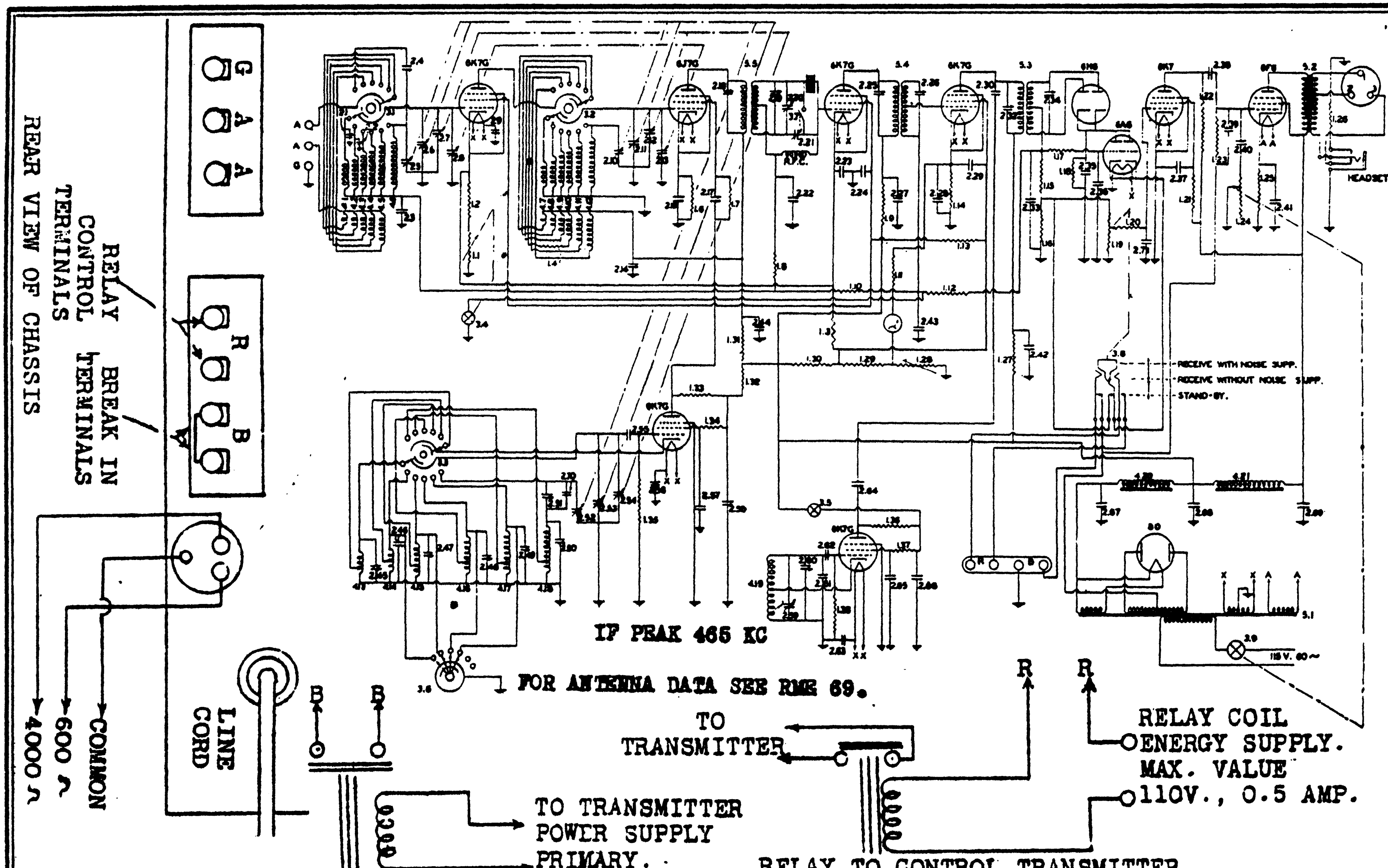


TYPICAL CIRCUIT FOR REMOTE BREAK-IN CONTROL OF RECEIVER. TERMINAL PAIR MARKED B ON RECEIVER CONNECT TO B - B. CIRCUIT BETWEEN B PAIR IS CLOSED WHEN RELAY OR REMOTE SWITCH IS CLOSED DURING TRANSMITTER STAND-BY PERIODS.

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

MODEL RME 69-B Batt.
MODEL RME 69-A AC
or Batt. Schematics

RADIO MFG. ENGINEERS, INC.

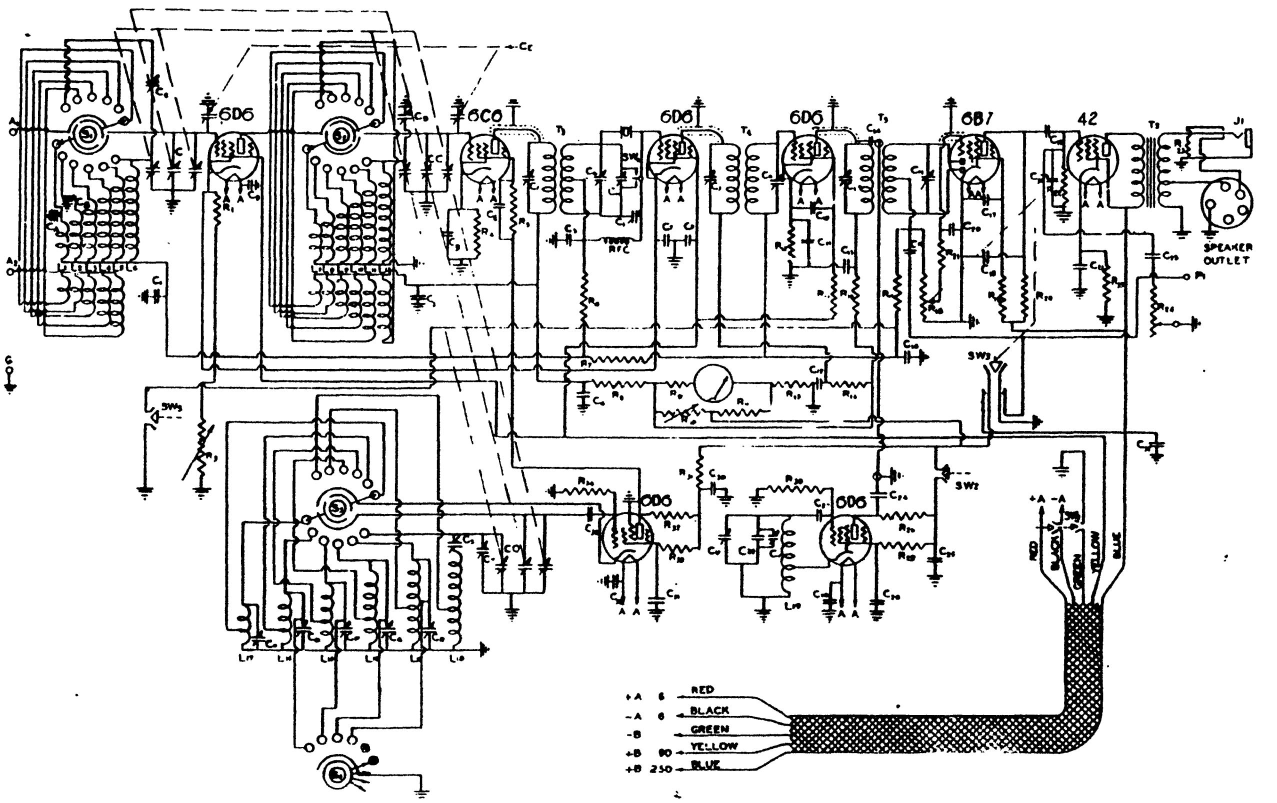


Fig. 16. Schematic Diagram of RME 69-B for Battery Operation

IF PEAK 465 KC

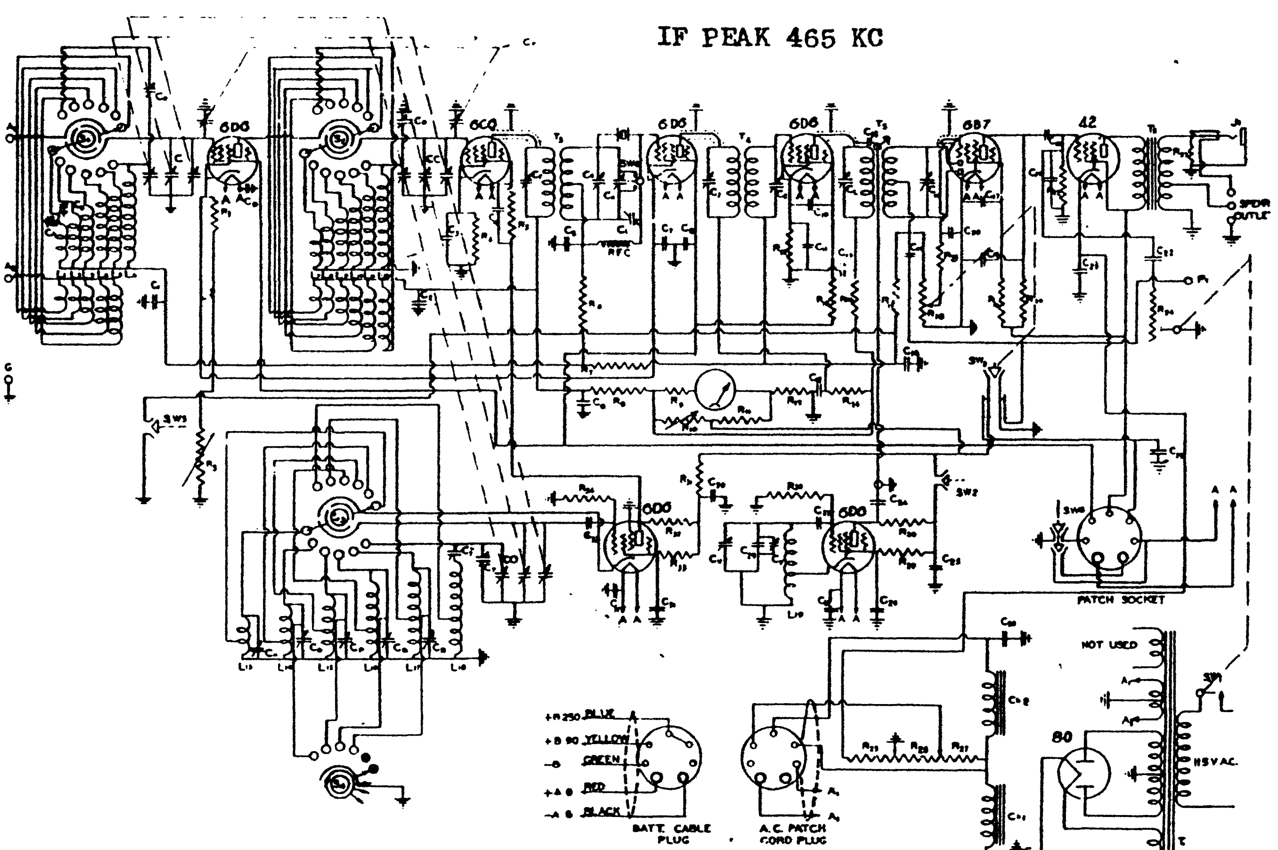


Fig. 17. Schematic Diagram of RME 69-A for AC or Battery Operation

MODEL RME 69-A AC or Batt.
MODEL RME 69-B Batt.
Parts List

RADIO MFG. ENGINEERS, INC.

DESIGNATION	SPECIFICATION
C_a and C_b	30 µµfd. adjustable mica padders.
C_c	30 µµfd. mica padder.
C_d	Mica trimming condenser on center section of main tuning condenser. 50 µµfd. max.
C_e	Dual section resonator control. 4 µµfd. minimum, 30 µµfd. maximum.
C_f, C_g, C_j, C_k, C_l, C_m.	Adjustable trimming condensers in the intermediate frequency transformers.
C_h	25 µµfd. midget air padder
C_i	30 µµfd. mica adjustable phasing condenser.
C_n, C_o, C_p, C_r	30 µµfd. adjustable padders.
C_q	70 µµfd. adjustable padder.
C_s	.0004 mica condenser shunted by 70 µµfd. mica adjustable trimmer.
C_t	Mica trimmer on the oscillator section of the main tuning condenser.
C_u	70 µµfd. adjustable mica padder.
C_v	25 µµfd. variable air condenser
C_1	.01.µfd. 400 volts.
C_2	.01 µfd. 400 volts.
C_3	.01 µfd. 400 volts.
C_4	.01 µfd. 400 volts.
C_5	.01 µfd. 400 volts.
C_6	.1 µfd. 400 volts.
C_7	.1 µfd. 400 volts.
C_8	.1 µfd. 400 volts.
C_9	.002 moulded mica condenser.
C_{10}	.01 µfd. 400 volts.
C_{11}	.1 µfd. 400 volts.
C_{12}	.1 µfd. 400 volts
C_{13}	.1 µfd. 400 volts.
C_{14}	1" of shielded braid wrapped around plate lead of second intermediate frequency amplifier tube. Approximate capacity 10 µµfds.
C_{15}	.00025 µµfd.
C_{16}	.01 µfd. 400 volts.
C_{17}	.1 µfd. 400 volts.
C_{19}	.01 µfd. 400 volts.
C_{20}	.00025 µfd. moulded mica condenser.
C_{21}	20 µfd. 25 volt electrolytic.
C_{22}	.01 µfd. 400 volts.
C_{23}	12 µfd. 450 volt electrolytic.
C_{24}	.0001 moulded mica condenser
C_{25}	.01 400 volt electrolytic
C_{26}	.01 µfd. 400 volt.
C_{27}	.0001 µfd. moulded mica.
C_{28}	.01 µfd. 400 volt.
C_{29}	.00025 moulded ± 5%
C_{30}	.1 µfd. 400 volts.
C_{31}	.01 µfd. 400 volts.
C_{32}	.01 µfd. 400 volts.
C_{33}	.0001 µfd. moulded ± 5%
C_{34}	8 µfd. 450 volt electrolytic
C_{35}	8 µfd. 450 volt electrolytic.
C_{37}	.00025 µfd. moulded condenser.

