Instructions for Radiator and Cooler Valves

I.L. 48-063-12

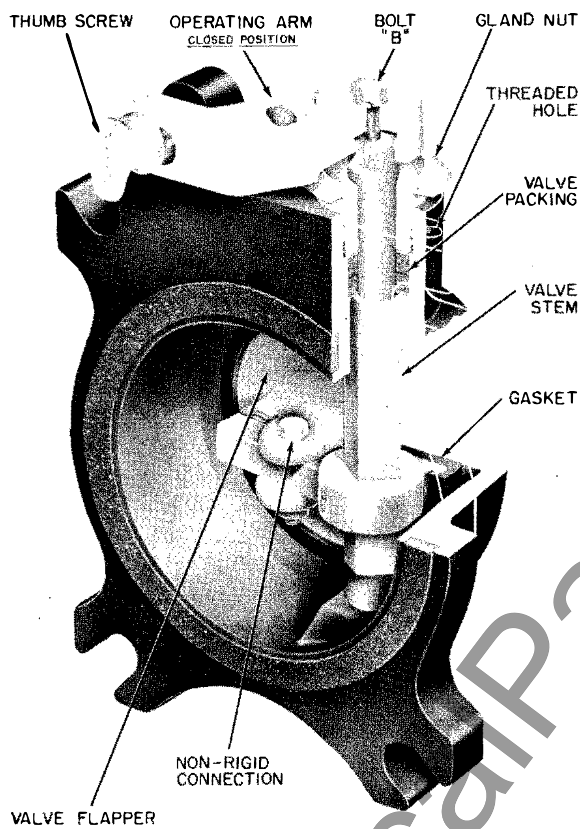

Fig. 1 Radiator Valve in Closed Position

The Westinghouse Radiator and Cooler Valves are of the flapper type. Generally valves are supplied on transformers with external cooling to allow removal of the cooling equipment without draining the unit. The cooling equipment may be removed for shipment, in which case the cooler and radiator valves are closed and blind flanges put over the openings.

DESCRIPTION

Radiator Valve. (Fig. 1) This valve is made up of the body, flapper, spring, flapper arm, valve stem, operating arm, gland nut, valve packing and miscellaneous hardware. The valve body is made of forged steel with the outer face grooved for a bolted gasketed joint. The body is welded onto the tank wall before assembly of the internal parts. The flapper has a cast aluminum body with a molded-on oil resistant synthetic rubber gasket. All of the other parts except the packing are aluminum.

The valve stem is sealed to the valve body with packing which is compressed by the gland nut. If leaks at the valve stem occur they can generally be stopped by tightening the gland nut.

Cooler Valve. (Fig. 2) The general construction of the cooler valve is similar to the radiator valve. The major difference in these valves is the size of opening. The cooler valve is larger than the radiator valve and is supplied where greater quantities of oil must flow.

OPERATION

The radiator valve is shown in the closed position in Fig. 1. To open the valve the thumb screw is removed and the valve handle moved approximately 90° counter-clockwise. The thumb screw is then tightened into the threaded hole shown in Fig. 1. The operating arm of the radiator is marked to indicate the closed direction.

The cooler valve is shown in the closed position in Fig. 2. The flapper position indicator points across the pipe when the valve is closed showing that the flapper is across the pipe preventing flow. To open the cooler valve bolt "A" is removed and the arm rotated approximately 90° clockwise and then flipped 180° to allow bolt "A" to enter threaded hole as shown in Fig. 2. The bolt is then tightened firmly into the threaded hole.

NOTE: It is essential that the flapper operating arm of the radiator and cooler valves be securely

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Instructions For Preparing Transformers for Operation with Nitrogen Gas

GAS-PROTECTED TRANSFORMERS may be installed with air in the gas space when simplicity of installation is of prime importance. In time, depending upon the oil temperature, the oxygen content is depleted by oxidizing oil leaving a blanket of inert gas above the oil. The amount of oxidation caused by this oxygen is so small that it is not harmful to the oil. During the early part of this period, when the oxygen content is greater then 7 percent, the transformer is not completely protected against the possibility of secondary explosion or fire in event of an internal fault. Therefore, if the customer wishes to obtain initial increased protection to the transformer, he can do so by purging the oxygen from the transformer with nitrogen.

