SERVICE

A MONTHLY DIGEST OF
RADIO AND
ASSOCIATED
MAINTENANCE

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EDITORIAL

WE have received a great number of suggestions relative to the future contents of this supplement and the SERVICE section. In view of the fact that this publication is a part of the Monthly Supplementary Service, we can state our policy relative to the supplements at this time.

There shall be no announcements of yearly editions of the Perpetual Trouble Shooter's Manual by John F. Rider. The manual shall be the basic book for years to come and will be kept up to date by means of the Monthly Supplementary Service. There shall be no holding out of material for the preparation of future year books. The suggestions received have been very gratifying and we feel that every subscriber will be pleased to learn that every effort will be made to include every bit of valuable information on the supplementary sheets. The sheets for the October and subsequent issues will contain the location of the various trimmer condensers, the frequencies utilized during trimmer adjustments, the peak frequencies of the superhet receivers, continuity tests and whatever special data is of value in connection with the receiver. This information will be additional to the regular type of data presented thus far.

Several of the pages in the radio section of this supplement are arranged to be cut up and the matter pasted on to the proper pages in the Perpetual Trouble Shooter's Manual. As you note, this data contains the location of the various neutralizing and trimmer condensers. We shall present in each of the subsequent supplements, chassis diagrams and layouts of the receivers shown in the basic book.

We welcome suggestions and also short articles pertaining to practical servicing. Proper credit shall be accorded the authors.

CONTENTS

SEPTEMBER, 1931

Adjusting Superheterodynes

The superheterodyne receiver with its three major sections subject to variations and adjustments presents a problem somewhat different than that of the conventional tuned radio frequency receiver. Imperfect alignment in a tuned radio frequency receiver means correction of the difficulty in but one part of the system. In the super, the condition representative of incorrect alignment may mean trouble in one or more points if not all three, the RF system, the intermediate frequency amplifier and the oscillator. Due to the relation between the three named sections of the receiver, it is extremely difficult to definitely establish the location of the defect when it appears to be incorrect tuning.

Recognition of the problems involved in the balancing or tuning adjustments of the superhet, the need for most rapid operation, the advantages of minimum equipment and minimum changes in the location of equipment results in the conclusion that a very definite method of procedure is most productive of rapid and efficient results. An investigation of the receiver manufacturers' service manuals seems to indicate a preference for such a system. In a way it means slightly more work because it is necessary to suspect all of the systems named and to check each of these systems, although it is possible that only one is out of alignment. The operator may be fortunate to find the trouble in the first system checked. At any rate a complete test means the knowledge that all parts of the system are perfect. It is of course necessary to mention that the method to be suggested is not the only satisfactory process. Each of the three named circuits can be checked in whatever order is desired by the service technician. The final result will be the same, but one system lends itself to more rapid and simpler tests.

The suggested method of aligning and balancing the modern super is to check the tuning in the following order:

1. The intermediate frequency amplifier.
2. The oscillator.
3. The RF tuning system.

The reasons for this choice are numerous. First it is possible to maintain the output meter in the same location for all the tests, namely across the secondary of the output transformer. Second is the fact that it is possible to make two of the tests with the test oscillator connected to the same part of the receiver, namely across the 1st detector control grid and the chassis or ground. The third reason is that it is possible to employ the inherent amplification available within the receiver, the audio frequency amplifier for the first test and everything after the 1st detector for the second test, thus making critical observation of the test meter unnecessary and enabling operation of the test oscillator at a low output, a condition conducive to better testing. The fourth reason is that a single type of indicating instrument is satisfactory. The fifth is that adjustment of the oscillator system in particular is aided when the intermediate frequency amplifier is known to be perfect.

What is to follow in the subsequent paragraphs is general information, but because of the similarity between all modern superheterodyne receivers, it may be accepted as being applicable to all these receivers. Particular mention must be made of what is known as flat top tuning adjustment in certain intermediate frequency amplifiers. Such mention is made in connection with the RCA-Victor model 80 series. However this adjustment is supplementary to the regular tuning adjustment, so that the initial tuning is applicable in every case.

Aligning Intermediate frequency amplifiers

Perhaps it might be well to mention some pertinent details relative to intermediate frequency amplifiers before embarking upon the tabulation of the process of aligning. The normal intermediate frequency band which includes the commonly used peak frequencies extends from about 125 to 450 KC. The most commonly used peak frequencies are 130, 175, 260 and 450 KC. This data is of particular value to warn against the general assumption that the popularity of the 175 KC. peak means its use in all systems. As an example, the peak frequency of the Atwater Kent 72 Superheterodyne series is 130 KC.

Another item of interest pertains to the tuning of the IF transformers. It is general custom to employ variable primary and secondary tuning. This does not mean that all intermediate transformers are thus tuned. There are some which utilize fixed primary tuning adjusted at the factory and variable secondary tuning adjustable by the man in the field.

As to the sequence of tuning, that is, the selection of which transformer is to be tuned first, it seems customary to select the transformer nearest the 2nd detector and work towards the first detector. There is no definite stipulation made that this must be so, but perusal of a large number of manufacturers service manuals shows this to be the recommended practice. The following tabulation represents the process of operation for the tuning of an intermediate transformer system. This tabulation covers ordinary tuning and not the adjustments required for flat top response characteristics. The numerical sequence of the transformers starts with the highest figure and works towards the lowest, the highest being near the second detector and the lowest nearest the 1st detector, as shown upon any schematic diagram. We assume two stages of intermediate frequency amplification.

1. Adjust test oscillator for rated peak frequency or intermediate frequency transformer system. Adjust test oscillator attenuator for about half of the maximum setting.
2. Connect output meter across secondary of output transformer. If other type of indicating instrument is employed, connect it in proper position in the 2nd detector plate circuit or elsewhere in audio system. (Various output indicating systems are mentioned elsewhere in this publication.)
3. Set receiver into operation in normal manner and adjust volume control to about one quarter of maximum.
4. Remove oscillator tube in receiver. If desired equivalent load upon power pack can be simulated by connecting a 15000 or 20000 ohm resistor between plate and cathode of oscillator tube.
5. Remove normal connection to 1st detector control grid.
6. Connect "A" terminal of test oscillator to control grid terminal of 1st detector and connect "G" terminal of test oscillator to ground or chassis of receiver.
7. Adjust test oscillator attenuator and receiver volume control so that the output meter indication is about 25 per cent of full. This will allow adjustment without causing the meter pointer to go off scale.
8. Adjust 3rd IF transformer secondary while observing output meter pointer. Maximum indication means maximum resonance. Try increasing and decreasing tuning capacity by turning control screw in both directions.
9. Adjust 3rd IF transformer primary tuning condenser while observing output meter pointer. Maximum indication means maximum response.
10. Readjust 3rd IF transformer secondary tuning condenser, while observing output meter.
11. Repeat adjustments for 2nd and 1st RF transformers as outlined under 8, 9, and 10.

Reference to some service manuals shows reversal of the sequence of the circuits selected. That is to say, the suggestion is made to tune the primary and then the secondary. Tests show that there is very little difference between the two methods.

Aligning Oscillator Circuits

The majority of oscillator circuits use two trimmer condensers. One is for the high frequency adjustment at about 1400 KC. and the other is the low frequency adjustment at 600 KC. In some cases these frequencies vary, as in the case of the Atwater-Kent 72 series, the high frequency adjustment is at 1500 KC. and the low frequency adjustment is at 800 KC. As far as checking of the oscillator is concerned, it is possible to determine if the oscillator needs rechecking before any changes in the trimmers are made. If for some reason, the receiver is inoperative and the IF circuits have been found intact and in good condition, it is a good idea to check the operation of the oscillator by proceeding in the following fashion:

1. Set the receiver into operation. Connect the output meter across the secondary of the output transformer.
2. Remove the regular contact to the 1st detector control grid terminal.
3. Connect the "A" terminal of the test oscillator which is adjusted to a known broadcast frequency, say 1000 KC to the 1st detector control grid terminal. Connect the "G" terminal of the test oscillator to the chassis or ground of the receiver.
4. Feed a signal from the test oscillator to the 1st detector tube. Set the dial of the receiver to the 1000 KC. mark. If the oscillator in the receiver is properly adjusted, the signal will be indicated upon the output meter. If no indication is observed and since the IF system is known to be intact, proceed as follows to definitely determine if the oscillator is out of order.