DESIGNATION	SPECIFICATION
S_1, S_2, S_3, S_4.	Band change switch.
SW_1	115 volt line switch.
SW_2	Beat oscillator on and off switch.
SW_3	Switch operated by control "H" for connecting monitor circuit and opening B supply to amplifier stages.
SW_4	Crystal switch for series or for parallel control.
SW_5	Cut-off switch for removing AVC action (operated in tandem with R_3)
R_{14}	2,000 ohms, 1/2 watt.
R_{15}	10,000 ohms, 1/2 watt.
R_{16}	2,000 ohms, 1/2 watt.
R_{17}	1 megohm, 1/2 watt.
R_{18}	250,000 ohm potentiometer audio level control.
R_{19}	1 megohm, 1/2 watt.
R_{20}	100,000 ohms, 1/2 watt.
R_{21}	50,000 ohm, 1/2 watt.
R_{22}	250,000 ohms, 1/2 watt.
R_{23}	5,000 ohms, 1/2 watt.
R_{24}	1,000,000 ohms potentiometer.
R_{25}	410 ohms bleeder section.
R_{26}	7200 ohms, bleeder section.
R_{27}	6800 ohms, bleeder section.
R_{28}	10,000 ohms, 1/2 watt.
R_{29}	100,000 ohms, 1/2 watt.
R_{30}	100,000 ohms, 1/2 watt.
R_{31}	2,000 ohms, 1/2 watt.
R_{32}	2,000 ohms, 1/2 watt.
R_{33}	50,000 ohms, 1/2 watt.
R_{34}	50,000 ohms, 1/2 watt.
J_1	Headphone jack.
RFC	16 millhenries.
CH_1	30 henries, 100 ma.
CH_2	30 henries, 50 ma.
T_1	Main power transformer.
T_2	Audio output transformer to 4,000 ohms and 600 ohms.
T_3	First intermediate frequency amplifier transformer.
T_4	Second intermediate frequency amplifier transformer.
T_5	Third intermediate frequency amplifier transformer.
R_1	150 ohms, 1/2 watt.
R_2	20,000 ohms, 1 watt.
R_3	30,000 ohms, variable.
R_4	5,000 ohms, 1/2 watt.
R_5	1 megohm, 1/2 watt.
R_6	250,000 ohms, 1/2 watt.
R_7	100,000 ohms, 1/2 watt.
R_8	2,000 ohms, 1/2 watt.
R_9	500 ohms, 1/2 watt ±5%
R_{10}	200 ohms, wire wound var. R meter balance
R_{11}	1,000 ohms, 1/2 watt.
R_{12}	500 ohms, 1/2 watt
R_{13}	100,000 ohms, 2 watts.

L_1	Band 6 RF grid coil.
L_2	Band 5 RF grid coil.
L_3	Band 4 RF grid coil.
L_4	Band 3 RF grid coil.
L_5	Band 2 RF grid coil.
L_6	Band 1 RF grid coil.
L_7	Band 6 first detector grid coil.
L_8	Band 5 first detector grid coil.
L_9	Band 4 first detector grid coil.
L_{10}	Band 3 first detector grid coil.
L_{11}	Band 2 first detector grid coil.
L_{12}	Band 1 first detector grid coil.
L_{13}	Band 6 oscillator coil.
L_{14}	Band 5 oscillator coil.
L_{15}	Band 4 oscillator coil.
L_{16}	Band 3 oscillator coil.
L_{17}	Band 2 oscillator coil.
L_{18}	Band 1 oscillator coil.

THE

RME-70

COMMUNICATIONS RECEIVER

OPERATING and SERVICE MANUAL

RADIO MFG. ENGINEERS, INC.
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. 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 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 amplfier is not set according to any arbitrary calibration on the test osciallator 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, 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) 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 th 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 amain 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 cathoce 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 sedtion 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 suppressor 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 byt 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 tupe 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 experiemce 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 comtacts 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 no se 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 bredom 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 ahift 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 effedts 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	0V
6K7 screen and ground	25V	0V
6F6 plate and ground	244V	0V
6F6 screen and ground	248V	0V
6F6 cathode and ground	16V	0V
80 rectifier fil. and ground	258V	0V
Oscillator plate & ground	248V	0V
Oscillator screen & gnd	115V	0V
Beat oscillator plate & gnd	180V	0V
Beat oscillator screen & gnd	100V	0V
The voltage across 1.32	14V	0V

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 500,000 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
2.36 .1 400V
2.37 .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

RME-70 PARTS LIST (Page 2)

SWITCHES

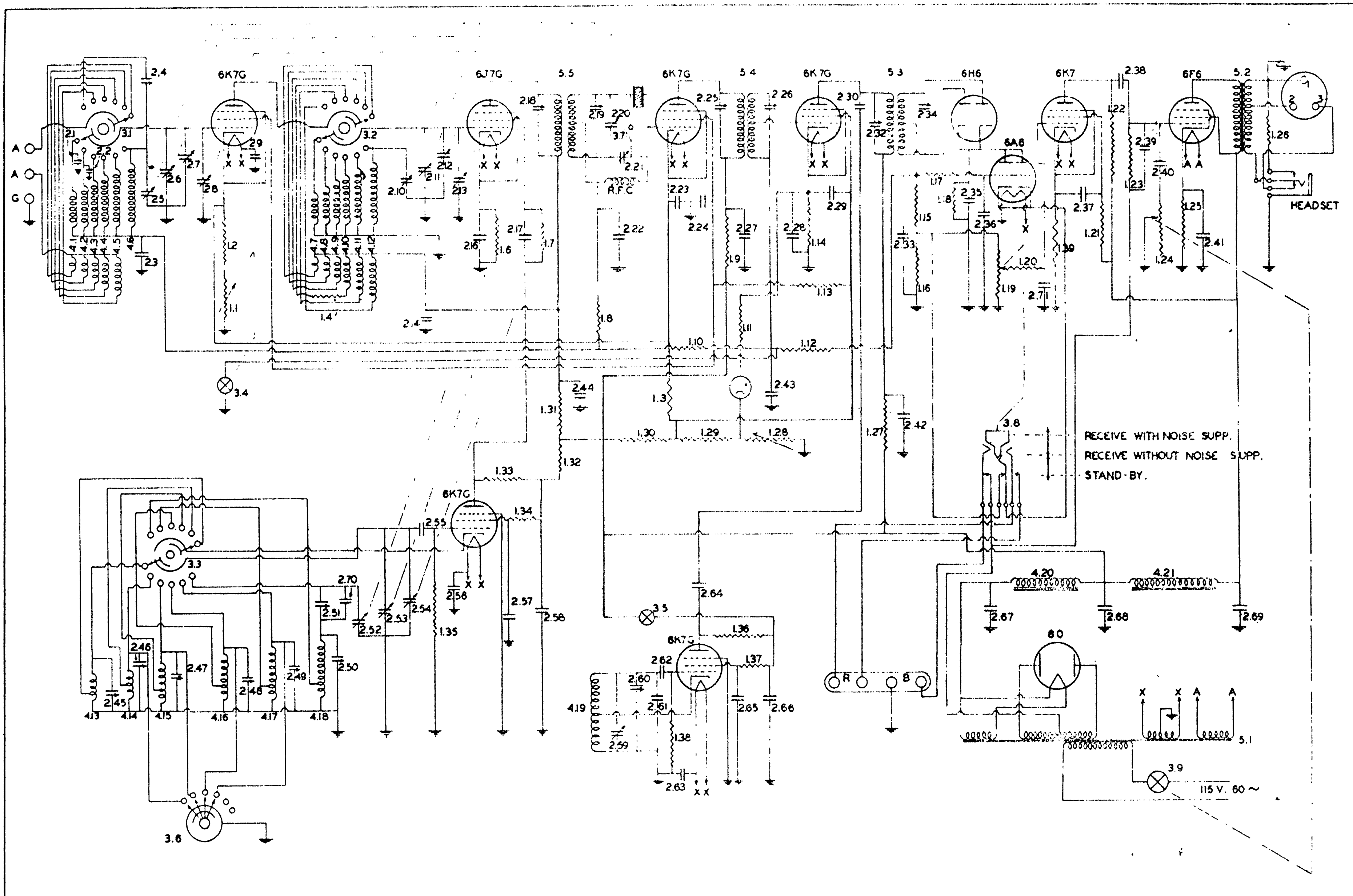
3.1 Band change switch
3.2 Band change switch
3.3 Band change switch
3.4 AVC On*Off
3.5 Beat oscillator
3.6 Band change switch
3.7 Crystal switch
3.8 Noise suppressor and stand-by
3.9 Line switch

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



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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 ... 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 ... made regarding the intermediate frequency amplifier.

When ... 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

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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 counterclockwise 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 meshed. 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 counterclockwise 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 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 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

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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 2.59 (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

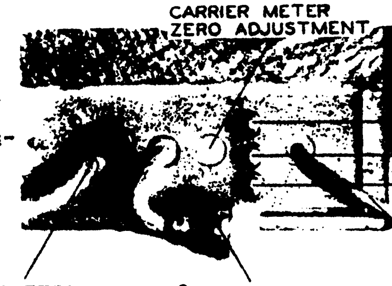

FIG. 8

MODEL
69 (late)

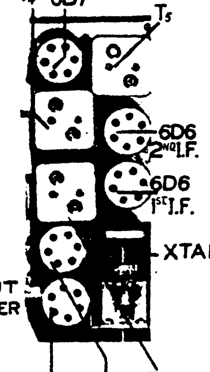

Fig. 4B

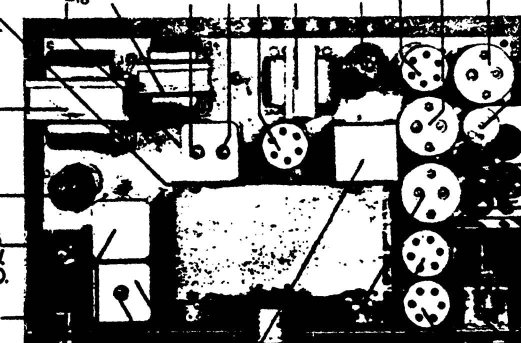

Fig. 4A

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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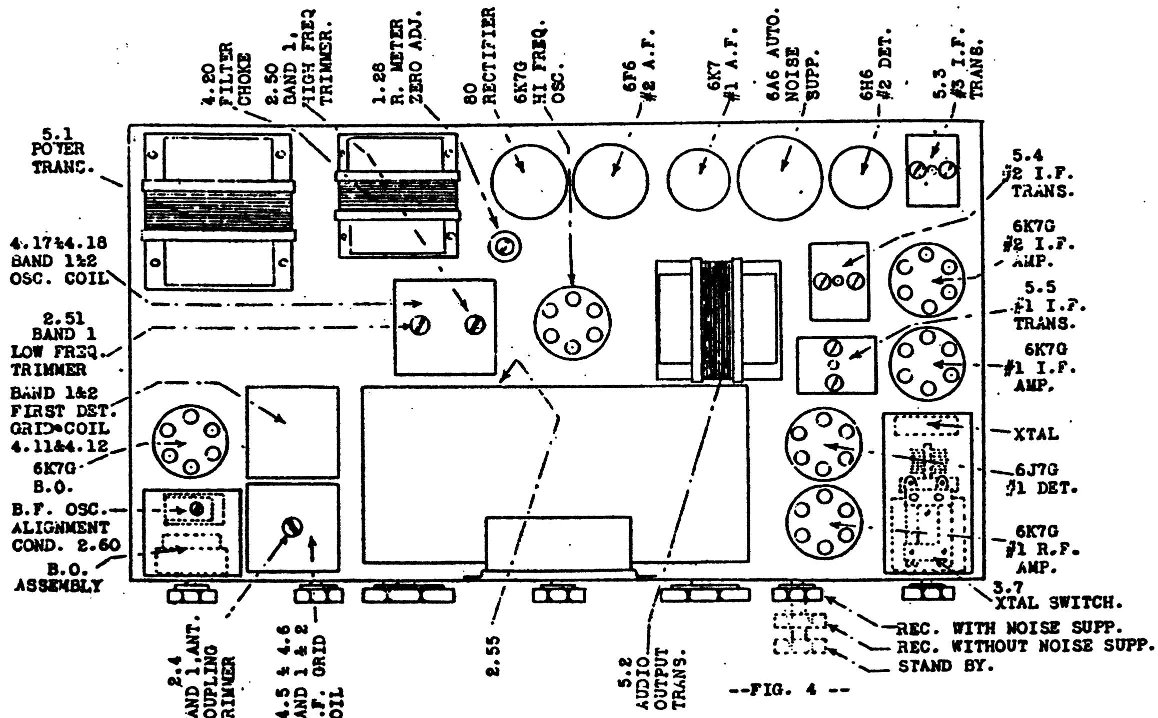