METHODS OF PURGING OXYGEN FROM THE TRANSFORMER

Vacuum Filling. If the instruction plate specifies that the transformer tank will withstand full vacuum and a vacuum pump is available, the procedure outlined below can be followed for complete removal of oxygen from the gas space and oil:

Inertaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); replace the operating nitrogen cylinder with a "purging" nitrogen cylinder (Westinghouse Nitrogen P.D.S. 5622) if transformer oil exceeds 7500 gallons, otherwise use operating nitrogen cylinder. (Westinghouse Nitrogen P.D.S. 6306). Close shut-off valve (clockwise to limit); attach a vacuum line to gas sampling valve in the Inertaire cabinet, and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour, open test valve and cylinder valve, and then open the shut-off valve slowly 1-1/2 turns to mid-position. (Do not exceed the vacuum limits of the transformer pressure indicator.) Allow nitrogen gas to flow into the gas space. Do not exceed the maximum pressure of the pressure limiting device.

3. Replace the purging cylinder with the operating cylinder if nitrogen P.D.S. 5622 was used for purging.

Sealedaire.

1. Assemble the transformer complete for operation (with the oil at the proper level); remove the pipe plug from the vent hole in the cover and attach a vacuum line. Seal the open end of the pressure-vacuum bleeder with rubber stopper or plug. Pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for one hour and then attach a nitrogen cylinder, with pressure reducing unit, to the top filter press connection and allow low pressure nitrogen to flow into the gas space. At atmospheric pressure, remove vacuum line and replace pipe plug in the vent hole. Additional nitrogen may be fed into the transformer tank, but do not exceed the maximum pressure of the bleeder valve. Close the top filter press valve and remove nitrogen equipment. Remove rubber stopper from bleeder valve.

Gas-oil Seal.

1. Assemble the transformer complete for operation (with the oil at the proper level); seal off the gas-oil seal compartment with the back-seating angle valve; attach a vacuum line to the gas sampling valve on the transformer; and pump the gas from the space over the oil.

2. After obtaining the maximum vacuum which the pump will produce, hold for

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Westinghouse Electric Corporation
Sharon Plant, Transformer Divisions, Sharon, Pa.

Printed in U.S.A. (T.P.)

Instructions for Transformer Oil Circulating Pumps

Circulating pumps supplied on Westinghouse forced liquid cooled power transformers are a specially designed centrifugal pump. Each unit consists of a close coupled pump and motor housed in a multipiece cast iron housing. Two H.P. pumps are supplied on units where adequate cooling can be obtained by 2 H.P. pumps. On larger units 6 H.P. pumps are supplied. The construction of the two pumps are similar and information given in this leaflet can be used for either pump.

INSTALLATION AND OPERATION

The pump may or may not be shipped mounted on the transformer. If not mounted, new gaskets, and sufficient gasket cement are furnished for mounting purposes. All flanged connections are designed for retained gaskets to provide correct gasket compression when the joint is pulled up metal to metal. When the cooling system mounting is complete the pump may be filled with transformer liquid by opening the tank and cooler valves and permitting liquid from the transformer to fill the pump. Entrapped air should be released by loosening the topmost vent plug. When liquid appears the plug should be tightened. **It is important that no air is trapped in the pumps. It is always good practice to allow pumps to run about 30 minutes before energizing the transformer initially to assure that any air not removed by venting has been pumped out.**

If the pump is operating correctly the flow gauge will indicate proper flow. Reverse rotation of the pump is indicated by a noisy rattle.

MAINTENANCE

This unit is designed to be maintenance free. Periodic checks should be made to insure that no unusual noises are occurring in the pump.

Bi-annually (more frequently after the pump has been operating for 6 or 8 years) the unit should be shut down, suction and discharge valves closed, and the power unit withdrawn to insure that no foreign materials have become entrained in the pump. The bearings should be checked for wear and replaced if there is any evidence of wear. No additional maintenance requirements are necessary.

IMPORTANT: Do not run these pumps dry as wiping of bearing will occur.

CONSTRUCTION (See Fig. 1).