1. Disconnect the test oscillator. Replace the regular lead to the 1st detector control grid.
2. Set the receiver into operation. Remove the oscillator tube used in the receiver and if desired connect a 15000 or 20000 ohm resistor between the plate and cathode of oscillator socket.
3. Couple the "A" lead of the test oscillator to the control grid lead of the 1st detector tube by winding a few turns of the coupling lead around the control grid lead. Connect the "G" terminal of the test oscillator to the chassis.
4. Adjust the receiver dial to a high frequency station, one which is known to be on the air, say at about 1200 or 1400 KC.
5. Adjust the test oscillator to this frequency and manipulate the test oscillator control slowly until the correct beat is produced at which time the signal should be indicated upon the output meter. The test oscillator now is functioning as the receiver oscillator and shows that the receiver system is in good shape but the receiver oscillator is out of order.

In the event that the operation of the receiver oscillator and the IF system and the audio system appears normal during the time that the test oscillator is connected directly to the 1st detector control grid and the oscillator in the receiver supplies the beating signal, it is possible to omit the adjustment upon the oscillator and to proceed directly to the alignment of the RF system.

Assuming that the receiver oscillator requires realignment proceed as follows:

1. Connect the "A" terminal of the test oscillator to the 1st detector control grid terminal. Connect the "G" terminal of the test oscillator to the chassis of the receiver. Set the test oscillator to 1400 KC. for the majority of receivers. Connect the output meter across the secondary of the output transformer. Set the tubes of the receiver into operation.
2. Set the receiver tuning control to 1400 KC. Locate the high frequency trimmer condenser. As a rule the frequency adjustment of the oscillator is HIGHER than the frequency adjustment of the RF system by the value of the IF peak adjustment. Unscrew the control screw about one and a half or two turns. Then while observing the output meter slowly turn the screw in the direction opposite to that previously and adjust for maximum output indication.
3. Locate the low frequency trimmer and change frequency setting of test oscillator to 600 KC. on the majority of receivers.
4. Tune receiver to 600 KC. and note output indication.
5. Observe output meter and slowly unscrew control screw. If output indication decreases continue for another half turn in same direction. Then screw in opposite direction slowly until maximum indication is obtained.
6. Now retune test oscillator to 1400 KC. and readjust tuning control of receiver to 1400 KC. and note action of output meter. It may be necessary to readjust high frequency condenser and then to repeat adjustment of low frequency trimmer. A few additional minutes spent readjusting both condensers until no variation in output is noted will be productive of superior results and receiver performance.

Perhaps it may be of benefit to mention that the previously described test for determining whether or not the receiver oscillator is inoperative by use of the test oscillator as the beating oscillator, is not absolutely imperative. However it does offer a means of distinguishing between the location of the trouble in the RF or oscillator systems.

Aligning RF Trimmer Condensers

It is difficult to give exact instructions pertaining to the RF trimmer condensers because the exact number are different in different sets. Also because the circuits used in many receivers differ from the conventional. Thus in the Atwater Kent 72 series a double spot circuit must be adjusted. In the Radiola 80 series a link must be changed. Further reference will be made later in this text. What is to follow is general information such as has been mentioned time and again in connection with the alignment of RF systems in tuned radio frequency receivers.

Now that the IF and Oscillator systems have been checked and are known to be perfect it becomes a simple matter to line up the RF trimmers. As a rule the high frequency adjustment is at 1400 KC. The low frequency adjustment is 600 KC. Two frequencies within this band suitable for testing at 1100 KC. and 800 KC. To check the usual run of receivers proceed as follows:

1. Adjust test oscillator to 1400 KC. and set receiver into operation. The output meter can remain connected to the secondary of the output transformer.
2. Connect the "A" terminal of the test oscillator to the aerial post of the set and the "G" terminal to the ground post or chassis. Set the test oscillator volume control at about one half of the maximum.
3. Tune in the test signal with the receiver and adjust the receiver volume control so that the output meter indication is about one third of the maximum. Tune the receiver for maximum output. Then adjust the various trimmer condensers starting with that used for the RF tuned circuit nearest the 1st detector as indicated upon the schematic diagram, and working towards the aerial circuit.

If the original receiver oscillator adjustment was correct, it will be unnecessary to adjust the trimmer circuits after setting the receiver tuning dial at exactly 1400 KC., because with the previously used test signal at 1400 KC and the receiver tuning dial set at 1400 KC., the 1400 KC. setting is proved to be correct. The trimmer adjustments should be checked at least twice so as to assure accurate settings.

In the Atwater Kent 72 superheterodyne series, the preselector adjustments are made at 1500 K.C. The adjustment of the double spot circuit in this receiver is as follows:

Using a normal 1500 KC. signal and with the receiver dial set at 1500 KC. adjust the pre-selector and antenna trimmers for maximum output indication upon the output meter.

Then increase the signal output of the test oscillator at 1500 KC. and tune in the double spot signal at 1240 KC. Now adjust the double spot circuit trimmer, (the condenser connected across the 4th RF transformer), so that the output shows minimum signal. Then switch to the normal 1500 KC. test signal output and readjust trimmer number 3 as shown in the schematic diagram in the August supplement, so that maximum output is secured.

In some instances the trimmer adjustments are made by shifting the position of one of the segments of the external plate in the tuning condensers.

A Few Practical Output Systems

The output indicating systems suitable for use in the output circuit of a radio receiver, as for example across the secondary of the output transformer are as follows:

1. The regular commercial output meters.
2. A current square thermo galvanometer with a 5 ohm rheostat connected across it for use as a shunt. Such a galvanometer is the usual radio frequency meter ratedat from 4 to 5.2 ohms internal resistance and about 115 milliamperes.
3. A 50 milliampere AC current meter equipped with a shunt of 10 or 15 ohms in the form of a variable resistance can replace the thermo galvanometer. The shunt can be eliminated by using a 100 milliampere AC meter.

The output indicating device suitable for use in the plate circuits of the detector tubes consists of a low range current meter located in the plate circuit of the detector tube when checking RF systems of tuned radio frequency receivers and in the plate circuit of the 1st detector when checking the RF system of superheterodynes. A similar arrangement is used in the plate circuit of the 2nd detector in the super when the intermediate frequency system is checked. The meter used in the 1st detector plate circuit can be a 0-1 DC milliammeter with a 15 ohm rheostat connected in shunt with the meter so as to increase its range approximately three fold and to provide a variable adjustment. The meter used in the 2nd detector plate circuit is a 0-5 DC milliammeter with a 5 ohm variable resistance as a controlling shunt. These meters are connected into the circuit by means of plate break-in adapters.

Diagnometer Tube Tests

Diagnometer Power Pentode Tube Tests

All Model 400-B Diagnometers having serial numbers ending with N-4 characters are modified for accommodating tests on the types '33 and '47 power pentode tubes and circuits. This is accomplished by the use of a 5-hole, 5-prong UY Pentode Tube Testing Adapter, part No. 6021, for tube testing and by the use of a pair of power pentode analyzing adapters, each having an external flexible connector.

Pentode Tube Testing:

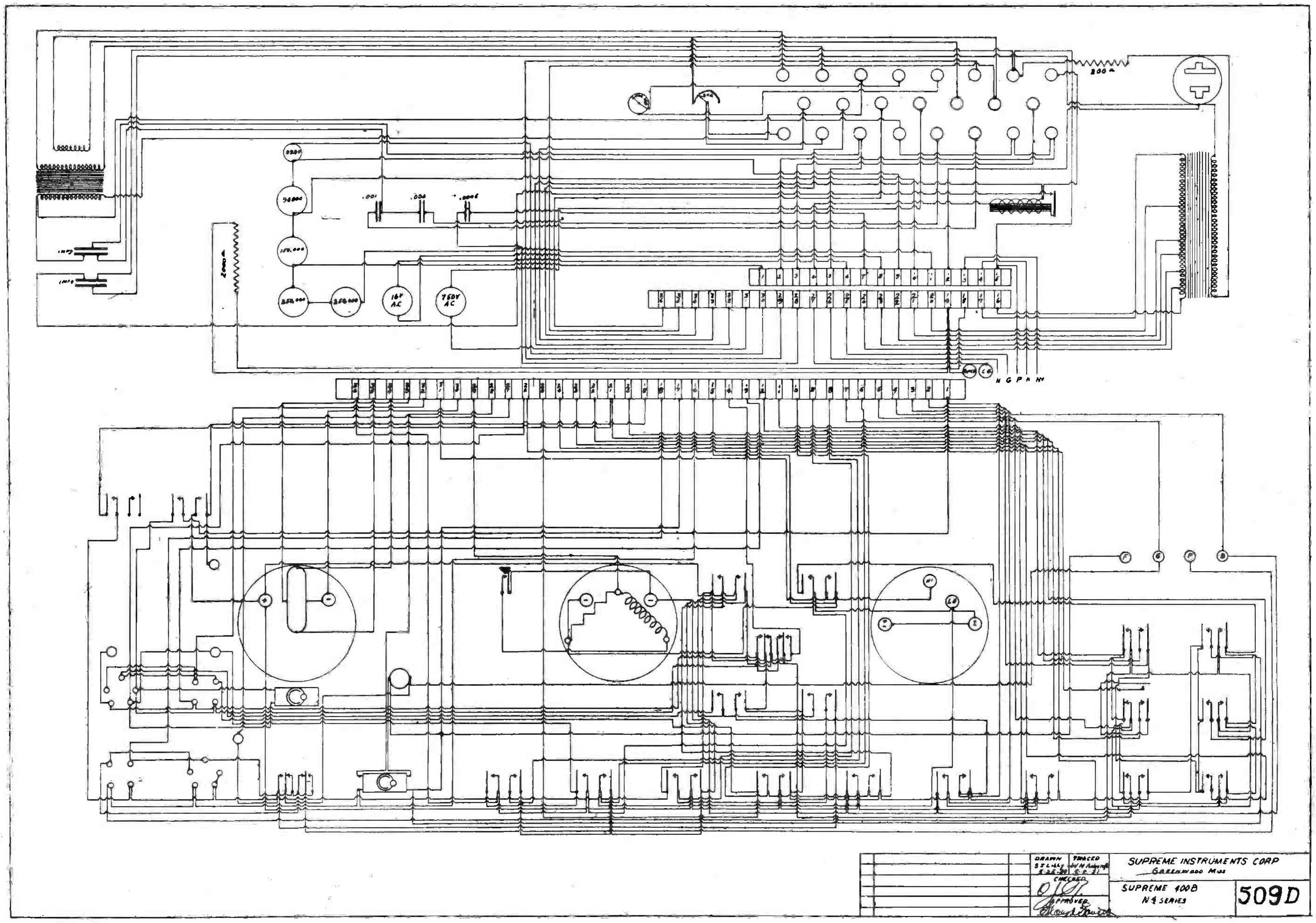
The following procedure is recommended for Diagnometer Power Pentode Tube Tests with AC power supply.

1. Remove any jumpers or test leads which may have been left connected to the instrument, open all jack switches on the panel, and clear the Analyzer Plug (10) from contact with any electrical conductors which may be grounded or connected to the common AC supply system.
2. Insert the polarized series socket adaptor (17), with a 100-watt Mazda lamp (18) in the receptacle on the end of the instrument tray. If any device other than a 100-watt Mazda lamp (18) should ever be used in the series socket adapter (17) the Milliammeter (6) might be harmed or show incorrect readings.
3. Connect the supply plug (21) to a convenient a.c. supply outlet.
4. Close the A.C. Line Jack (3) and observe the supply voltage on the 150-scale of the a.c. voltmeter (2).
5. Insert the Oscillator Coil, with its label to the front, in the pin jacks (1) marked "B.P.G.F." on the panel.
6. Insert the UY Power Pentode Tube in the 5-hole, 5-prong Power Pentode Tube Testing Adapter No. 6021 which has no flexible lead terminated by a pin plug, and place the tube and adapter in the UY Tube Testing Socket (22).
7. Throw the biasing toggle switch (25) to its "Zero" position.
8. Close the proper power plant jack (36) with a jack plunger.
9. As the tube attains its operating temperature, the plate current of the tube, as modified by the r.f. pulsations induced by the oscillatory circuit, will be indicated on the 125-scale of the d.c. milliammeter (6). If the plate current reading (6) is less than 25 milliamperes, the milliammeter push button switch (7) may be depressed for a more discernible reading on the 25-mil. scale.
10. Depress the "Stop Oscillation" button (27) for observing the plate current reading of the tube in a non-oscillating condition.
11. With the "Stop Oscillation" button (27) depressed, throw the biasing toggle switch (25) to its "Bias" position. The resulting change in plate current (6) is an indication of the amplifying merits of the tube under test, the greater the change for any type of tube the better the tube.
12. Release the "Stop Oscillation" button (27) and observe the plate current reading (6) of the tube, as modified by the r.f. pulsations induced by the oscillatory circuit, with the "Zero-Bias" toggle switch (25) in its "Bias" position.
13. The four plate current readings may be compared with the test readings which will be furnished as soon as available after receipt of the attached request form.

Power Pentode—Circuit Analyses:

The adapters recommended in the following procedure have terminals with exposed contacts which carry very high electrical potentials with relation to the top heater plugs (12) of the analyzer plug, and with relation to the radio chassis or ground. The operator is warned that these terminals should not be touched when the radio is operating. All connections should be completed or opened only when the radio power supply is open. The following procedure is recommended for power pentode circuit analyses:

1. Remove the Oscillator Coil from the Oscillator Coil Pin Jacks (1), and remove all jack plungers and connecting leads from the Diagnometer.
2. With the radio turned "Off," remove a power pentode tube from the radio and insert the tube into the 5-hole, 5-prong Power Pentode Analyzing Adapter, No. 6022, which has a flexible lead terminated by a pin plug, and insert the Adapter and tube into the UY "Load" socket (19).
3. Insert the pin plug terminal of the adapter into the "SP. CH.—GRID" Diagnometer panel pin jack.
4. Throw the "UX-HEATER" toggle switch (20) to the "UX" position.
5. Insert the Analyzer Plug (10) into the 4-hole, 5-prong grooved-pin Power Pentode Analyzing Adapter, No. 6023, which has a flexible lead terminated by a battery clip or connector spade which should be connected to the space charge lug on the base of the Analyzer Plug, and insert the adapter and plug into the vacant radio power pentode tube socket.
6. Turn the radio "On," and adjust the volume and tuning controls to whatever positions may be recommended by the radio manufacturer for analyzing. The plate current load of the tube will be indicated on the 125-mil. scale of the d.c. milliammeter (6) during the analysis. If the reading is less than 25 milliamperes, the "Press for 25-mil. scale" Milliammeter push button switch (7) may be depressed for a more exact reading on the 25-scale of the meter. If the tube is good, a normal reading on the d.c. milliammeter (6) generally indi-



Wiring diagram of 400-B, Series N-4

cates continuity of all radio circuits terminating at the socket being analyzed.

7. If it is desired to continue the analysis on the same socket, insert the jack plunger in the a.c. filament jack (26) or (28) the scale marking of which least exceeds the filament rating of the tube. The filament voltage should then be indicated on the a.c. voltmeter (2) scale which corresponds to the closed jack (26) or (28).
8. Insert the jack plunger in the Plate Jack (33), (34), or (35) the scale marking of which least exceeds the plate potential specified for the radio tube socket. The applied plate potential should then be indicated on the d.c. voltmeter (8) scale which corresponds to the scale marking of the closed jack (33), (34), or (35).
9. Insert the jack plunger in the "Space Charge" jack (14) and observe the space charge (pentode) voltage reading on the 250-scale of the d.c. voltmeter (8).
10. The negative grid potential should be indicated on the 100-scale of the d.c. voltmeter (8) when the jack plunger is placed in the grid jack (30). If the grid of the radio tube socket being analyzed is resistance-coupled to the preceding stage, a more accurate reading of the applied grid potential will be indicated by connecting a test lead between the grid contact of the unoccupied "Load" socket (19) and the "Grid Return" which is usually the grounded chassis of the radio.

Conversion of Earlier 400-B Types:

The earlier types of the Model 400-B Diagnometer can be converted so as to conform to the N-4 series. The various earlier series are listed in the paragraphs which follow, with the procedure which should be followed in effecting these modifications. The Diagnometer users may order the necessary parts, which include explanatory blue prints, and make the conversions themselves, or they may forward their Diagnometers to the factory or to the nearest Authorized Supreme Service Station where the conversion will be made for the total costs listed as corresponding to the respective types. All conversions involve the elimination of the Rejuvenator features.