--FIG. 4 --

SWITCHES

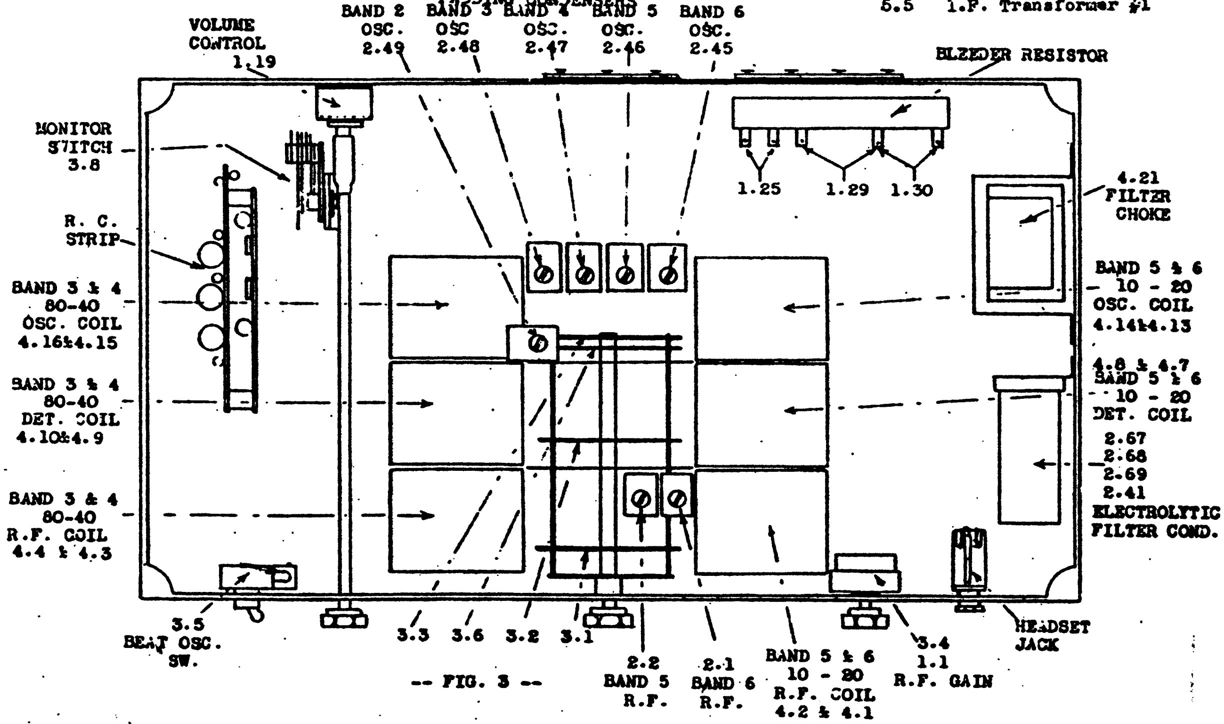
3.1	Band change switch
3.2	Band change switch
3.3	Band change switch
3.4	AVC On-off
3.5	Beat Oscillator
3.6	Band change switch
3.7	Crystal switch
3.8	Noise suppressor and stand-by.
3.9	Line switch

INDUCTANCE

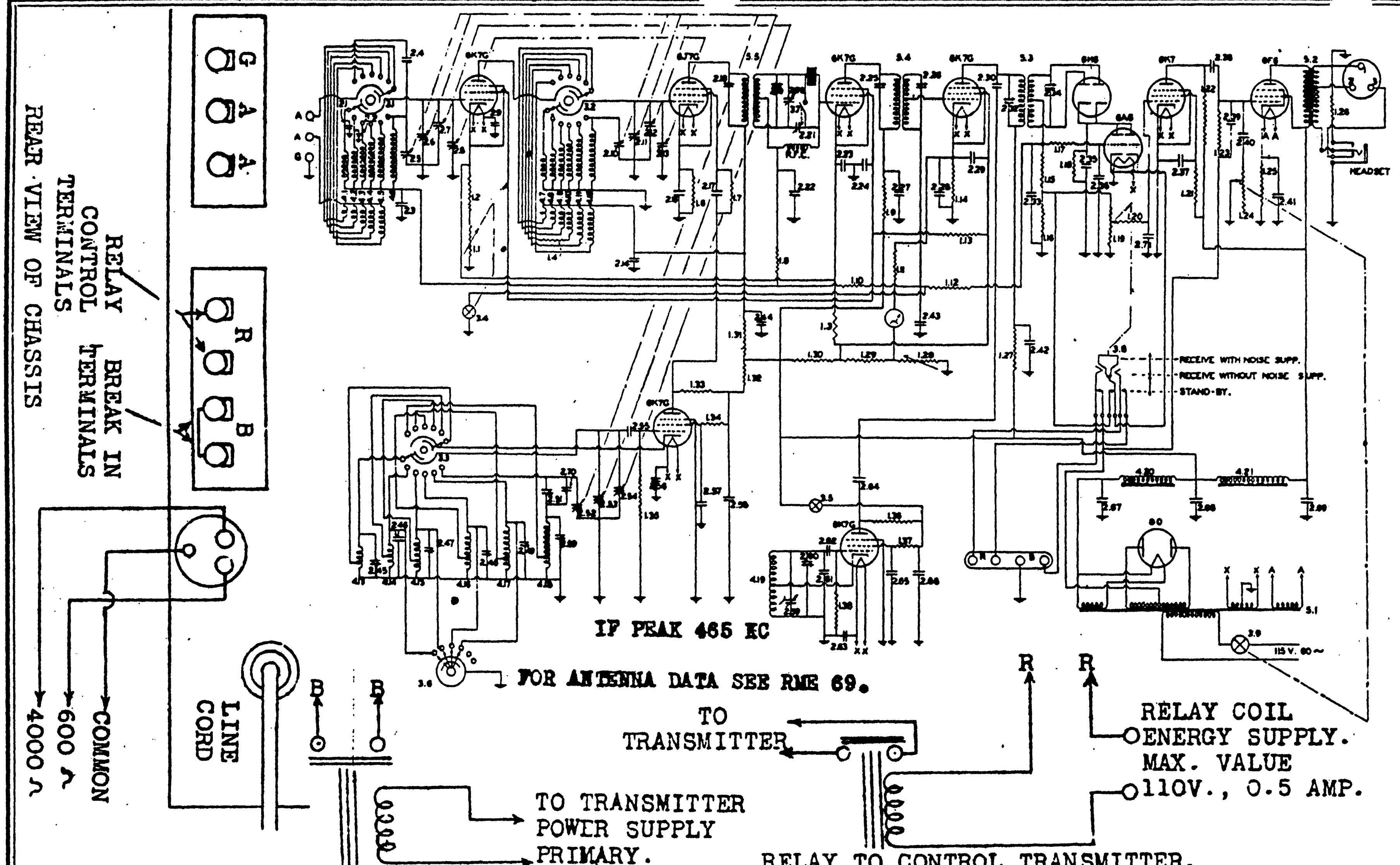
4.1	Band 6 R.F. Grid coil
4.2	Band 5 R.F. Grid coil
4.3	Band 4 R.F. Grid coil
4.4	Band 3 R.F. Grid coil
4.5	Band 2 R.F. Grid coil
4.6	Band 1 R.F. Grid coil
4.7	Band 6 1st Det. coil
4.8	Band 5 1st Det. coil
4.9	Band 4 1st Det. coil
4.10	Band 3 1st Det. coil
4.11	Band 2 1st Det. coil
4.12	Band 1 1st Det. 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 50 MA Filter choke
RFC	10MH R.F. Choke

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 --



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)

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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

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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 amplifior 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 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 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 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 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

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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 meshed. 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 2.59 (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

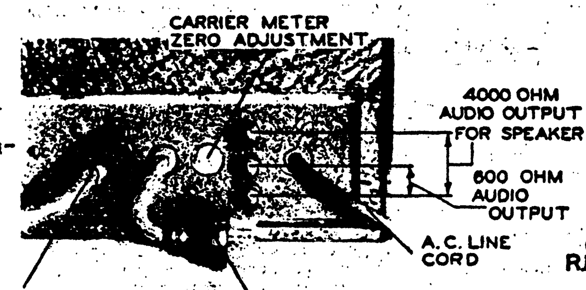

FIG. 8

MODEL 69 (late)

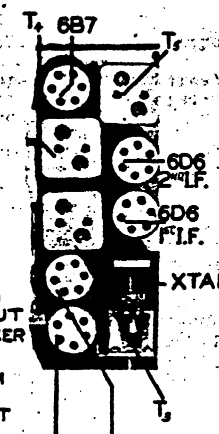

Fig. 4B

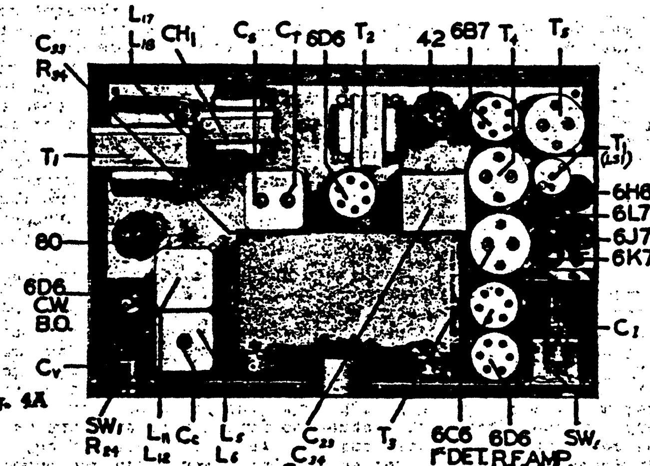

Fig. 4A

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.

OPERATING INSTRUCTIONS FOR THE RME TYPE DM-36 FREQUENCY EXPANDER

The RME type DM-36 Frequency Expander has been designed to give high signal gain and high image frequency rejection ratios to signals received in the ranges between 28 to 30 megacycles and the range between 56 and 60 megacycles. These are, of course, the border frequencies and adequate over-lap is embodied in the tuning range of the instrument to facilitate full coverage of these bands. Coverage of the frequency ranges is provided for by a full 180^{o} rotation of the tuning indicator, giving what might be called full band spread to these two very important amateur communication channels. The cabinet is designed to match other RME receiving and preselection equipment and all controls requisite to proper performance of the unit are located on the panel.

This unit is in effect a frequency converter and therefore acts as a radio frequency amplifier and mixer tube with its oscillator in an over-all superheterodyne type of circuit. It must be used in connection with a regular receiver capable of tuning to a frequency of 10,000 KC (10 MC). The associated receiver therefore acts as an intermediate frequency amplifier unit and a demodulator and audio amplifier in order to reproduce the output of the expander.

The RME-69 and the RME-70 receiver either alone or in combination with the DB-20 preselector form a very high quality associated equipment for use with this DM-36 type frequency expander, or it may be used with any suitable type of receiver which will tune to a frequency of 10,000 KC. In this respect it is invaluable in extending the range of those receivers to the 30 and 60 megacycles amateur bands. In addition to that it provides adequate band spread tuning and high sensitivity for signals in those ranges.

ANTENNAE

An antenna changeover switch is provided on the DM-36 for connecting the antenna used on the triple terminal strip (See Fig. 2) to either the DM-36 in combination with the associated receiver or directly to the receiver with which the instrument is associated. This is accomplished by setting the switch to the position marked "DM-36" on the left pointer position, or to the right pointer position marked "RECEIVER", as indicated in Figure 1.

The triple terminal strip is designed for connecting the antenna to be used for the 28 to 30 megacycle band and also the antenna which will probably be used on the receiver alone when the DM-36 is not connected in the circuit. In order to make it possible to get the best results from the five meter channel a separate pair of terminals have been provided so that a doublet antenna may be connected into the primary coil of the five meter channel (See Fig. 2). The best performance will be obtained when an antenna is used especially designed for the middle frequency of the five meter amateur band--that is, 58 megacycles. It can either be a half wave doublet fed from the center to the DM-36 by means of a twisted pair or it can be a single wire antenna a half wave long placed vertically or horizontally (preferrably horizontally) in space and fed to the receiver by connection to antenna terminal #1, in which case antenna #2, for the five meter band, can be connected directly to the terminal marked "G" on the DM-36, see the page appended giving various configurations of antenna construction and the method of connection to the DM-36 for the various frequencies (Fig. 5).

In order to install this unit it is necessary only to have available a satisfactory outlet for the 115 volt, 50 to 60 cycle supply, or other supply if the expander has been ordered for special voltage or frequency, and a suitable receiver which will tune to 10 megacycles.

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In order to install this unit it is necessary only to have available a satisfactory outlet for the 115 volt, 50 to 60 cycle supply, or other supply if the expander has been ordered for special voltage or frequency, and a suitable receiver which will tune to 10 megacycles.

A special twisted pair link connector with a four prong plug is supplied with the DM-36 for connection to the receiver. If the receiver is of the three terminal input type--that is, two primary coil antenna terminals and a ground terminal, the ground terminal should be connected directly to a ground and the twisted pair coupling link, supplied with the DM-36, can be used to connect to the other two antenna terminals, as indicated on the sketch of antenna arrangements (Fig. 5). Or, if the input circuit of the receiver with which the DM-36 is used consists only of two terminals, connect the red wire of the twisted pair link to the terminal marked "antenna" of the high side input and the black wire to the "ground" terminal of that receiver. It is only necessary thereafter to connect the proper antenna to the terminals, as suggested in the discussion regarding antennae, and to turn the line switch to the "on" position. Make sure before attempting to tune that the receiver with which the DM-36 is associated is set exactly to 10 megacycles (10,000 KC) or as closely thereto as it can possibly be set, or when the DM-36 has warmed up to operating temperature with antenna changeover switch set to "DM-36", the associated receiver tuning may be adjusted to a frequency (close to 10 MC on receiver dial) which gives greatest background noise response. This will occur due to the fact that output of the DM-36 is tuned to 10 megacycles and this method will assure setting the receiver to the correct frequency setting.

After the DM-36 has been turned on for approximately thirty seconds to one minute, it should be warmed up to a point where it will operate satisfactorily. The receiver, of course, should also be in operating condition and should have received the same warm-up period if it was cold when the equipment was turned on. It is necessary, of course, to set the receiver to 10 megacycles which in the case of the RME-70 and RME-69 will be found on band #4. In the case of the RME-70 and RME-69 the resonator control should be adjusted so that maximum background response is obtained. This will be slightly to the right of the vertical position of the pointer. The receiver should be adjusted for optimum sensitivity in a fashion identical to that which it would be adjusted if a signal were going to be received at 10 megacycles. When the receiver has been taken care of insofar as adjustment is concerned the DM-36 may be switched to either the 56 to 60 megacycle band or to the 28 to 30 megacycle band and the antenna changeover switch set to read "antenna" on the "DM-36" (left hand position of the pointer) and tuning can be accomplished by turning the main tuning condenser control.