For Pumps: S#460C744G01, S#460C744G02, S#460C744G03, S#460C745G01, S#460C745G02, S#460C969G01.

The motor and pump have been designed as a single integral unit.

General construction includes a dynamically balanced rotor assembly consisting of a motor armature pressed onto a steel shaft. Bearings are fitted into inner and outer casing covers, both of which are accurately located on the outside diameter of the motor stator. The outer casing cover in combination with a 1/4" cross section "O" ring seals the unit. The casing is provided with a radius to facilitate entry of the "O" ring.

Under normal operating conditions with the pump mounted in a horizontal position all axial thrust is balanced out. Small amounts of axial thrust, in either direction, such as those encountered as a result of starting, vertical mounting or small suction heads are absorbed between lapped thrust coolers and steel backed babbitt bearing faces. Axial thrust is balanced under dynamic conditions across the impeller by means of back ribs on the impeller back shroud.

Instructions for Forced-Air Cooling Equipment Unit Fan Assembly

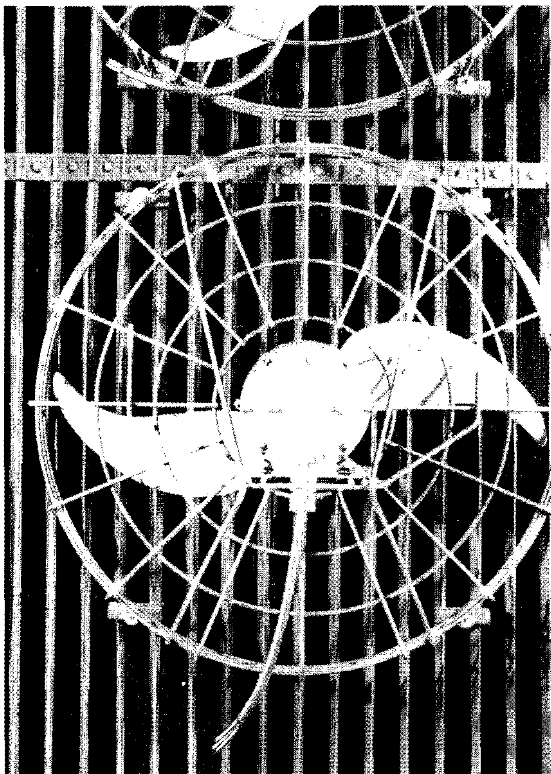

Fig. 1 *Radiator Forced-Air Equipment*

Westinghouse manufactures three types of forced-air cooling equipment for use on OA/FA (oil-insulated air-cooled, forced air-cooled) transformers: The bank type for radiators, the cooler tube type, and the portable type. The control equipment for all types is the same. An occasional inspection and greasing of motors is required after installation, as described later.

Standard unit fan assemblies are furnished with single or three-phase motors. Single-phase motors are capacitor-start, capacitor-run, with the capacitor mounted in a cylindrical case attached to the motor. Both single and three-phase motors are equipped with internally placed thermoguards for protection.

Rotation of the fan blade is counterclockwise when looking at the motor from the lead end. Pipe plugs are omitted from the underside of each end cap to eliminate condensation inside the motor.

Bank Type Radiator Forced-Air Equipment. The bank or multi-fan unit type forced-air equipment consists of a number of fans mounted on the side of the first of a group of radiators. One fan of such an arrangement is shown in Fig. 1.

The Westinghouse type radiator with its expanded cooling elements arranged in parallel rows provides a group of continuous ducts. The blast of air from the fans is directed through this duct system, thereby greatly increasing the normal convection characteristics.

This type of forced-air equipment is applicable only to the Westinghouse radiator. The radiators must be mounted in alignment in banks to provide the proper duct system.