Original 400-B Design:

The original Model 400-B Design has serial numbers composed of numerals only. The following items are required for converting an original Diagnometer to the N-4 series:

1 No. 146 N-4 Panel	$1.65
1 No. 240-D Blue Print	.50
1 No. 512-D Blue Print	.50
1 No. 509-D Blue Print	.50
8 No. 88 Jack Switches	2.80
1 No. 86 Nickled pin Jack	.10
1 No. 1213 200-ohm Plate resistor	.45
1 No. 6021 Pentode Tube Testing Adapter	1.00
1 No. 6022 Pentode pin plug Adapter	1.50
1 No. 6023 Pentode spade lead Adapter	1.50

N and N-1 Series:

There is no circuit difference in the "N" and "N-1" series Diagnometers. The following items are required for conversion to the N-4 series:

1 No. 146 N-4 Panel	$1.65
1 No. 288-D Blue Print	.50
1 No. 515-D Blue Print	.50
1 No. 509-D Blue Print	.50
2 No. 88 Jack Switches	.70
1 No. 86 Nickled pin Jack	.10
1 No. 6021 Pentode Tube Testing Adapter	1.00
1 No. 6022 Pentode pin plug Adapter	1.50
1 No. 6023 Pentode spade lead Adapter	1.50

N-2 Series:

The following items are required for conversion of the "N-2" series Diagnometer to the "N-4" series:

1 No. 146 N-4 Panel	$1.65
1 No. 388-D Blue Print	.50
1 No. 517-B Blue Print	.50
1 No. 509-D Blue Print	.50
1 No. 6021 Pentode Tube Testing Adapter	1.00
1 No. 6022 Pentode pin plug Adapter	1.50
1 No. 6023 Pentode spade lead Adapter	1.50

N-3 Series:

The following items are required for conversion of the "N-3" series Diagnometer to the "N-4" series:

1 No. 146 N-4 Panel	$1.65
1 No. 508-D Blue Print	.50
1 No. 518-B Blue Print	.50
1 No. 509-D Blue Print	.50
1 No. 6021 Pentode Tube Testing Adapter	1.00
1 No. 6022 Pentode pin plug Adapter	1.50
1 No. 6023 Pentode spade lead Adapter	1.50

Theory of Mechanical Refrigeration

Editorial Note: The material presented in the next few pages is taken from the "Service Manual for Mohawk Refrigerators with the Duozone Unit," published by the All-American Mohawk Corp.

The Refrigerant

The refrigerant used in all MOHAWK ELECTRIC REFRIGERATORS is Methyl Chloride, and the correct charge for the household machine is one pound. A shortage of refrigerant is usually indicated by a lack of refrigeration, the machine running constantly without the suction line frosting, and a steady hissing noise at the expansion valve.

When refrigerant is required, the first thing to do is locate the leak in the system and repair it. You will usually find some indication of oil around the place that is leaking.

Service tanks should always be attached to the outlet port of the suction line valve on the side of the compressor with a long enough piece of copper tubing that will be flexible and allow the tank to stand in an upright position.

When a system is short of refrigerant, it is good practice to let out all the charge still remaining in the system and recharge it—weighing the one pound of refrigerant into the machine. The service tank can be set on a postal scale with the charging line attached, and the charge measured accurately. When discharging a machine before recharging, leave only enough gas in the system to create a pressure that will keep air from entering.

Never run a unit in a way that will draw a vacuum on the system. It is much better practice to remove air from a system by attaching a service tank as described above, shutting off the suction line valve so that the refrigerant will feed to the compressor only, then opening the suction line connection at the suction line valve and running the machine. The refrigerant will be forced through the entire system, and the air forced out through the loosened suction line connection. As soon as the air is out of the system, the connection can be tightened and the machine run until it contains the correct charge. (See Drawing No. 3A.)

Service of Mohawk Compressors for Household Refrigerating Machines

Duty for Compressor

The compressor has only one function. It takes low pressure, heat-laden Methyl Chloride vapor from the suction line and compresses it in the condenser, thereby raising its temperature to a point where the heat can be removed from the vapor by the air from the fan, thus changing the vapor back to its liquid state. The entire refrigeration cycle is given elsewhere in this Manual, but the above is the only part the compressor plays in it.

SERVICE INSTRUCTIONS

Testing the Compressor

The compressor takes the refrigerant in vapor form from the suction line at approximately 5½ lbs. pressure, and compresses it in the condenser to a point where it will condense into liquid. There are line valves bolted to the compressor at both the inlet and outlet, making it possible to easily remove the compressor for repairs and shutting off both valves, unbolting them, and taking out the base bolts. To test the operation of the compressor to be sure that it is functioning properly, it is only necessary to shut off the line valves, remove the outlet port plugs from both valves, and run the compressor with the air going through it. If it is discharging air from the port in the top line valve, install a pressure gauge in this port, start the compressor, and see that it will pump to about 225 lbs. If it will do this, you may be sure that the piston rings and suction valve are working properly. With the gauge screwed into the outlet port tightly, let the compressor pump 225 lbs. pressure, then stop the motor. If the pressure holds, or if the needle drops back very slowly, the discharge valve holds satisfactorily. If either valve fails to hold, remove the valve, examine and clean it, or renew the disc if necessary.

Seal leaks are rare, but can usually be repaired by removing the compressor, disassembling it, removing the seal by unscrewing the seal nut which is just back of the flywheel, and taking the shaft out by unscrewing it from the cam and connecting rod assembly. Clean and polish the seal face of the shaft with Crocus cloth, and if the face of the seal is not smooth, lap it tightly with a rotating motion with oil on a true razor hone.

To determine the amount of oil in the crankcase of the compressor, shut off the suction line valve on the side of the cylinder and remove the pipe plug from the top of the crankcase directly under the line valve. A short piece of insulated wire makes a good measuring rod. There should be between 1½" and 1¾" of oil in the crankcase. Use only MOHAWK REFRIGERATING OIL in our refrigerating systems.

The compressor can run in one direction only. When you are facing the flywheel (looking at the compressor from the back of the cabinet) the wheel must turn in the same direction as the hands of a clock. If it is reversed, the compressor is very likely to be damaged.

Cleaning and Oiling the Compressor

Whenever the compressor is taken apart for any reason, the oil should be removed and discarded. Before the compressor is reassembled, the parts should all be thoroughly washed in Carbon Tetrachloride or Gasoline. The former is preferable, as there is no fire hazard, and it is a better solvent of oil. As soon as the parts are clean, they should be oiled with MOHAWK Refrigerating Oil to prevent rusting. On a damp day, if all the oil is removed while cleaning, they may rust in a very few minutes.

Before reassembling the cylinder to the crankcase, fill the compressor to between one-eighth of an inch and one-quarter of an inch of the bottom of the camshaft.

IMPORTANT:—Use only MOHAWK Special Refrigerating Oil that has been purchased from the MOHAWK Factory, and kept in a tightly sealed can. Other oils, no matter who uses them, are not suitable for MOHAWK Refrigerating Machines, and must not be used under any circumstances.

THE SEAL

Purpose

The seal on the compressor of the MOHAWK Refrigerating Machine provides a leak-proof joint at the point where the camshaft extends to the outside of the crankcase. It prevents the leakage of Methyl Chloride or oil—both when the shaft is revolving, and when it is stopped. There is a hardened smooth face on a shoulder of the shaft against which a bearing of self-lubricating metal is held in place. The surfaces of these parts are perfectly smooth where they make contact, and form a leak-proof joint at all times.

The self-lubricating bearing is sealed to the crankcase with a flexible metal bellows. One end of the bellows is soldered to the Seal Bearing or "Seal Nose," as it is commonly called, and the other end is soldered to the Seal Ring which is sealed to the crankcase with a gasket.

The Seal Ring inside of the bellows holds the Seal Nose firmly against the Seal Face of the shaft.

A McKim gasket between the end of the crankcase boss and the Seal Ring is compressed by the Seal Nut, and forms a tight joint.

Testing the Seal

The usual indication of a seal leak is oil under the seal on the floor, base, or a few drops of oil on the bottom of the seal nut. Vaseline is put inside the bellows when the seal is assembled, and a little of it may run out when the compressor is warm. This must not be confused with oil that indicates a seal leak.

If you believe there is a seal leak, but are not sure, proceed as follows to test the seal:

Shut off the unit and close both the Suction Line Valve and the Top Line Valve tightly. Connect a service tank of Methyl Chloride to the port in the Suction Line Valve. Open the valve on the service tank so that there will be high pressure from the service tank in the Compressor. If the leak is very bad, you may hear it hiss when the pressure is applied. In most cases, you have to use soap lather to be sure. Take a small rag, soak it with lather, and wedge it between the seal nut and the flywheel hub in the form of a "U," leaving only the top open. Apply lather to the open end at the top where it can be seen, and bubbles will come through the lather if there is a leak. Take plenty of time to watch for bubbles, as the leak may be a very small one.

Repairing a Seal Leak

Remove the shaft assembly as described for removing the Piston Assembly. The camshaft, flywheel and seal assembly are taken out of the compressor together. Remove the flywheel from the shaft, and slip the seal assembly off the shaft.