On the 28 to 30 megacycle band it will probably be possible to hear stations at most any time. On the 56 to 60 megacycle band signals will be heard only when conditions warrant insofar as distance reception is concerned, but stations up to thirty miles should be audible whenever they are on the air.

It will be found that for the first twenty minutes the calibration may be slightly off in the low frequency direction. This however will quickly settle down to accurate calibration as the instrument warms up. In the first two or three minutes it will be noticed that signals very rapidly leave tune due to this rapid warm-up of the instrument. When, however, the DM-36 has warmed up for twenty or thirty minutes and the room temperature remains normally constant, as it would in most conditions, the calibration is very stable and the instrument performance will be very stable and very accurate in calibration.

It is recommended if one is familiar with adjustments a slight improvement in the performance may be made by lifting the unit so that the two trimming holes are visible (as in Fig. 3 of the diagrams). There are two trimmers here which line up the R.F. circuit for both the 56 and the 28 megacycle bands. The connection of widely variant types of antennae to the input terminals in some cases will cause a slight misalgnment of the radio frequency grid circuit. Compensation can be made by adjusting these two padders for their respective bands, after the instrument has warmed up for about forty-five minutes and a signal is being received. Maximum reading of the R meter when the signal is exactly tuned will indicate the proper position to set the adjustments. Care must be taken not to make a very great adjustment or any great degree of rotation of these padders since they will be, under all conditions, very close to maximum adjustment. The best that can be hoped for is a very slight touch-up in case the antenna circuit has effected the tuning of the grid circuit in a way which it is possible to effect it under certain conditions.

CAUSES FOR FAILURE TO OPERATE

If the overall combination seems dead it may be due to the fact that a tube has become dislodged in its socket during shipment and inspection of the various tubes will show whether or not this is the case. It is also possible that a ground placed on both the DM-36 and the associated receiver may cause short circuit of the output of the DM-36 if the DM-36 leads are reversed in the case of a high-low terminal connection.

Another reason why the overall combination may be dead can be due, of course, to the fact that the receiver is tuned to a frequency other than 10 megacycles.

Another reason for failure to operate is that a tube may be burned out and this should be determined before any steps are taken to tamper with the instrument or to make any other types of service adjustments.

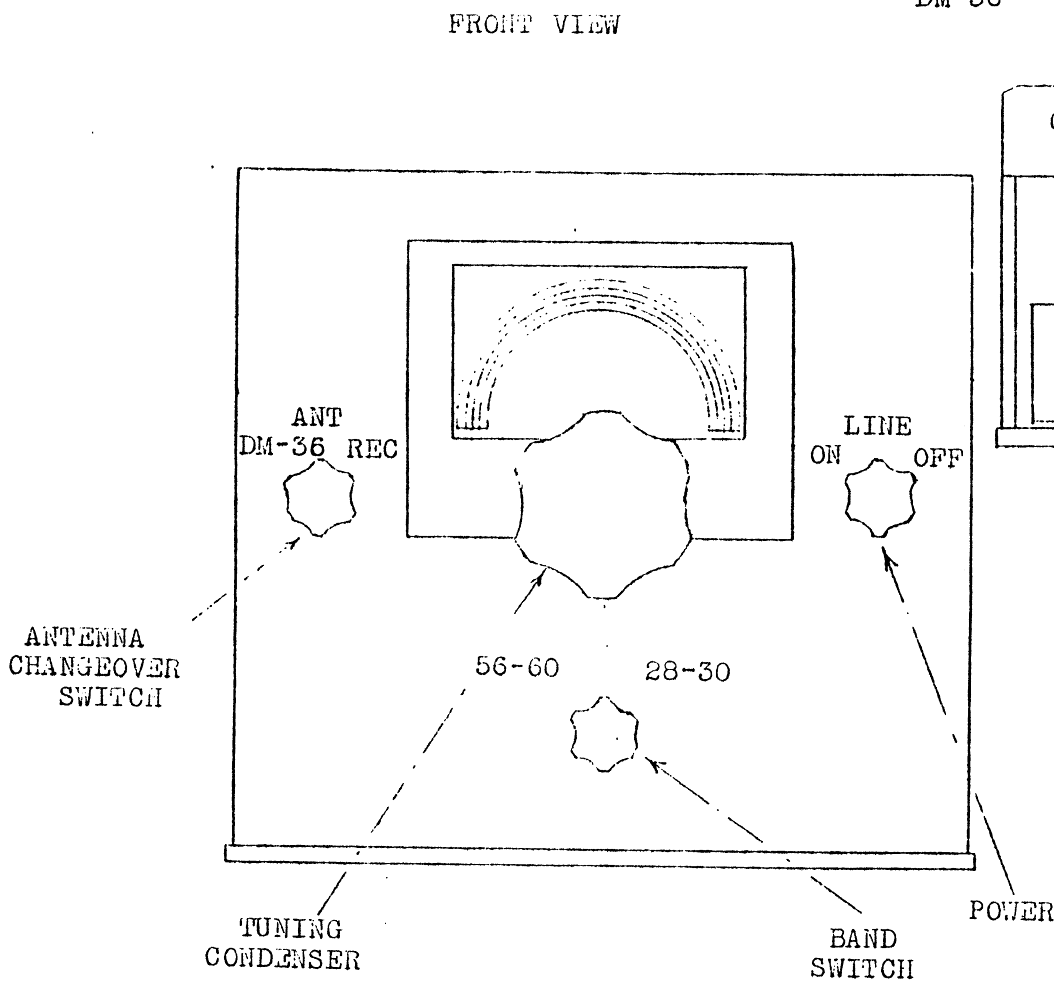
It is, of course, necessary to have direct current voltage from the rectifier in the circuits requiring that type of supply and in order to check whether or not the rectifier is working it is possible to momentarily short the stator connection of the oscillator condenser (the fartherest section from the panel of the variable condenser) to ground in which case a small spark should be visible. Care should be taken not to short this for any length of time.

It will not be possible to operate the receiver alone if an antenna is connected only to the five meter terminal of the DM-36, since that particular circuit is not switched over to the receiver input when the antenna changeover switch (the left hand control on the panel) is operated. Only the ten meter antenna circuit is switched over to the receiver. From this it also follows that the connection of a ten meter antenna only to the DM-36 will not permit operation of the DM-36 on five meters, since the two antennae are separate as before stated.

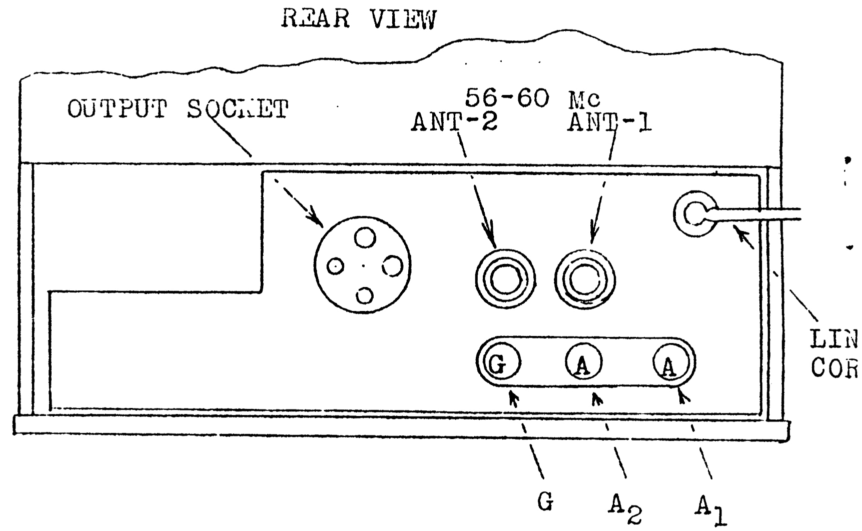
In case of any serious difficulty in which it is impossible to find out the cause of non-operation, or faulty operation, or unsatisfactory performance of this instrument, please get in touch with Radio Manufacturing Engineers, who will cooperate to the fullest extent in correcting the difficulty.

Changes are made from time to time in all equipment manufactured by Radio Manufacturing Engineers. They assume no obligation for the installation of these changes or improvements in equipment made prior to date of change.

--DM-36--



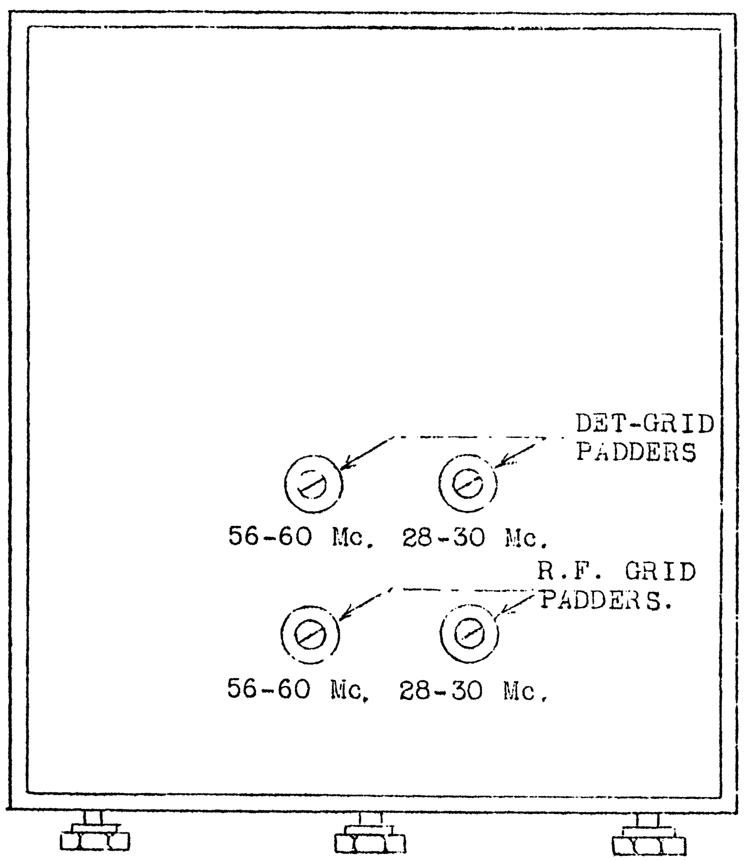
-- FIG. 1 --



IF SINGLE WIRE IS USED ON BAND 28-30 Mc. CONNECT ANTENNA LEAD TO A_1, AND GROUND A_2 TO TERMINAL 'G'.

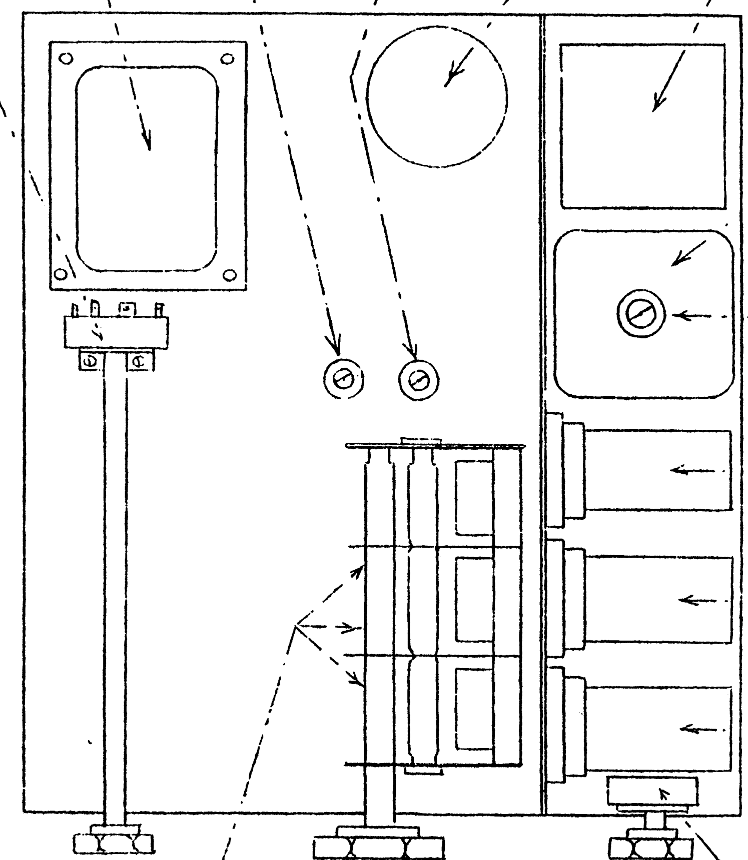
IF SINGLE WIRE IS USED ON BAND 56-60 Mc. CONNECT ANTENNA LEAD TO ANT-1, AND GROUND ANT-2 TO TERMINAL 'G'; DIRECTLY BELOW IT.