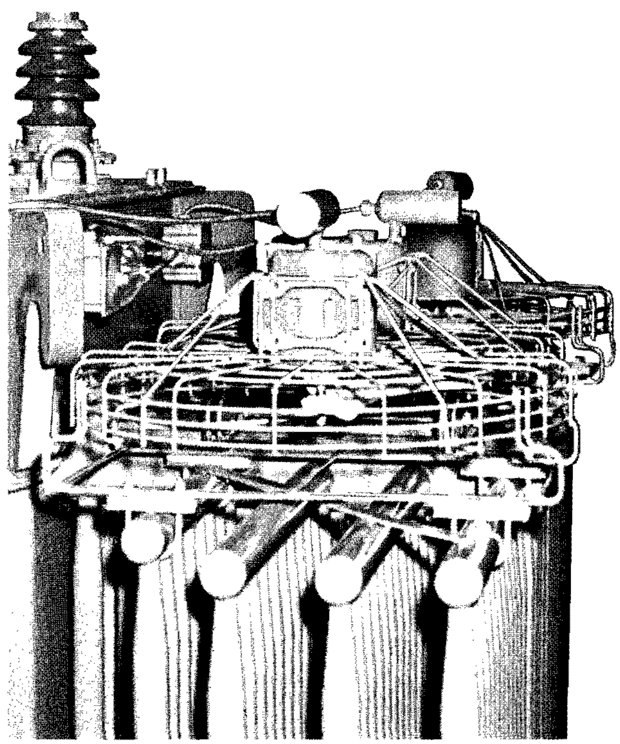

Fig. 2 *Tube Cooler Type Forced-Air Equipment*

Effective December, 1962 Supersedes I.L. 48-063-13, February, 1962

MAINTENANCE

Greasing. The motors have ball bearings designed to operate for long periods of time without greasing. Overgreasing a ball bearing assembly is an invitation to trouble.

Motors Without Pressure Grease Fittings. It is recommended that the threaded plug at each bearing hub be removed at one to two-year intervals. Fill the plug hole with grease, press in firmly with the thumb and replace the plug. Do not use pressure guns that will force the grease past the bearings into the windings.

Motors With Pressure Grease Fittings. The motor is designed with a pressure and relief fitting at both bearings. They have ball bearings with a seal on the winding side of the motor and a shield on the opposite side. All motors which operate more than 50% of the time or are subjected to climatic conditions as they exist in the southern half of the United States should be regreased every six months. All other motors can be lubricated yearly.

A high grade of grease, such as Esso Beacon 325 (MIL G3278) should be used as a lubricant for either motor. This grease can be obtained from Lima Motor Division through the nearest Westinghouse Office.

Painting. Good practice dictates that apparatus should be kept protected with paint. The entire air blast equipment, except the propeller, should be painted at regular intervals.

Inspection. A regular thorough inspection should be made of the equipment to insure the best service.

Renewal Parts. When ordering renewal parts, send a complete description of the particular part and the transformer serial number to the nearest Westinghouse Office.

Instructions for Westinghouse Radiators

I.L. 48-063-32

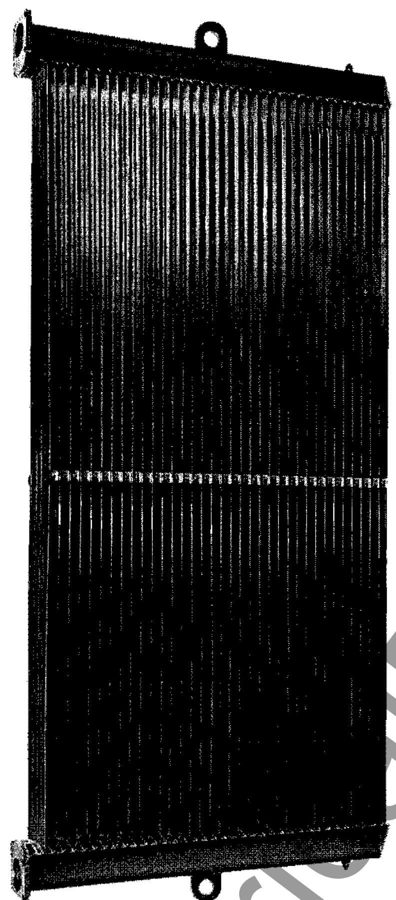

Fig. 1 *Westinghouse 36-Fin Radiator*

THE WESTINGHOUSE RADIATOR is a highly efficient cooling unit which is designed for use on large self-cooled transformers where high cooling capacities are required. It is detachable and may be removed for shipment, which reduces shipping clearances and relieves tank wall stresses which might develop due to sudden shocks in transportation.