Examine the end of the crankcase boss and the Seal Gasket for possible places of leakage. It may be that the leakage was past the gasket, and a new gasket will stop the leak.

If the face of the shaft is smooth and bright—even though thinly covered with copper, and the face nose smooth and free from scores, it would indicate leakage elsewhere.

Before deciding to replace a shaft on account of marks on the seal face, clean the face thoroughly, cut a hole in a piece of fine Crocus cloth and put the end of the shaft through it so that the polishing surface is against the seal face. Put the seal nut on the shaft backwards, and use it as a lapping block, turning the shaft backwards and forwards. If the marks on the shaft are removed, it need not be replaced. The point of a lead pencil run over the face of the shaft will quickly tell you whether or not it is smooth.

If the face of the seal nose is scored or rough, it is best to replace the whole seal assembly. The seal nose may be lapped on a true razor hone with a slow rotating movement, and made to hold. It is a very particular job, and often, even though care is taken, is not successful. We do not recommend it on that account.

If the Seal Gasket is removed from the Seal Nut, it should not be used again under any circumstances, as it will be almost impossible to make it hold.

Before reassembling a Seal to a Compressor, put a small amount of vaseline in the seal around the seal spring. Be very careful that none of it gets to the part of the crankcase that is under pressure at times, as it will eventually find its way to the compressor valves and cause trouble.

When a new seal assembly is to be installed, always clean the shaft carefully before assembling the compressor. After using Crocus cloth, clean the parts thoroughly, as Crocus will cause trouble if it gets into the compressor.

If a new seal is installed, let the compressor run for half an hour before testing it. This gives the seal a chance to seat itself.

PISTON ASSEMBLY

NOTE:—The parts that make up the Piston Assembly are never sold separately. The fit of both the wrist pin and the cam is so important that, if one part is worn and needs to be replaced, we consider it better policy to replace the entire assembly.

Testing the Piston Assembly

The most important tests are the alignment of the connecting rod and the piston, and bearing surface of the cam.

To check the alignment of the piston, you can use the cylinder as a gauge. The check is made to be sure that the piston itself is at exactly right angles to the camshaft. Remove the cap screws that hold the cylinder to the crankcase and the gasket from between the two parts. Due to the small amount of play between the cam and the connecting rod, you will find that the cylinder can be rocked very little from side to side. Holding your fingers over both flanges, rock the cylinder and see that it lifts on both sides the same amount. If it lifts on one side and will not lift on the other, or if it can be lifted higher on one side than on the other, the alignment is not correct. Check the alignment most carefully before trying to straighten the rod, as it is very seldom a rod will be found that is not straight and true. To straighten a rod, leave the cylinder on the compressor as when you test the alignment, and bend the rod by hand a very little at a time until checking tells you it is true and straight.

The bearing surface of both the cam and connecting rod should be smooth, clean, bright and free from scratches or scores of any kind. Unless one of the parts is worn, the clearance between the two will be right. If either or both parts are worn so that the fit is loose, the Piston Assembly should be replaced. Be sure the cam runs freely and smoothly in the connecting rod.

If the wrist pin is loose enough that there is appreciable play, the entire assembly should be replaced.

Examine the piston and cylinder for scratches and scores, as either indicates that some foreign substance got between these parts and started the scoring.

Removing the Piston Assembly

To remove the piston assembly, first remove the cylinder and put a wood block—a small hammer handle will do nicely—in the crankcase between the cast iron counter balance and the side of the crankcase. The counter balance is a nut morticed into the cam. The nut is threaded onto the shaft and drives the cam. With the nut held firmly in place turn the flywheel unscrewing the shaft from the nut. After it is loosened unscrew the Seal Nut and back it off at the same time you unscrew the shaft from the piston assembly.

DISCHARGE VALVE

Purpose

The Discharge Valve acts as one dividing line between the high pressure and the low pressure side of the system. It admits Methyl Chloride vapor as it is compressed by the piston, and closes automatically, keeping it in the high pressure side of the system.

Test

The Discharge Valve can best be tested for a leak before it is removed from the compressor. This procedure is described fully under "Testing the Compressor."

Examine the sea of the valve for foreign matter that would hold the valve open. See that there are no marks on the seat that would cause the valve to leak. Examine the valve disc to see that it is smooth and clean.

Repair

If the valve was held open by foreign matter of some kind, wash the entire assembly thoroughly with Gasoline of Carbon Tetrachloride.

If the seat is clean, bright, and free from scratches, and the disc damaged in any way, the disc can be replaced.

If the seat is damaged, the entire assembly should be replaced.

INTAKE VALVE

Purpose

The Intake Valve is located in the top of the piston. It opens on the downward stroke of the piston, and allows the cylinder to fill with Methyl Chloride vapor from the crankcase. On the upward stroke of the piston, the valve closes by its own stiffness, and the pressure above it, and the piston compresses all of the vapor in the cylinder, forcing it through the Discharge Valve.

Test

The Intake Valve can be tested most satisfactorily before the compressor is taken apart. The indications of a failing suction valve are given under "Testing the Compressor." A small piece of foreign matter of any kind can hold the Intake Valve open and stop the compressor from pumping. If the valve leaks, which is indicated as outlined above, examine the disc and the seat. Both should be clean and bright where they make contact. The intake valve disc can be removed readily by taking out the valve retainer screws and lifting off the retainer plate. Be careful not to lose the two small balls that hold the disc and spring in place.

Repair

If the valve was held open by foreign matter, it should be cleaned. It is not good policy to use either Gasoline or Carbon Tetrachloride to clean the piston unless the entire piston and connecting rod assembly is out of the compressor, as some of the cleaning medium might get into the crankcase and dilute the oil.

END THRUST ASSEMBLY

Purpose

The end thrust assembly consists of the Cap or Retaining Nut, the Thrust Plug, the Thrust Ball and a Gasket.

This assembly provides a leak-proof cap for the outside end of the rear main bearing, and a Ball Thrust to withstand the pressure on the crankshaft of the seal spring.

The thrust ball fits the end of the camshaft and rides against the hardened and ground steel thrust plug.

Test

About the only inspection ever needed on this part is to test it for leaks. Use soap lather around the cap, and watch for bubbles. When you have the compressor apart for other reasons, or when you have removed the Retaining Nut to replace a leaking gasket, examine the Thrust Ball and Thrust Plug for undue wear. These parts almost never cause any trouble.

THE FLYWHEEL

Purpose

The flywheel serves the double purpose of a drive pulley and flywheel. It is held on the shaft with a nut and lock washer that presses the flywheel onto a taper.

Removing the Flywheel

The flywheel can be readily removed with the flywheel puller as supplied in the Standard Tool Kit. Apply the Puller, and, if the flywheel does not start immediately, tap the Puller screw lightly with a hammer, and tighten the screw a fraction of a turn at a time.

THE MOTOR

Complete instructions for caring for the motor are given in the envelope attached to the motor. The instructions should be used when any motor trouble develops. Motors are guaranteed by their manufacturers rather than by us. If you cannot repair the motor, take the matter up with the motor manufacturer or their representatives in your locality. The motor should be oiled at both oil cups every two or three months, and ordinarily, this is all the attention it requires.

Brushes and Commutator

If commutator becomes rough or dirty, it may be smoothed with a very fine (00) sandpaper while motor is running.

Operation

This motor will bring its normal load up to full load speed and brushes will leave commutator, within five or ten seconds after motor is switched on. Failure of motor to come up to speed and throw off brushes is an indication of overload, or of low voltage in the supply circuit.

Occasionally a motor may be called upon to carry a very heavy starting load. In such cases, the motor may not throw off its brushes immediately. If, however, the motor does not come up to speed and throw off brushes within one minute, look for trouble elsewhere, such as low line voltage.

For diagram of motor connections for 110 volt, 220 volt, etc., see instructions in envelope attached to motor.

Alternating current motors used by MOHAWK are the conventional repulsion-induction type.

The Direction of Rotation

The direction of rotation of all motors installed in the field should be checked carefully, as very serious trouble will result by operating any MOHAWK compressor backwards. This point is given a very careful check when units are assembled at the factory. When facing the fan end of the motor, the direction of rotation should be clockwise.

To Change the Direction of Rotation

To change the direction of rotation of an A. C. motor, it will be necessary to shift the brush rigging to another position. These positions are marked so they will not be misunderstood. On the standard motor used by MOHAWK, the brush rigging is held in position by one lock screw.

The Direction of Rotation

The direction of rotation of any motor used on MOHAWK REFRIGERATORS must be noted carefully to be sure the compressor is not run backwards, as this will cause very serious trouble if permitted. When facing the fan end of the motor, the rotation should be clockwise.