-- FIG. 2 --



--FIG.3--

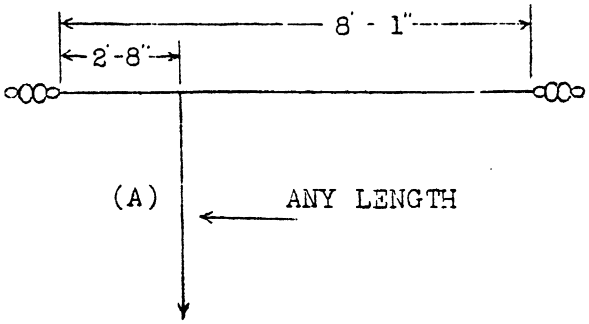
BOTTOM VIEW



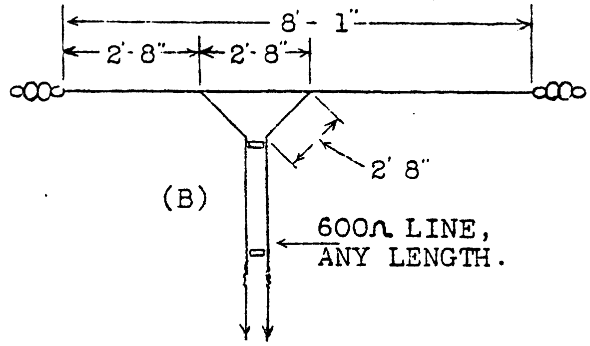
--FIG. 4--

TOP VIEW

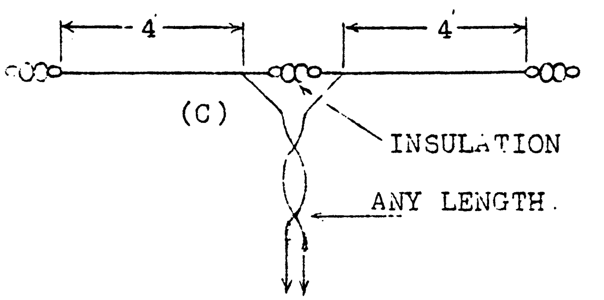
--- 56 MEGACYCLE ANTENNA ---



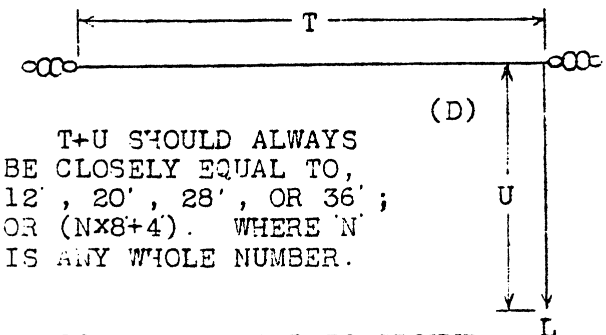
CONNECT 2 TO 3 TO GROUND.
CONNECT L TO 1.



CONNECT TO 1 AND 2.



CONNECT TO 1 AND 2.



T+U SHOULD ALWAYS BE CLOSELY EQUAL TO, 12', 20', 28', OR 36'; OR (N×8+4'). WHERE 'N' IS ANY WHOLE NUMBER.

CONNECT 2 TO 3 TO GROUND,
CONNECT L TO 1.

--- 28 MEGACYCLE ANTENNA ---

FOR ANY TYPE AS ABOVE, DOUBLE THE LENGTH OR OTHER DIMENSION INDICATED FOR 56 Mc., AND CONNECT AS FOLLOWS.

(A)
CONNECT 3 AND 4
CONNECT L TO 5.

(B)
CONNECT TO 4 AND 5.
CONNECT 3 TO GROUND.

(C)
SAME AS B.

(D)
SAME AS A.

ANTENNA INPUT TERMINALS OF THE
RME DM-36 FREQUENCY EXPANDER.

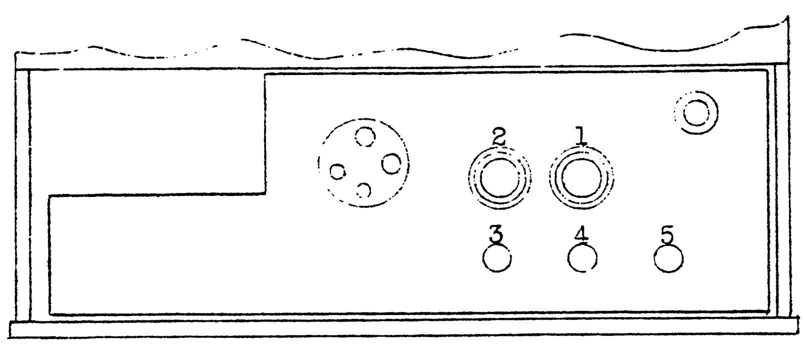
1- 56 Mc. ANT.

2- 56 Mc. ANT.

3- GROUND.

4- 28 Mc. ANT.

5- 28 Mc. ANT.



--- FIG. 5 ---

PARTS LIST FOR THE RME MODEL DM-36 BAND EXPANDER

PART CODE NUMBER	SPECIFICATION
1.1	200 ohms, 1/3 watt resistor
1.2	35 ohms, 1/3 watt resistor
1.3	5000 ohms, 1/3 watt resitor
1.4	10,000 ohms, 1 watt resistor.
1.5	5000 ohms, 1/3 watt resistor
1.6	15,000 ohms, 10 watts C.T.
1.7	35 ohms, 1/3 watt resistor
2.1	20 mmfd. condenser
2.2	Tuning condenser
2.3	20 mmfd. condenser
2.4	400 mmfd. condenser
2.5	400 mmfd. condenser
2.6	400 mmfd. condenser
2.7	400 mmfd. condenser
2.8	250 mmfd. condenser
2.9	20 mmfd. condenser
2.10	20 mmfd. condenser
2.11	Tuning Condenser
2.12	400 mmfd. condenser
2.13	400 mmfd. condenser
2.14	400 mmfd. condenser
2.15	50 mmfd. condenser
2.16	30 mmfd. condenser
2.17	.01 mfd. condenser
2.18	400 mmfd. condenser
2.19	100 mmfd. condenser
2.20	Tuning Condenser
2.21	15 mmfd. Condenser
2.22	15 mmfd. condenser
2.23	1500 mmfd. condenser
2.24	500 mmfd. condenser
2.25	15 mfd. condenser
2.26	10 mfd. condenser
2.27	15 mmfd. condenser
3.1	S.P.S.T. Switch
3.2	4.P.D.T. Switch
A,B,C,D. E F G.	Band Switch
4.1	Choke, 30 henries
5.1	Power transformer
L_1	10 M. R.F. coil
L_2	5 M. R.F. coil
L_3	10 M. Det. coil
L_4	5 M. Det. coil
L_5	10 M. Osc. coil
L_6	5 M. Osc. coil
L_7	Output Coupling Transformer (10 M.C.)

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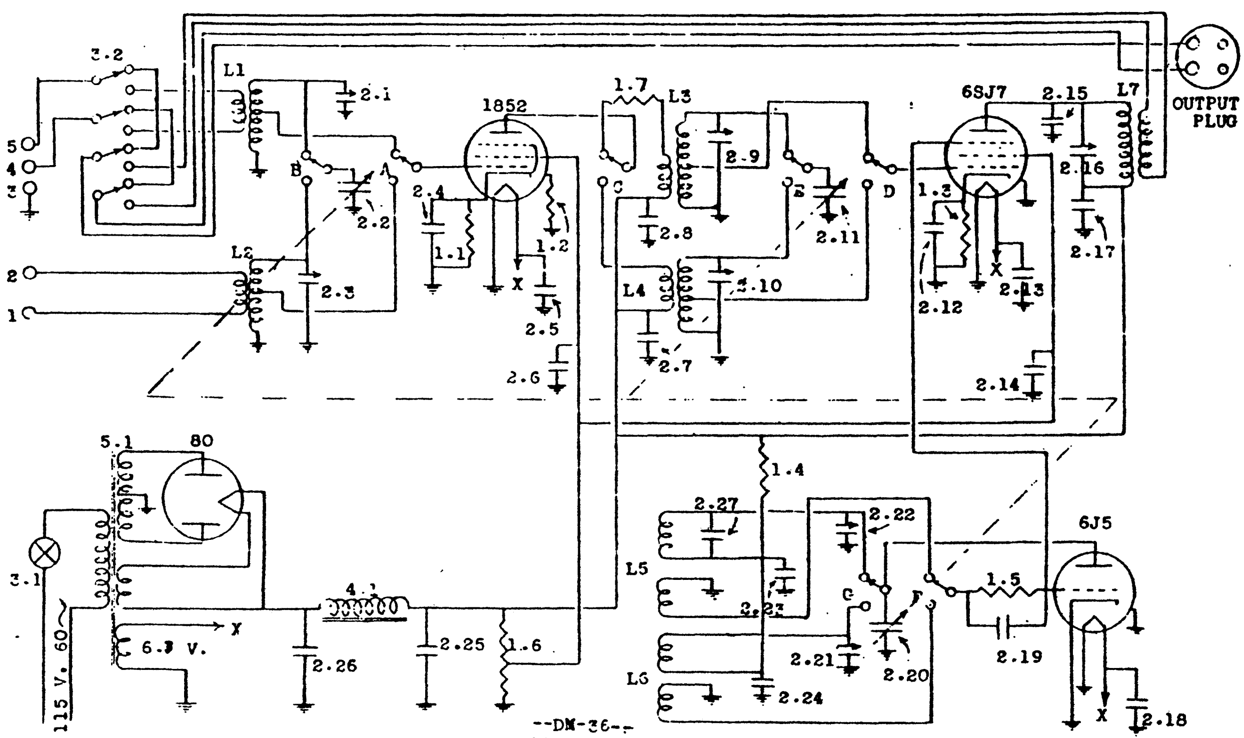
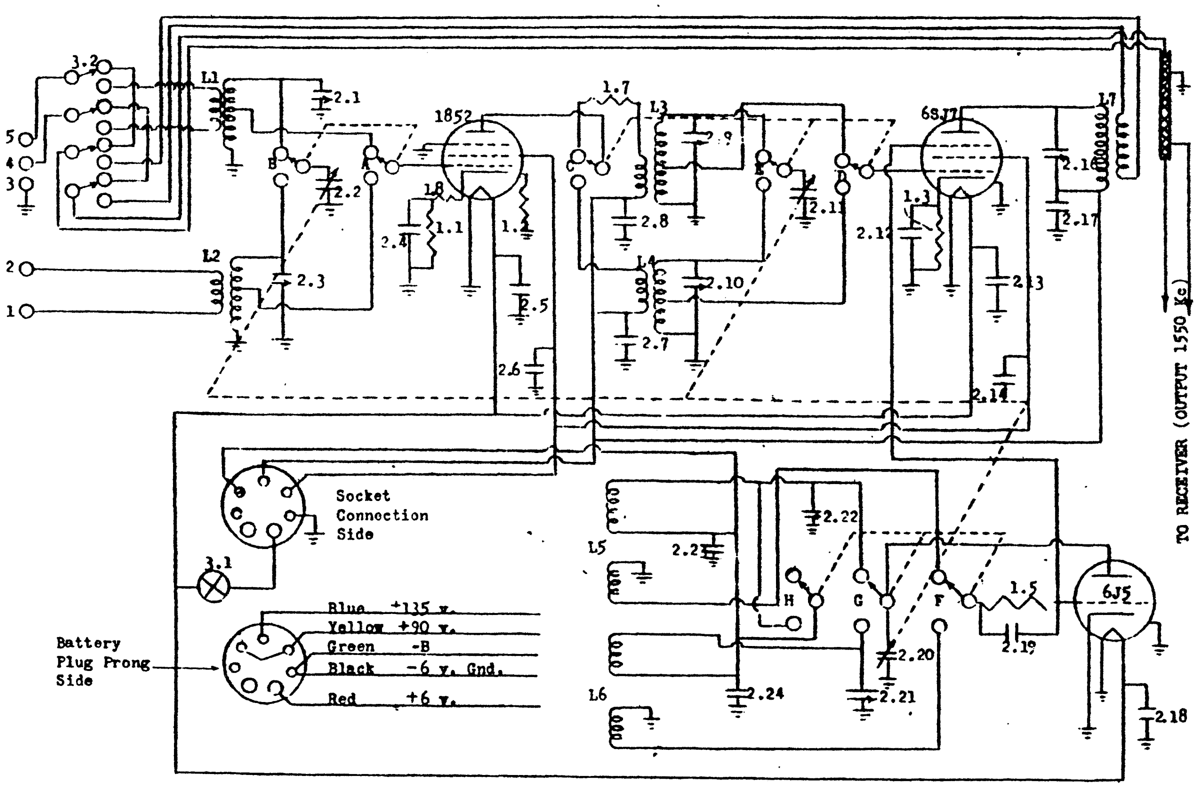
MODELS DM-36 (Late) DM-36A
Band Expanders



--DM-36--
--SCHEMATIC--



DM-36A SCHEMATIC

MODEL DM-30X
MODELS DM-36 (Late)
DM-36A

RADIO MFG. ENGINEERS, INC.

PARTS LIST FOR THE RME MODEL DM-36 BAND EXP

PART CODE NUMBER	SPECIFICATION
1.1	200 ohms, 1/3 watt resistor
1.2	35 ohms, 1/3 watt resistor
1.3	5000 ohms, 1/3 watt resitor
*1.4	10,000 ohms, 1 watt resistor
1.5	5000 ohms, 1/3 watt resistor
*1.6	15,000 ohms, 10 watts C.T.
1.7	35 ohms, 1/3 watt resistor
†1.8	35 ohms, 1/3 watt resistor
2.1	20 mmfd. condenser
2.2	Tuning condenser
2.3	20 mmfd. condenser
2.4	400 mmfd. condenser
2.5	400 mmfd. condenser
2.6	400 mmfd. condenser
2.7	400 mmfd. condenser
2.8	250 mmfd. condenser
2.9	20 mmfd. condenser
2.10	20 mmfd. condenser
2.11	Tuning Condenser
2.12	400 mmfd. condenser
2.13	400 mmfd. condenser
2.14	400 mmfd. condenser
*2.15	50 mmfd. condenser
2.16	30 mmfd. condenser
2.17	.01 mfd. condenser
2.18	400 mmfd. condenser
2.19	100 mmfd. condenser
2.20	Tuning Condenser
2.21	15 mmfd. Condenser
2.22	15 mmfd. condenser
2.23	1500 mmfd. condenser
2.24	500 mmfd. condenser
*2.25	15 mfd. condenser
*2.26	10 mfd. condenser
*2.27	15 mmfd. condenser
3.1	S.P.S.T. Switch
3:2	4.P.D.T. Switch
A,B,C,D, E,F,G.†(H)	Band Switch
*4.1	Choke, 30 henries
*5.1	Power transformer
L_1	10 M. R.F. coil
L_2	5 M. R.F. coil
L_3	10 M. Det. coil
L_4	5 M. Det. coil
L_5	10 M. Osc. coil
L_6	5 M. Osc. coil
†L_7	Output Coupling Transformer (10 K.C.) 1550 Kc. I.F. Output Transformer
†Switch 3.2	Antenna Changeover Switch
†Switch 3.1	Line Snap Switch
†Output Shielded Cable.	3 feet of .25 inch tinned braided shield wire with female and male type of automobile antenna connector.