DESCRIPTION

The radiator is of all-welded sheet metal construction with vertical cooling sections through which the oil circulates and is cooled. A formed metal header welded to each end of the assembly of sections, complete the structure and provides connections for the fittings which attach the radiator to the tank. The length of the radiators vary from eight to fourteen feet in one foot steps.

The individual fin sections are made from two preformed sheets of steel. The sheets are formed and trimmed so that when the two sheets are mated together they form several oil passages across the width of the fin. The sheets are welded together by an automatic resistance welding machine along the edges and between the individual lobes.

The ends of the fin sections are then flanged and trimmed. This flange over-laps the flange on the adjacent fin and they are mash seam welded together and then planished to give a smooth joint. The flanged connection between fins is curved which eliminates horizontal surfaces between fins and insures complete drainage. See Fig. 2.

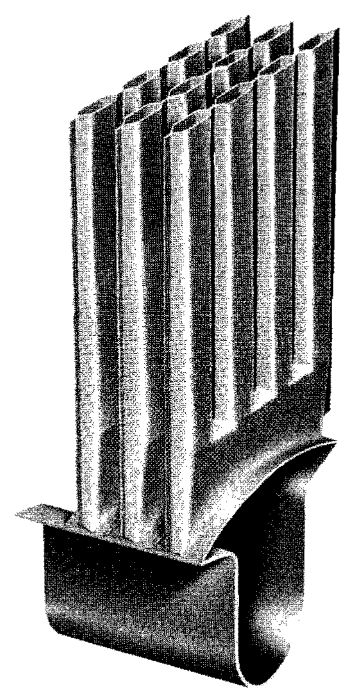

Fig. 2 Radiator Section Showing Joints Formed with Mash-Seam Welder

Instructions for INERTAIRE ® Equipment Types RBE and RVE

I.L. 48-063-31

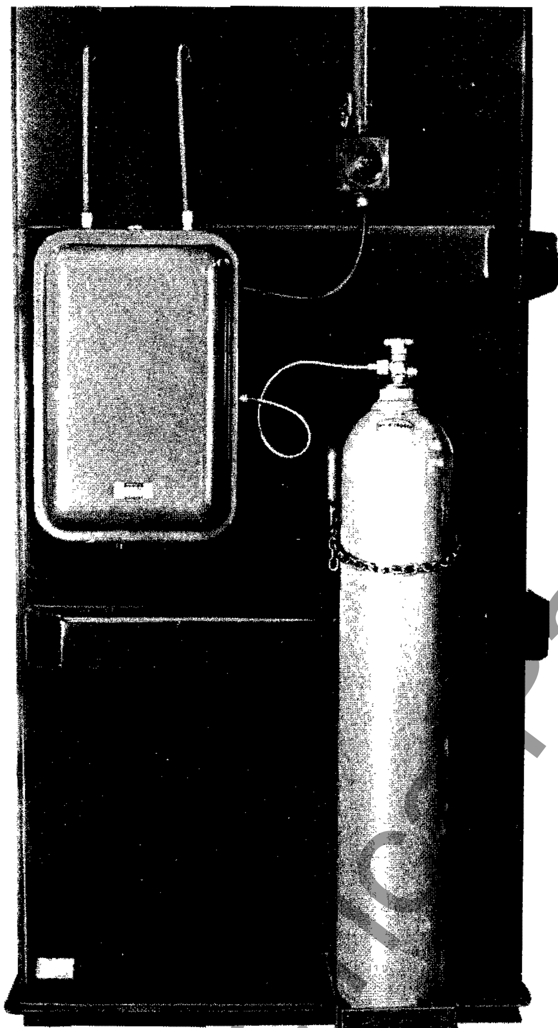

Fig. 1 *Typical Installation of Inertaire Equipment*

INERTAIRE is the name originally given by Westinghouse to a system for removing oxygen and moisture from the air being drawn into a transformer tank when decreasing temperature would create a partial vacuum within the tank. With the oxygen and moisture removed, the remaining inert gases are almost wholly nitrogen. Subsequent development has evolved means for feeding dry nitrogen at low pressure into the transformer tank from high pressure nitrogen cylinders, instead of depending on removing oxygen and moisture from the air drawn in during breathing.