CONDENSER-RECEIVER ASSEMBLY

(See Drawing No. 4)

The Condenser-Receiver Assembly is a very important part of any refrigerating machine. Its purpose is to remove heat from the compressed Methyl Chloride vapor so that it will return to liquid form and be ready for another cycle. The entire refrigeration cycle is given under the title, "Cycle of Refrigeration."

There are two parts of this assembly—the Condenser and the Receiver. The Condenser has radiating surface over which air is blown by a fan, thus dissipating the heat into the room. The Receiver is where the Methyl Chloride is stored after it has been liquified.

It is very seldom that any service is required on a condenser. If a leak occurred at any point, it would be apparent immediately, and could be repaired in a few minutes with an ordinary soldering iron.

Caution

Never try to solder the condenser while there is refrigerant in it. The pressure will prevent the solder covering the opening and the leak will put an excessive pressure on the condenser.

The Freezing Unit

The Freezing Unit used in MOHAWK Refrigerators is of the Direct Expansion type using an expansion valve. (See Drawing No. 5.)

There are two separate parts of the Freezing Unit, each having a particular purpose. The coil below the ice tray sleeves is for the express purpose of freezing ice and desserts. The sleeves are soldered directly to this coil affording perfect contact between the coil itself and the ice trays. The Expansion Valve admits the refrigerant to this coil first where it quickly freezes the water in the pans if it is not already frozen. The top coil above the ice tray sleeves is of the Fin type with an exceedingly large amount of surface, which will cool the air in the refrigerator without being reduced to low sharp temperatures. After the refrigerant passes thru the lower coil and freezes the ice in the pans, it produces refrigeration in the top fin coil that cools the air. When this coil is reduced to the proper temperature the thermostat stops the machine. The capillary bulb of the thermostat is clamped to the back of the top coil. As long as there is heat to be taken up from the ice trays, the refrigerant vaporizes in the lower coil and does not produce refrigeration in the upper coil which permits the machine to keep running, thus automatically giving longer running periods while the ice is being frozen.

THE EXPANSION VALVE

(See Drawing No. 6)

The expansion valve is the automatic device that regulates the flow of refrigerant from the liquid line to the freezing unit. The suction line pressure controls the passage of refrigerant. When the refrigerating machine leaves the factory, the expansion valve is set at a pressure of

5½ lbs. It is seldom that any adjustment will be required. There is a plug cap over the adjusting screw in the center of the front plate of the valve. The plug cap and gasket are necessary to exclude moisture from the bellows. You can check the suction line pressure by attaching a compound gauge in the outlet port of the line valve on the side of the compressor, and slightly opening the valve. If the pressure is below 5½ lbs., raise it by turning in on the adjusting screw a quarter turn at a time until the correct pressure registers on the gauge. If it is too high, turn out on the screw the same way.

If the suction line pressure is erratic and fails to hold properly, first test the compressor as outlined in the Chapter on Compressors. If it pumps and holds pressure properly, the fault is probably in the expansion valve. You can remove the expansion valve by closing the line valve on the bottom of the condenser and pumping the charge into the condenser, then disconnect the liquid line and unscrew the valve. By removing the two hexagon caps at each end of the expansion valve, you can clean and inspect the inside of the valve. Before reassembling it, wash it thoroughly with carbon tetrachloride or clean undiluted alcohol. Be sure that the strainer in the valve is clean and unobstructed.

Purpose of the Expansion Valve

The Expansion Valve has one function to perform on a Refrigerating Machine. It maintains a given pressure in the Freezing Unit all the time the unit is operating.

Methyl Chloride boils at 10.65° below zero Fahrenheit. This is a lower temperature than we want in the Freezing Unit. To raise the temperature of the boiling liquid in the Freezing Unit, we raise the pressure. In most cases, this pressure is about five or six pounds. The Expansion Valve admits liquid Methyl Chloride to the Freezing Coil in sufficient quantities to maintain the predetermined suction pressure. Drawing No. 6 shows a cross-section of the Expansion Valve.

Adjusting the Expansion Valve

There is only one adjustment in the Expansion Valve. The adjusting screw, letter "E," can be turned to the right or left, raising or lowering the pressure that the Expansion Valve will maintain. Examine Drawing No. 6 carefully, that you will understand the mechanism. Liquid Methyl Chloride enters the valve from a liquid line, passing through the screen "C." As you see, there is a jet in the valve which is closed by the needle "B," held in position by spring "A." On the left-hand side of the valve, as shown in the cut, you will see a bellows "D," and the adjusting spring "F." The chamber in the valve around the bellows is connected to the Freezing Coil by an outlet bolt which is not shown in the cut. This chamber is, of course, at the same pressure as the freezing coil and the suction line. When the pressure in the freezing unit is reduced by the compressor drawing Methyl Chloride vapor out of the Freezing Unit, the adjusting spring forces the plate, which is across one end of the bellows, away from the adjusting nut and against the lever. A small movement of the lever lifts the needle from its seat and admits liquid Methyl Chloride to the freezing unit from the liquid line.

From the above, you will see that the lever that operates the valve is moved by the bellows plate, and that this bellows plate is balanced by pressure of the freezing unit on the warm side, and the adjusting spring on the other. Increasing the pressure on the adjusting spring by turning the adjusting screw to the right raises the suction line pressure, as to operate; the freezing unit pressure must build up to a point at which it will balance the adjusting spring.

To Raise the Suction Line Pressure

To raise the suction line pressure, turn the adjusting screw clockwise.

To Lower the Suction Line Pressure

To lower the suction line pressure, turn the adjusting screw counter-clockwise.

The small chamber inside of the bellows around the adjusting screw and the adjusting spring is sealed from the outside atmosphere with a cap and a gasket. This cap must always be in place when the machine is operating. The temperature of the valve changes, as the machine starts and stops, and, unless this chamber is sealed, moisture condenses inside of the valve. Sealing the valve with the cap and gasket avoids any possibility of this trouble.

Repair of Expansion Valve

There is very little possibility of an Expansion Valve needing repairs of any kind. Most Expansion Valve trouble is due to either moisture or foreign matter accumulating around the valve head. Moisture trouble is discussed in detail under the head of "Moisture in the System."

If the Expansion Valve fails to respond to adjustment, the two hexagon caps can be removed from the valve, the jet taken out with a screw driver, and all the parts thoroughly cleaned. In cleaning an Expansion Valve, the parts should be washed in either alcohol or carbon tetrachloride, and the valve blown out with dry air or Methyl Chloride vapor before it is reassembled. Look through the opening in the jet to be sure that it is clear and free from foreign matter. See that the valve stem works freely in the guide. While the Expansion Valve is apart, clean the screen thoroughly.

There is slight chance of leaks at the hexagon caps. These joints are sealed with a tongue and groove joint, and a metal gasket. Pull them down tight, and they will not leak.

THE THERMOSTAT

(See Drawing No. 6)

The Thermostat on the MOHAWK Refrigerator is adjusted at the factory to "cut-in" and "cut-out" at proper temperatures. When it is necessary to change the cut-out point beyond the range obtained by moving the Dial "A" between numbers 1 and 8, a further adjustment can be obtained by removing the screw that holds the knob in place and using the knob as a wrench. Each number on the Dial makes a difference of about one degree in the temperature setting. If the temperature in the refrigerator is not low enough you can turn the adjusting knob to the right two or three numbers to get the desired temperature—then remove the knob and set it back to number 1. The hexagon brass rod on which the knob is mounted is the adjusting screw. Turn the hexagon Screw "C" clockwise to lower the cut-out point, that is to a higher number—and counter-clockwise to a lower number to raise the cut-out point.

The differential is the distance between the "cut-in" point and the "cut-out" point. Differential adjustments are obtained by means of Screw "D," which is a small screw inside of the hexagon rod that adjusts the range. To raise the cut-in point turn this small screw clock-wise and to lower the cut-in point, turn the screw counter-clockwise. This does not change the cut-out temperature of the thermostat.

The Thermostat used on MOHAWK Refrigerators has an overload relay which will cut off the current and stop the machine in case the motor is overloaded. This makes a fuse on the motor line unnecessary. In case there is low voltage on the line or an overload on the motor from any cause, the "on" and "off" switch button will throw out. When this happens the machine can be started again by pushing in on the switch button, but an examination should be made to determine the cause of the overload.