*DM 36 ONLY
†DM 36A ONLY

The RME Model DM-36A Frequency Expander is identical in circuit arrangement, with certain exceptions, to the DM-36, and has the same sensitivity to the high frequencies. The exceptions to the similarity are; over-all size of the housing, and the intermediate frequency developed for injection into the associated receiver.

In all units of this type it is necessary, of course, to use a complete type of receiver in conjunction with the expander in order to provide the facilities of demodulation and audio reproduction, together with additional gain and selectivity. In the case of the DM-36A this associated receiver is intended to be an automobile type of receiver, which will tune to 1650 kilocycles. Practically all of the standard types of automobile receivers on the market today will tune to this frequency.

The DM-36 is in effect a frequency converter and therefore acts as a radio frequency amplifier and mixer tube with its oscillator in an over-all superheterodyne type of circuit. It must be used in connection with a regular receiver capable of tuning to a frequency of 10,000 KC (10 MC). The associated receiver therefore acts as an intermediate frequency amplifier unit and a demodulator and audio amplifier in order to reproduce the output of the expander.

ANTENNAE

It is suggested that for best results insofar as antennae are concerned for these DM-36A converters, that vertical radiators, grounded to the body of the car, be used. Figure 6 shows the suggested dimensions and general configuration of antennas recommended for use with the convertor in the two frequency bands. It is to be understood, that for optimum results, one antenna will not be satisfactory for both frequencies. Reference to figure 6 will suggest various ways of constructing suitable pick-up antennae for use with these converters.

The input impedance to the converter is very low and therefore will work out very satisfactorily with the single wire feeders as suggested.

An antenna changeover switch is provided on the DM-36 for connecting the antenna used on the triple terminal strip (See Fig. 2) to either the DM-36 in combination with the associated receiver or directly to the receiver with which the instrument is associated. This is accomplished by setting the switch to the position marked "DM-36" on the left pointer position, or to the right pointer position marked "RECEIVER", as indicated in Figure 1.

The triple terminal strip is designed for connecting the antenna to be used for the 28 to 30 megacycle band and also the antenna which will probably be used on the receiver alone when the DM-36 is not connected in the circuit. In order to make it possible to get the best results from the five meter channel a separate pair of terminals have been provided so that a doublet antenna may be connected into the primary coil of the five meter channel (See Fig. 2). The best performance will be obtained when an antenna is used especially designed for the middle frequency of the five meter amateur band--that is, 58 megacycles. It can either be a half wave doublet fed from the center to the DM-36 by means of a twisted pair or it can be a single wire antenna a half wave long placed vertically or horizontally (preferrably horizontally) in space and fed to the receiver by connection to antenna terminal #1, in which case antenna #2, for the five meter band, can be connected directly to the terminal marked "G" on the DM-36, see the page appended giving various configurations of antenna construction and the method of connection to the DM-36 for the various frequencies (Fig. 5).

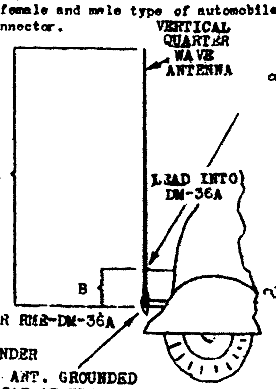
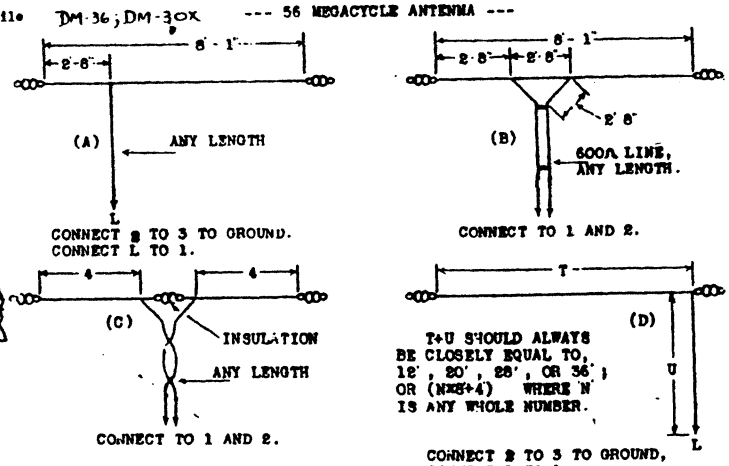


FIGURE 6
SUGGESTED ANTENNA FOR RME-DM-36A
MOBILE TYPE UHF EXPANDER

DM-36; DM-30X --- 56 MEGACYCLE ANTENNA ---



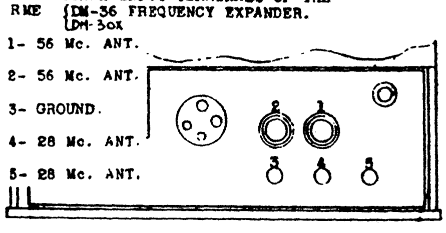
DM-36; DM-30X
--- 28 MEGACYCLE ANTENNA ---

FOR ANY TYPE AS ABOVE, DOUBLE THE LENGTH OR OTHER DIMENSION INDICATED FOR 56 Mc., AND CONNECT AS FOLLOWS.

(A) CONNECT 3 AND 4 CONNECT L TO 5.
(B) CONNECT TO 4 AND 5. CONNECT 3 TO GROUND.
(C) SAME AS B.
(D) SAME AS A.

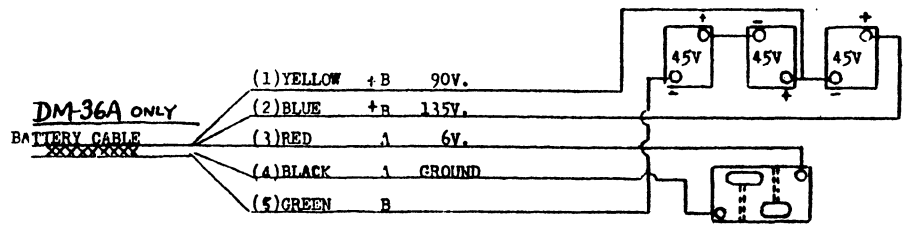
ANTENNA INPUT TERMINALS OF THE RME {DM-36 / DM-30X} FREQUENCY EXPANDER.

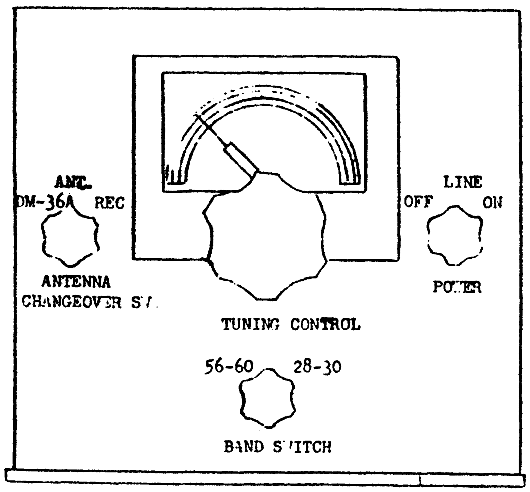
1- 56 Mc. ANT.
2- 56 Mc. ANT.
3- GROUND.
4- 28 Mc. ANT.
5- 28 Mc. ANT.



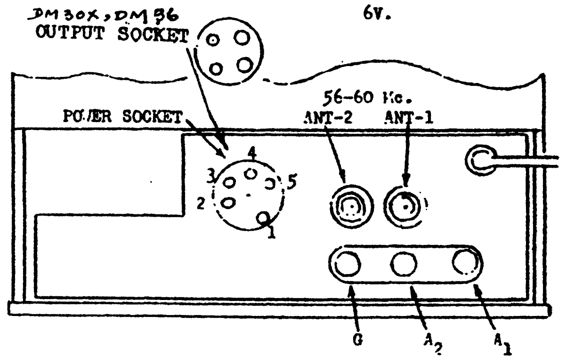
RADIO MFG. ENGINEERS, INC.

MODELS DM-30X
MODELS DM-36 (Late)
DM-36A





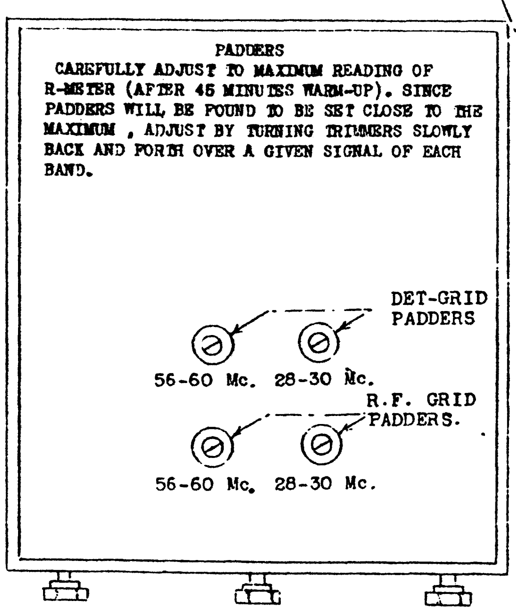
FRONT VIEW
--FIG.1--



IF SINGLE WIRE IS USED ON BAND 28-30 Mc. CONNECT ANTENNA LEAD TO A_1, AND GROUND A_2 TO TERMINAL G.

IF SINGLE WIRE IS USED ON BAND 56-60 Mc. CONNECT ANTENNA LEAD TO ANT-1, AND GROUND ANT-2 TO TERMINAL 'G' DIRECTLY BELOW IT.

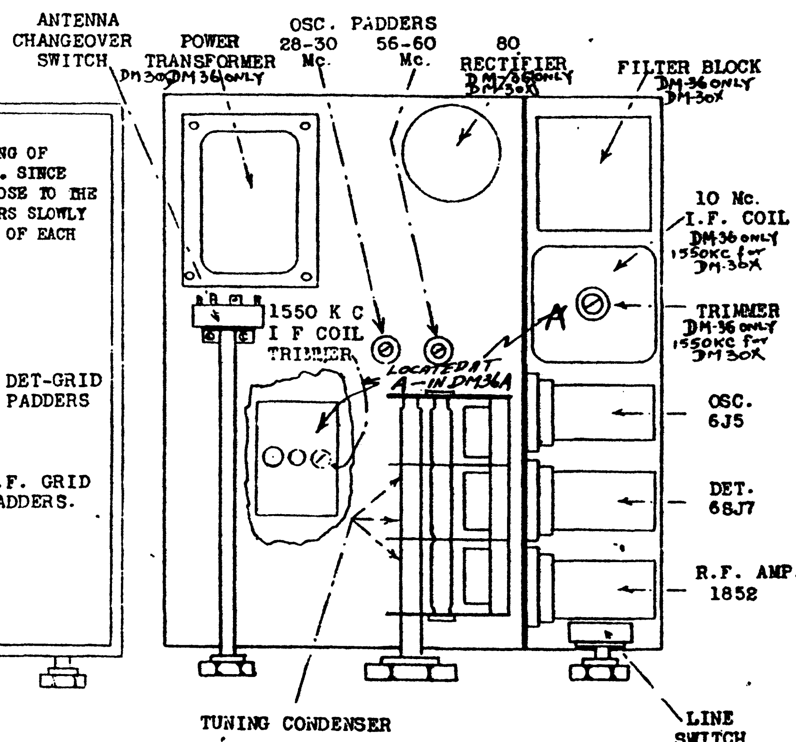
REAR VIEW
--FIG.2--



---FIG. 3---

BOTTOM VIEW

--DM-36A
--DM-36--



--FIG. 4--

TOP VIEW

RADIO MFG. ENGINEERS, INC.

The RME DB-20 Preselector is a compact efficient design of a straightforward radio frequency amplifier cascade with a specified input and output impedance. The input impedance is of a low value varying between 200 and 350 ohms over the frequency range covered by the tuning elements of the instrument. The output impedance varies over the same range in the same manner so that the insertion of this amplifier between the antenna and the RME-69 receiver incurs no mismatch in the coupling system and provides an increase in selectivity and gain due to its insertion.

The adjustment of the amplifier is calibrated on a scale in as close a manner as it is possible to calibrate such an instrument and tuning of the instrument should be done so that the setting of the indicator on the DB-20 scale is very close to the frequency being used. One check on this method is to set the tuning control of the amplifier to a position which gives a maximum meter reading on a given signal when used in conjunction with the RME-69 or any other receiver having a tuning indicator. In the absence of the tuning indicator background noise or signal strength may be used as an indication of optimum setting of the preamplifier and this will compensate for small variations which are bound to occur in the calibration of the instrument.