Westinghouse Types RBE and RVE Inertaire equipment maintain a cushion of inert dry gas above the oil of transformers or similar oil-filled equipment.

The nitrogen is supplied from a steel cylinder which is initially filled to a pressure of 2000 pounds per square inch. A pressure reducing valve automatically feeds nitrogen into the transformer whenever the transformer pressure falls below 1/2 pound per square inch.

A relief valve assembly incorporated in the final stage of the reducing valve conserves the nitrogen in the gas space by permitting it to escape to the atmosphere only when the pressure in the transformer, due to the expansion of the oil with temperature, exceeds the predetermined value of 8 pounds per square inch (5 psi if RVE). A sampling valve connected to the gas space provides means for taking a sample of the gas to determine its oxygen content.

DESCRIPTION

Reducing Valve and High Pressure Gauge. A three-stage reducing valve, Fig. 2, is used to reduce nitrogen cylinder pressure of 2000 psi to 1/2 psi minimum operating pressure. The first stage is compensated to give constant pressure and flow to the second stage regardless of drop in cylinder pressure. In passing through the first stage the pressure is reduced from 2000 psi to approximately 100 psi.

The second stage further reduces the pressure to approximately 6 to 10 psi before the gas enters the third and final stage reducer where the pressure is reduced to 1/2 psi. The nitrogen is fed into the transformer gas space at this final pressure when the pressure in the gas space falls below 1/2 psi.