The Power Element (Bellows Capillary Line and Capillary Tube) of this thermostat can be removed and replaced if necessary without replacing the entire thermostat. In case the Power Element loses its charge, it can be unscrewed from the thermostat and examined. Press in on the end of the Power Element that was in the thermostat and see whether there is pressure in the power element. If there is not this part of the thermostat must be replaced. The Power Element must be screwed tightly into the thermostat or the operation will be faulty.

Before deciding that a thermostat is at fault, make a very careful check of the system to be sure that the trouble is not elsewhere. The suction line pressure must be set accurately at 5½ lbs. A high back pressure of 10 or 11 pounds will cause the suction line to frost and keep the machine running continuously as the temperature at the thermostat clamp will not be low enough to stop the machine.

A low back pressure produces such temperatures in the lower coil that their refrigerant does not reach the thermostat clamp as soon as it should. This keeps the machine running more or less continuously.

A shortage of refrigerant, with consequent inefficient operation of the system, will keep the machine running most of the time through no fault of the thermostat.

An inefficient compressor due to faulty suction or discharge valve may keep the machine running continuously.

If the capillary bulb is not clamped tightly in the thermostat clamp on the back of the top coil, the capillary bulb will not cool properly and stop the machine. All of these things should be checked before deciding that the thermostat should be changed.

THE METHYL CHLORIDE CHARGE

It is most important that a refrigerating machine always have the correct charge of Methyl Chloride. One of the first things a service man must learn is to determine whether the machine has the right amount of charge to work efficiently.

Too Little Charge

Too little charge in a machine is usually indicated by a lack of refrigeration, and the machine running a large part or all of the time. This is due to the fact that there is not a "liquid seal" ahead of the expansion valve all the time, and that uncondensed vapor is being put through the valve into the freezing coils. Needless to say, if the Methyl Chloride is not condensed to liquid before it enters the freezing coil, it cannot go through a change from liquid Methyl Chloride to Methyl Chloride vapor, thereby taking up heat. Oftentimes, if the charge is too small, there will be a "liquid seal" only a part of the time, and the refrigeration in the coil will take place intermittently. A low head pressure usually indicates a shortage of refrigerant, but this is not an infallible rule.

Too Much Charge

Too much charge is usually indicated by exceedingly high head pressures, and is usually accompanied by a cold receiver, and a cold lower part of the fin type radiator, and visible laboring of compressor and motor.

You will usually find that the part of the condenser and receiver assembly that contains liquid Methyl Chloride is cold or cool, and that the part of the condenser where the refrigerant is condensing is warm when the machine first starts.

When a refrigerating machine is in normal operation, the entire condenser should be warm, and the receiver should be either cold, or, at least the lower part of it cold, indicating that the lower part of the receiver contains liquid. This will insure liquid Methyl Chloride in the liquid line at all times. There is a tube inside of the receiver extending from the bottom line valve to within one-eighth of an inch of the bottom of the receiver. This tube, of course, takes the liquid refrigerant directly from the bottom of the receiver, and will keep the liquid line full of refrigerant as long as there is any in the receiver.

If there is condensation in the condenser, the temperature of the condenser must be above room temperature; otherwise, the heat would not flow from the condenser to the surrounding air. Feeling of the condenser with your fingers on the return elbows at the end of the condenser will usually give you the temperature quite accurately. You will have to make allowance for the difference in temperature due to high or low room temperatures. **Be very careful not to get your fingers in the fan when feeling of the condenser.**

If you are reasonably sure that the machine is short of charge, you can determine this quickly by loosening the flare nut where the liquid line attaches to the bottom line valve. If liquid Methyl Chloride immediately starts out of this opening, it is well to look elsewhere for the trouble. You may be sure, at that time, that there is a "liquid seal" ahead of the expansion valve. Possibly the most accurate way of determining the charge of Methyl Chloride is to attach a service tank in an upright position to the suction line valve on the side of the compressor. Open the valve on the service tank and the suction line valve, and immediately feel of the condenser. The high suction line pressure obtained from the service tank will give you a considerable increase in the condensation in the condenser. The condenser will get hot immediately. The receiver will probably warm up on top and remain cold on the bottom if there is sufficient charge in the machine. If the condenser and receiver both heat up immediately, you may be sure there is little or no liquid Methyl Chloride in the unit.

As stated above, the correct charge for a household refrigerating machine is one pound. Until you have had some experience in determining the charge otherwise, you can blow out the small amount of refrigerant remaining in a machine that needs charging, and add exactly one pound of Methyl Chloride by weighing the tank before and during the charging process. A long copper tube can be used between the service tank and the suction line valve on the compressor, and the service tank can be set on a small scale. This is the most accurate way.

Charging the Refrigerating Machine

The refrigerant is always pumped into the refrigerating machine through the suction line valve with the service drum in an upright position so that the Methyl Chloride will be in the form of vapor. When Methyl Chloride vapor is drawn out of the service tank by the compressor, it produces considerable refrigeration in the service tank. The pressure in the tank is quickly reduced. It is, therefore, well to set the service tank in a pail of warm water to prevent a reduction in pressure. Never allow a refrigerating machine to run on a vacuum. This is very likely to cause the oil to be pumped out of the crankcase.

HIGH CONDENSING PRESSURE

A high condensing pressure greatly impairs the efficiency of the condensing unit. A normal condensing pressure is approximately 15 pounds higher than the room temperature in degrees Fahrenheit. This may be exceeded a few pounds where the room temperature is very high. In a room of 70° Fahrenheit, the head pressure should be about 85 pounds, while in a room of 90° Fahrenheit, the head pressure would probably reach 110 pounds. On self-contained units, the air around the condensing unit should be considered rather than the room temperature.

There are two causes of excessive condensing pressure: One is an overcharge of Methyl Chloride, and the other is air in the system.

To reduce the head pressure in either case, air or an excess of Methyl Chloride can be purged out of the condenser through the outlet port of the discharge line valve on top of the compressor. To purge the condenser, open the discharge line valve as far as it will go, and remove the plug from the outlet port. With a line valve wrench, open the valve slightly, allowing the air or Methyl Chloride to escape through the port.

If you are endeavoring to remove air only, the port should be opened slightly for ten or fifteen seconds.

If you are removing an excessive charge, the amount that will be blown out will be governed by the amount of the overcharge. The blowing should be done for short intervals, allowing the unit to run between times. By noting the pressure and the temperature of the condenser, you will readily know when a proper amount is left in the condenser.

REMEMBER that the part of the receiver or condenser that holds liquid will be cool, and the part that is condensing vapor into liquid will be warm.

MOISTURE IN REFRIGERATING MACHINES

Refrigerating machines using Methyl Chloride as a refrigerant will not work satisfactorily if there is any moisture in the system. Methyl Chloride and water do not form a corrosive mixture as is the case with Sulphur Dioxide and water, and the compressor and other moving parts are not permanently injured by moisture in the system. Moisture will, however, freeze in the expansion valve and prevent the proper operation of this part.

All refrigerant-containing parts of the MOHAWK Machine are dried in an oven under vacuum for a considerable length of time to remove every possibility of moisture in the unit when it is shipped from the Factory. All copper tubing shipped from the Factory is cleaned, dried thoroughly, and the openings sealed to exclude air and moisture. It is most important that all copper tubing used with MOHAWK Refrigerating Machines be purchased from the Factory to prevent the introduction of moisture into the system.

All tubing must be kept sealed until the refrigerating machine is connected and charged. If a part of one length of tubing is used, the remaining ...... ? ...... ? ...... ? ...... ? ...... ?
plete stoppage of the flow of refrigerant through ...... ? ...... ?
ating machine is taken apart for any reason, all lines disconnected must be capped until the machine is ready to be reassembled. If a length of copper tubing is left open to the air, moisture will accumulate on the inside of the tube due to condensation of moisture from the rise and fall of room temperature.

THE DRIER

Indications of Moisture

The usual indication of moisture in the system is either the failure of the expansion valve to hold a constant pressure on the suction line, or the complete stoppage of the flow of refrigerant through the expansion valve. The latter would be indicated by the suction pressure going down to 15″ or 20″ of vacuum after the unit had been running a short time.