One side of the output circuit of the DB-20 is grounded and it is essential that the proper wire of the output cable be connected to the antenna post of the receiver with which it is used in order to provide proper operation for the combination. The high side or the ungrounded lead of the output cable is marked with a red tracer and this should be normally connected to the antenna terminal which would be used in the connection of a Marconi Antenna against ground in normal receiver operation without the DB-20. On the RME-69 receiver this is the outside terminal of the three-terminal input strip marked A - A - G. The other lead, which is a plain black wire, is to be connected to the middle antenna terminal and a ground jumper can be used to connect, A (center) to G on the terminal strip. In the case of a receiver being used with the DB-20 which has only a two-terminal input, that is antenna and ground, the black wire connects, of course, to the ground and the red tracer wire to the antenna terminal. A reversal of these leads will cause inefficient operation and probably no operation at all even when the antenna switch is thrown so that the antenna is connected directly to the receiver. This can be a source of trouble when poor operation is experienced.
A change-over switch is provided and consists merely of a four pole double throw switch indicated in Fig. 1 so that when it is thrown to the left the antenna is connected to the DB-20 and the DB-20 connected to the receiver input terminal. When the switch is thrown to the right the antenna is connected directly to the receiver and the DB-20 circuits are entirely removed from the picture.

PROCEDURE FOR ALIGNMENT OF THE RADIO FREQUENCY CIRCUIT

As an indicating device for alignment changes the meter on the RME-69 receiver can be used to indicate maximum signal being supplied the receiver from the DB-20. In the case of other communication receivers the same method may be used with their respective carrier level or R meter indication. In case the alignment is made with a receiver without carrier indicating devices an output meter can be used in the regular manner in which it is used for the alignment of receivers, but in this case, of course, it will be necessary to use a modulated signal input to the DB-20 to supply an audio component which can be used to operate the output meter.

All adjustments described should be adjusted to and left set at maximum meter readings be it carrier amplitude indicator or output as indicated on the output meter.

First set the receiver to 1000 Kc. and tune the DB-20 to 1000 Kc. which will be indicated on the main tuning dial and the band in which will be found 1000 Kc. is provided by setting the switch to position one (1). Set the pointer of the DB-20 on 1 Mc. reading of the scale and supply 1 Mc. signal input to the antenna terminal to the DB-20 setting the selector switch on the DB-20 (Fig.1) to the left position. When in this position adjust C_c, C_d and C_e for maximum meter reading.

Then switch to band two and three successively and check the setting at 2, 3, 4 and 5 megacycles. These frequencies, of course, will be checked by placing the band switch in the proper position required for tuning to these frequencies. The receiver, of course, must also be adjusted to these frequencies simultaneously with the DB-20.

The calibration for these frequencies will be found to be dependent on the settings of C_c, C_d and C_e which are made for 1000 Kc. on band one and will be in adjustment if band one is properly aligned.

Next turn the switch to position four and feed a signal of 7 Mc. into the receiver and adjust the tuning control of the DB-20 so that it sets on 7 Mc. Under these conditions check the setting of C_g for peak output. (Fig. 2).

Next set the band switch on position five and insert a signal of 14 Mc. into the receiver adjusting the tuning control of the DB-20 to 14 Mc. under these conditions adjust C_b, C_f and C_k for maximum output.

Next set the band switch to position six and set the tuning indicator to 30 Mc. on the scale and insert a signal of 30 Mc. into the DB-20. This condition obtained adjust C_a, C_d and C_h for maximum output.

During all of these settings and adjustments, of course, the receiver should be set to the same frequency as the DB-20 so that it will be able to receive the output of the DB-20 at the proper frequency.

The adjustments just described will assure maximum output due to alignment of the RF circuit in the DB-20.

The voltages to be expected at points indicated on the schematic diagram of Figure 13 are as follows:

1 to ground (volume control set to minimum) 26.6 volts.
1 to ground (volume control set to maximum) 3.4 volts.

2 to ground 265 volts	6 to ground 265 volts
3 to ground 100 volts	7 to ground 123 volts
4 to ground 3.4 volts	8 to ground 333 volts
5 to ground 333 volts	9 to ground 380 volts

A to A 6.6 volts at 115 volts line voltage AC

The following continuity checks should be made;

	Band (1)	Band (2)	Band (3)	Band (4)	Band (5)	Band (6)	
11 to ground	3.8	1.4	0.6	0.2	0.2	0.2	(ohms)
12 to 13	0.2	0.2	0.2	0.2	0.2	0.2	(ohms)
14 to 15	0.2	/0.2	0.2	0.2	0.2	0.2	(ohms)
16 to ground	3.8	1.4	0.6	0.2	0.2	0.2	(ohms)
17 to ground	3.8	1.4	0.6	0.2	0.2	0.2	(ohms)

All measurements made with output cable and antenna disconnected and changeover switch in DB-20 position.

Voltages greater or smaller than these values listed by an amount exceeding 15% indicates difficulty in the power circuits of the receiver.

Resistances greater or less by 15% than the resistances listed indicates conditions other than normal in continuity in these circuits.

If the amplifier is dead as evidenced by a loss in signal strength on a given signal when the DB-20 is cut into the circuit the loss being compared with the signal received when the antenna is connected directly to the receiver may be due to a dead tube which is usually due to the fact that the filament is burned and can be ascertained by placing the hand on the tube to see whether or not it is warm or cold. If it is warm, of course, the filament is lit and probably the tube is satisfactory. If the tube is cold the filament is probably open and therefore the tube needs replacing. Of course, tubes can be defective from other reasons which can not be detected in this manner but must be ascertained by checking on a regular tube checker.

Another reason for a dead amplifier may be due to lack of voltage on elements of the tube and can be checked by the voltage check.

Cause of no voltage on the plate or screen of the tube can be due to short circuit in the by-passes of C_7, C_2, C_4, C_8, C_{10} or C_1 or an open resistor R_5, R_2, R_3 or an open choke T_2 or a burned out 80 rectifier tube or an open circuit in the antenna coil or the output coils of the DB-20 which can be checked by the continuity measurements listed above.

If the amplifier has very little gain (the average gain should be 3R's over that of the receiver itself) it is probably due to misalignment and can be corrected by the procedure described on pages 2 and 3, or there is a defective tube which is not providing all the gain that is standard and the tubes can be checked and replaced by tubes having suitable characteristics.

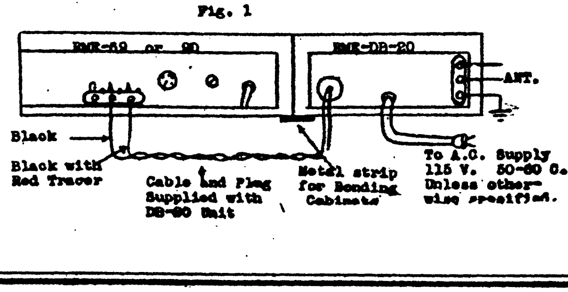
Additional information regarding special cases of trouble can be obtained from the Radio Mfg. Engineers by listing the details in a letter and writing direct to the factory.

METHOD OF CONNECTION OF THE DB-20 WITH THE RME-69 RECEIVER

The DB-20 unit is housed in a furniture steel crinkle finished cabinet which matches the height and appearance of the cabinet used to house the RME-69 receiver. It is designed to be placed at the left side of the receiver. Figure 1, Sheet 2, shows a sketch of the rear view of the DB-20 placed alongside of the receiver. In order to make sure that the two cabinets are well bonded together, it is advisable to make sure that all paint is cleaned from the adjacent cabinet bottom edges, and the two placed close together on a clean surface copper strip about three inches by ten inches long, or aluminum, or any metal of a non-ferrous kind with a clean surface.

The main factor to consider is that the two cabinets are properly connected to this ground. This prevents the possibility of any feedback due to the antenna of the DB-20 getting close to the output wires of the DB-20 and causing oscillation and also reduces the effect of signal leakage direct to the receiver due to the fact that the units are at a high impedance above ground. When this location and placement of the two units has been achieved, the connections can be made as indicated in Figure 1. The cable and plug indicated in the diagram are furnished with the DB-20 unit. In this twisted pair will be found one black wire and one black wire with red tracer. The black wire with the red tracer should be placed as indicated on the outside antenna post of the RME-69 Receiver. The black wire can be placed on the other antenna post and the ground should be connected to any good ground available. If it is certain that the bond is good, the ground as indicated on the DB-20 will be sufficient for the entire system.

Fig. 1



RADIO MFG. ENGINEERS, INC.

MODEL DB-20, Late
MODEL DB-20 Batt.
Trimmers; Chassis
Parts List

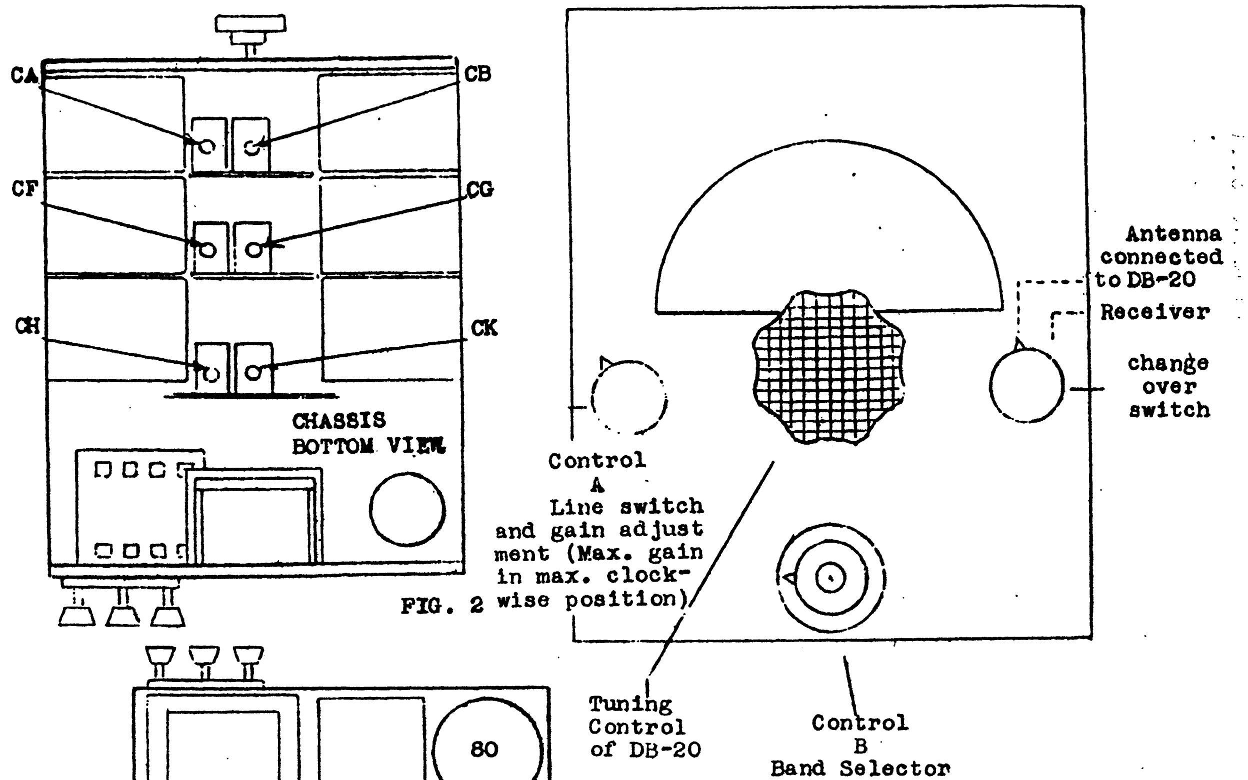


FIG. 2

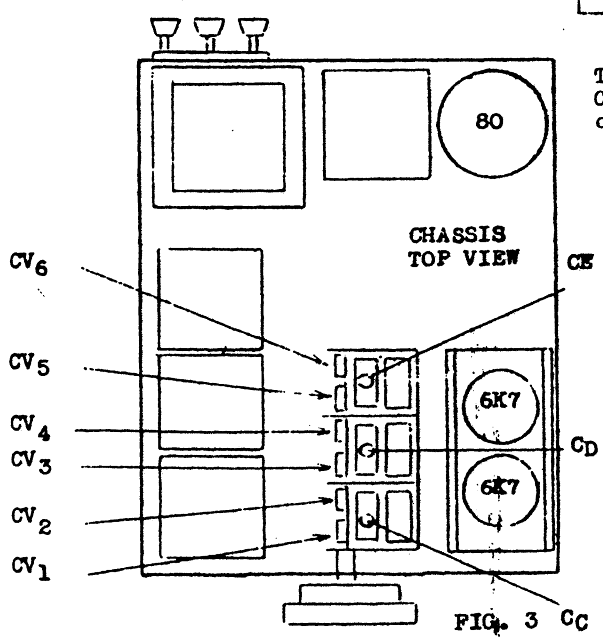


FIG. 3

BATTERY OPERATED DB-20 PARTS LIST

RESISTORS

1.1.....300 ohm
1.2..10,000 ohm
1.3..10,000 ohm
1.4..30,000 ohm variable
1.5.....300 ohm
1.6..10,000 ohm
1.7..50,000 ohm 1 watt

CONDENSERS

2.1....... .01
2.2....... .01
2.3....... .0001
2.4....... .01
2.5....... .01
2.6....... .01
2.7....... .01

CA	5 - 30 µµfd Adj. padder
CB	5 - 30 µµfd Adj. padder
CC	Variable condenser trimmers
CD	Variable condenser trimmers
CE	Variable condenser trimmers
CF	5 - 30 µµfd Adj. padder
CG	5 - 30 µµfd Adj. padder
CH	5 - 30 µµfd Adj. padder
CK	5 - 30 µµfd Adj. padder
CV_1	Variable tuning condenser
CV_2	Variable tuning condenser
CV_3	Variable tuning condenser
CV_4	Variable tuning condenser
CV_5	Variable tuning condenser
CV_6	Variable tuning condenser

SWITCHES

3.1 Line switch
3.2 Antenna changeover switch
3.3 Band switch section
3.4 Band switch section
3.5 Band switch section

PARTS LIST FOR DB-20

R_1 300 ohm
R_2 10,000 ohm
R_3 10,000 ohm
R_4 30,000 ohm variable
R_5 300 ohm
R_6 10,000 ohm
R_7 15,000 ohm 10 watt
R_8 50,000 ohm 1 watt

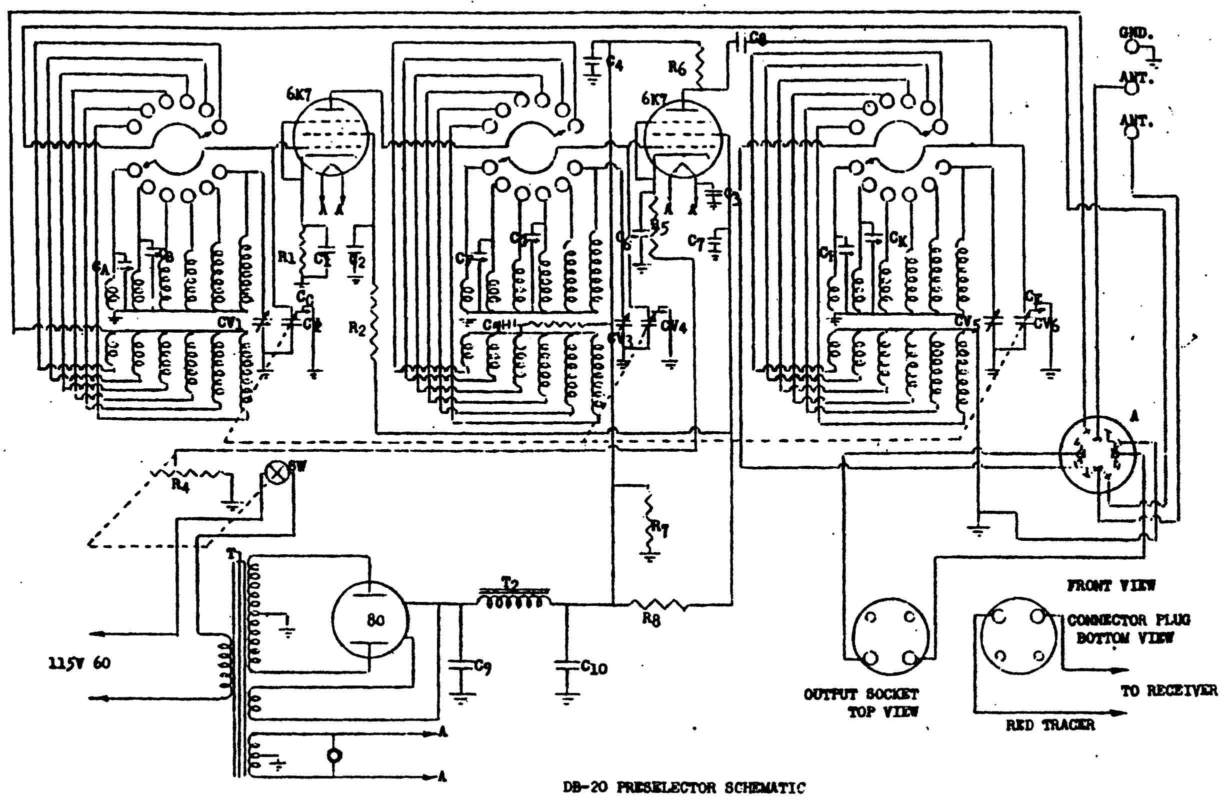
C_1 .01
C_2 .01
C_3 .002
C_4 .01
C_5 .01
C_6 .01
C_7 .01
C_8 .0001
C_9 8 µfd.
C_{10} 12 µfd.

T_1 Power transformer
T_2 Filter choke

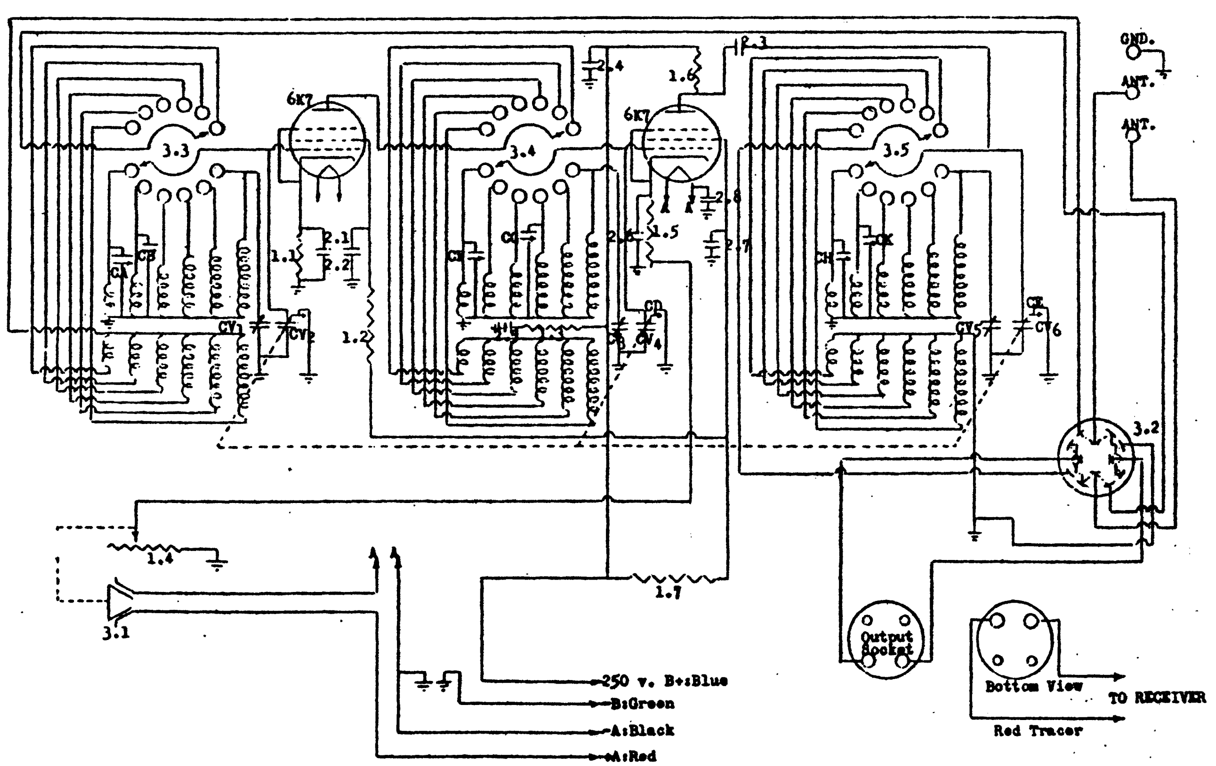
C_a 5 - 30 µµfd adj. padder
C_b 5 - 50 µµfd adj. padder
C_f 5 - 30 µµfd adj. padder
C_g 5 - 30 µµfd adj. padder
C_h 5 - 30 µµfd adj. padder
C_k 5 - 50 µµfd adj. padder
C_{v1-6} Variable tuning condenser
C_c, C_d, C_e Variable condenser, trimmers

RADIO MFG. ENGINEERS, INC.

MODEL DB-20, Late
MODEL DB-20 Batt.
Schematics



DB-20 PRESELECTOR SCHEMATIC

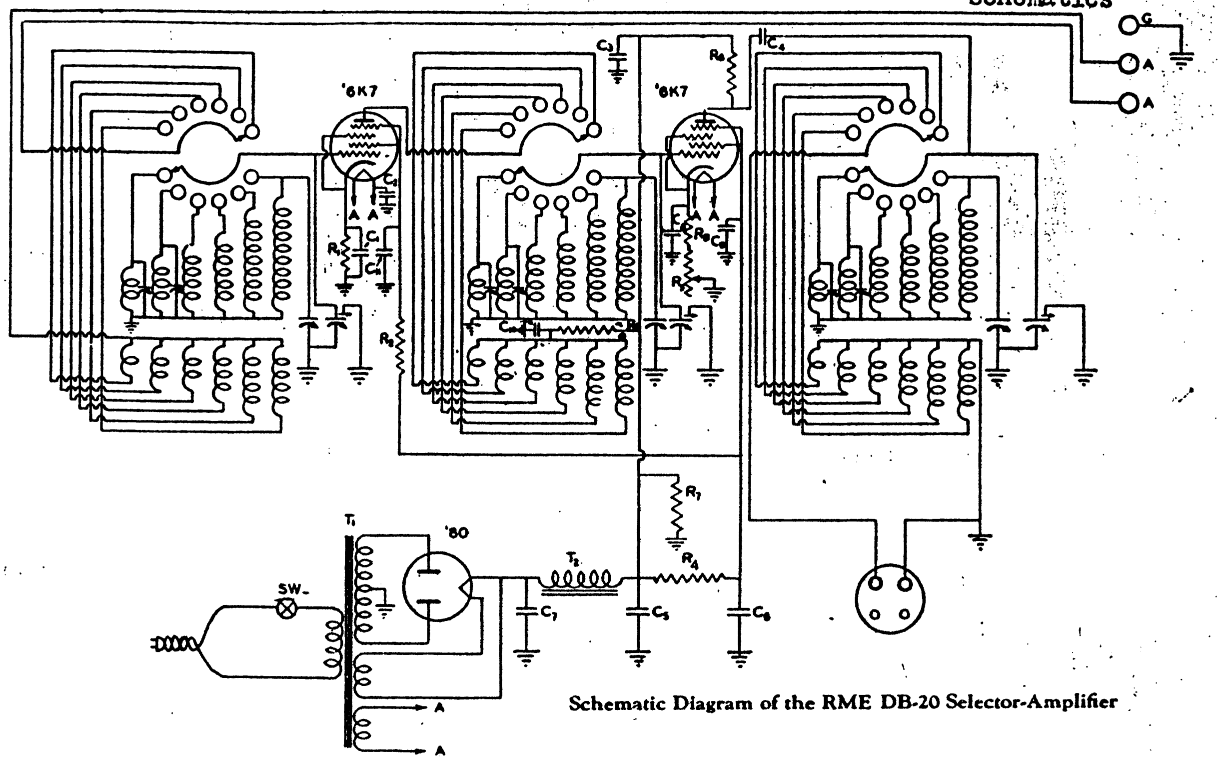


DB-20 BATTERY OPERATED SCHEMATIC

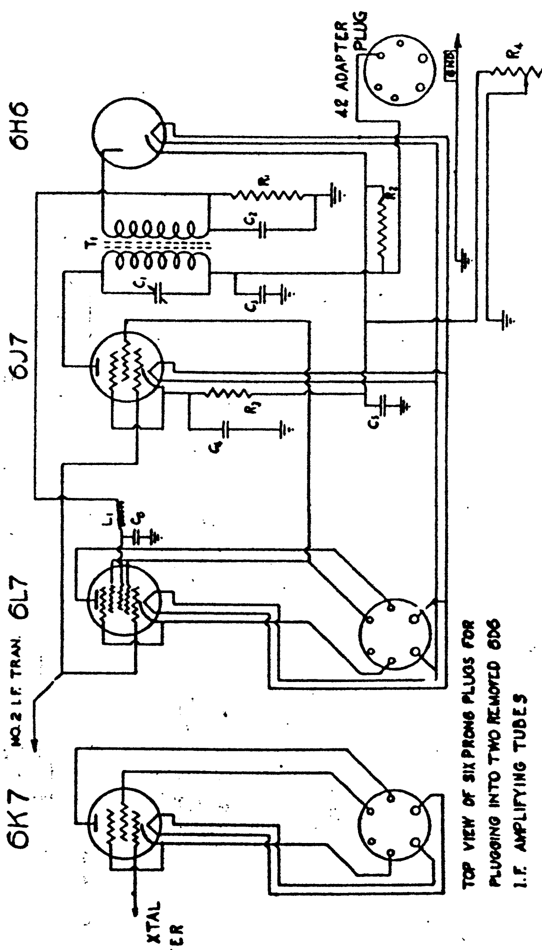
MODEL RME DB-20
Amplifier Schematic

RADIO MFG. ENGINEERS, INC.

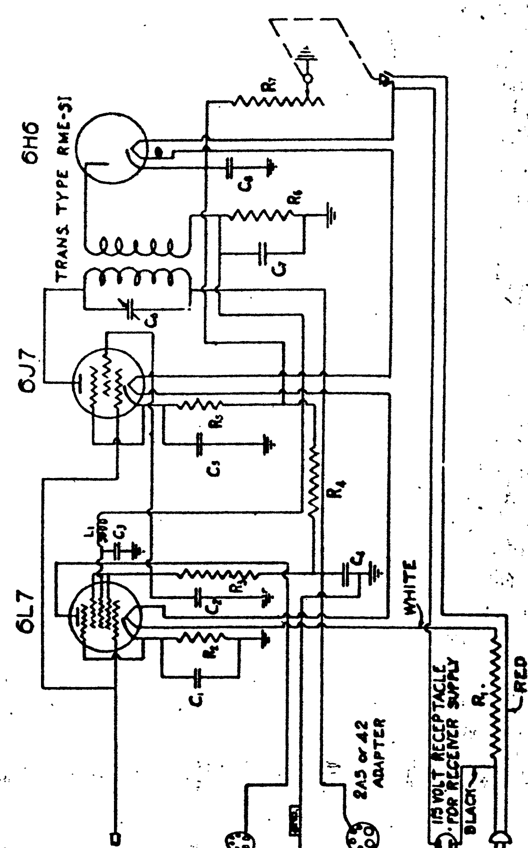
MODEL RME LS-1
MODEL RME LS-2
Noise Suppressors
Schematics



Schematic Diagram of the RME DB-20 Selector-Amplifier



Schematic Diagram of the RME LS-1 Noise Suppressor



Schematic Diagram of the RME LS-2 Noise Suppressor