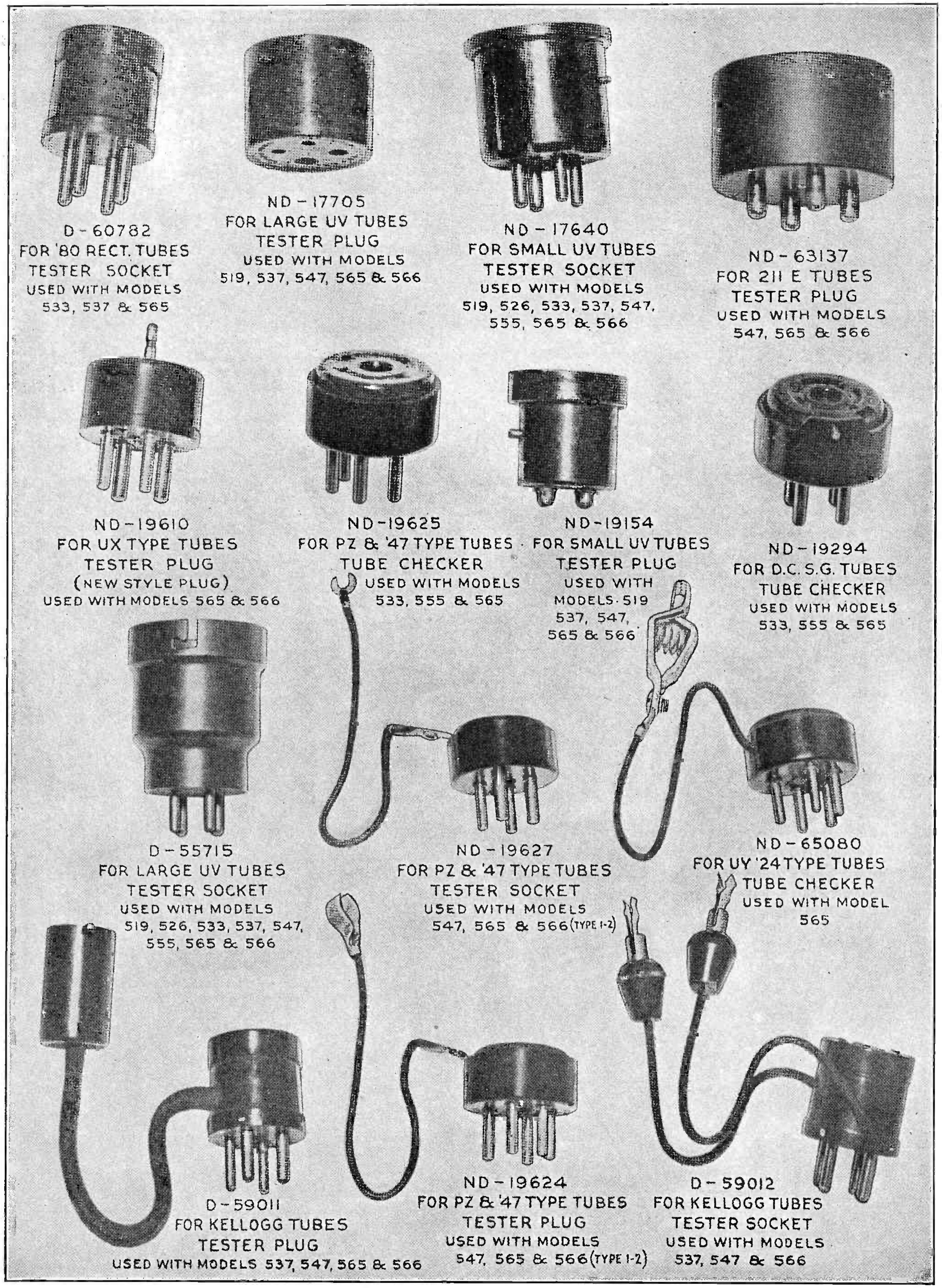
Installing the Drier

The Drier is a small container filled with anhydrous Calcium Chloride. The Drier is installed in the liquid line of the refrigerating machine, and the charge of Methyl Chloride is run through this Drier for a few hours. The Calcium Chloride in the Drier will absorb moisture out of the Methyl Chloride, leaving it perfectly dry. The Drier is fitted with ¼″ flare fittings at both ends. The usual procedure is to pump the charge into the condenser by closing the bottom line valve, disconnecting the liquid line from the bottom line valve, and connecting the Drier between the liquid line and the bottom line valve. A short extra piece of ¼″ copper tubing is necessary for this hook-up.

To successfully remove moisture from the system, the freezing unit must be comparatively warm. As you can easily understand, if the freezing unit is frosted, any moisture that passes through the expansion valve will freeze on the inside of the freezing unit coil and stay there. After installing the Drier, adjust the expansion valve to the highest pressure possible, and let the unit run for an hour or two. If the tubing starts to frost, stop the machine and let it stand with the refrigerator door open for at least two hours. This procedure of starting and stopping the unit should be repeated several times, to be sure that any moisture in the system has found its way into the Drier.

Removing moisture from a refrigerating machine with a Drier is a rather long, tedious process. It requires a lot of time, and must be avoided by taking the proper precautions to exclude moisture when the unit is being installed. It is, however, easier to remove moisture this way than to take out the entire installation and have the various parts dried in an oven. As stated above, to be sure that the Drier removes the moisture from the system, you must run the machine for short periods and let it stand long enough between each period for the freezing unit to warm up. If the Drier is not used properly, the machine will often start to work and hold its proper pressure until the next time the customer stops the machine to defrost the freezing unit. At that time, moisture that has frozen in the freezing unit coil will again start circulating in the system and start trouble.

NOTE: *A Drier should never be used over three times on refrigerating machines without returning it to the factory for a refill of Calcium Chloride. If, for any reason, you believe there is an excessive amount of moisture in a refrigerating machine, use a new Drier, and do not use the same Drier again before it is refilled.*



Illustrations of Weston Aaapters

Testing Power Pentode Tube (Type PZ) With Weston Test Sets as Used in New Atwater Kent Compact

When testing this tube on Model 533 Tube Checker, 555 Tube Checker or 565 used as a Tube Checker, place adapter ND-19625 in UY socket ('27 socket on Model 555). Then place power pentode tube in adapter. Set filament voltage to 2.5. Use high range of milliammeter but read on 0-20 scale. Approximate values are 3.5 to 4.8 with grid test button up and 6 to 8 with grid test button down.

To check the PZ tube on Models 547, 566 or 565, the latter used as a set tester, use adapter ND-19624 and attach to tester plug; the lead on the side of this adapter is clipped to grid terminal on side of plug. Adapter ND-19627 should be inserted in the UX socket of the test set; the lead on the side of this adapter is connected to the grid terminal binding post on the panel. See printed Lefax form for test data on the various current and voltage readings.

The Audio Power Pentode Tube, type PZ, has the following voltages and current applied:

—F to P	Approx. 250 volts
—F to Space Charge Grid	(K Term. of Socket) Approx. 250 volts
—F to G	16.5 volts
—F to +F	2.5 volts A.C.
Plate Current	32.5 milliamperes
Space Charge Grid Current	7 milliamperes

Position of Rotary Switch for various readings as follows:

PZ Tube	Mod. 547	Mod. 565	Mod. 566
Plate	B-250	B-250	B-250
Sp. Ch. Grid	Type 2 & 3 + C-250	SG-250	C-250
Grid	Off Scale	Con. Gr. 100	Con. Gr. 100
Filament	AC-4	AC-4	AC-4
P-MA	Tog. Sw. 100	Tog. Sw. 100	Pl. MA. 100
Sp. Ch. G-MA	Rect. 100	SG-25	SG-25

Adapter prices as follows:

ND-19625	$ .60	net
ND-19624	.75	"
ND-19627	.60	"

Shipment can be made promptly from our stocks.

Adapters for Checking the 211-E Tube on Weston Models 547, 566 or 565, Used as a Set Tester

The Western Electric 211-E tube which is widely used in sound projection apparatus can be checked on any of the above mentioned test sets. Necessary adapters consist of Tester plug adapter D-63137, price **$1.00** net. Test set socket adapter, D-63136, price **$1.25** net.

Ratings on this tube are as follows:

Plate voltage	1000 volts
C Bias	55 "
Filament	10 "
Plate MA	72 MA.

Readings on the various test sets with Bi-Polar switch setting as follows:

	Mod. 547	Mod. 565	Mod. 566
Plate	B-750 Off Scale	B-1000	B-1000
C Bias	C-100	C-100	C-100
Filament	AC-16 A-10	AC-16 A-10	AC-16 A-10
Plate MA	Tog. Sw. 100	Tog. Sw. 100	Pl. 100 MA.

Adapters D-63136 and D-63137 can be shipped from stock.

Test data on G-51 Multi-Mu Tube when checked with the following Models:

(Tested in same socket as 224 tube)

	Button Up	Button Down
MODEL 565 used as Tube Checker	4.5 —6	9—10.5
MODEL 533 TUBE CHECKER	6 —7	10—13
MODEL 555 TUBE CHECKER	1.25—2	4— 5.5