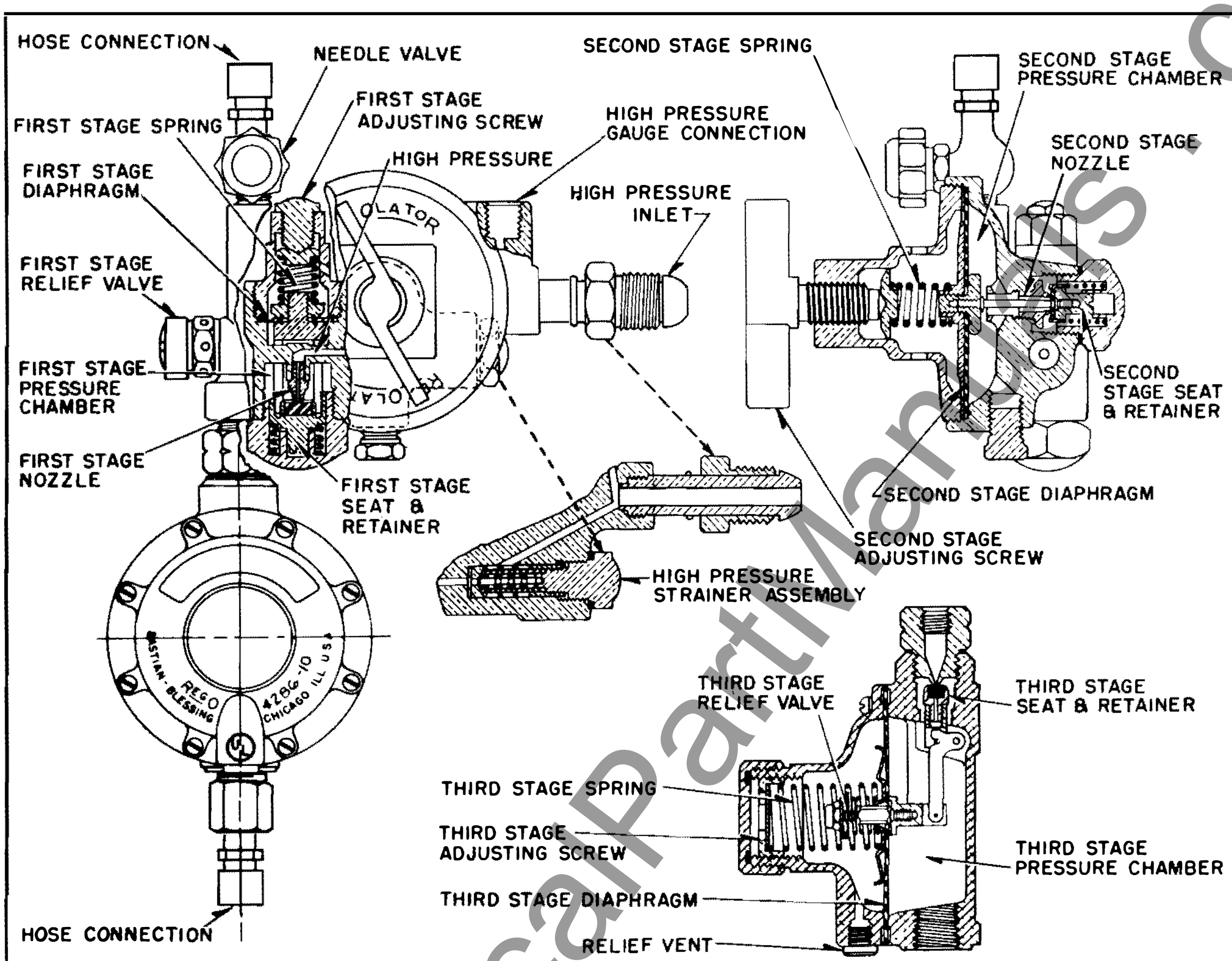

Fig. 2 *Reducing and Relief Valve Assembly*

A high pressure relief is provided in the event of excessive heat near the cylinder causing the cylinder pressure to increase to a dangerous value. The high pressure relief consists of a diaphragm backed by rose metal. When excessive heat occurs, the rose metal backing the diaphragm melts, leaving the diaphragm unsupported. The diaphragm then ruptures, permitting the gas to escape to the atmosphere through several holes arranged to distribute the thrust in all directions.

The test needle valve with a hose connection is located at the outlet of the second stage. This connection provides a relatively low pressure source (3 to 10 psi) for checking the relief pressure of a relief valve incorporated as part of the third stage. This connection may also be used for purging the gas space if desired.

The pressure at this connection can be adjusted by turning the adjusting screw (or T-handle) clockwise to raise the pressure or counterclockwise to lower the pressure.

NOTE: After using this connection, the adjustment should be reset to provide approximately 6 pounds per square inch pressure, (but never less than 3 pounds per square inch), since 6 pounds per square inch pressure gives the best performance in the following stage.

The third stage of the valve is the lower portion of the device. It is adjusted at the

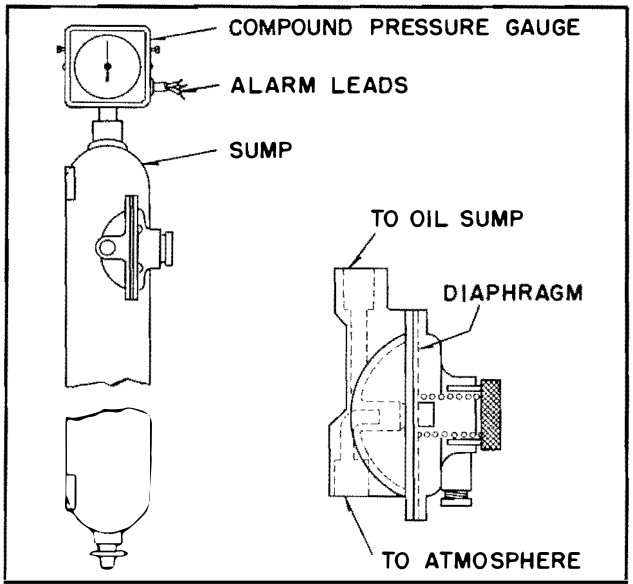

Fig. 3 *Sump, Compound Pressure Gauge, and Diagram Type Breathing Regulator (Regulator on Type RVE Only)*

factory to feed nitrogen into the gas space when the pressure in the transformer falls below 1/2 pound per square inch, and to seal off the gas space from the nitrogen supply when this pressure rises above 1/2 pound per square inch. This setting should not be disturbed under any circumstances. Incorporated within the third stage is a relief valve which acts to prevent the transformer pressure from exceeding 8 pounds per square inch. It is a spring loaded diaphragm valve. When the gas pressure on the transformer side exceeds 8 pounds per square inch, the valve opens slightly, permitting the gas to escape to the atmosphere through a relief vent in the body of the valve thus relieving the excess pressure. As soon as the pressure falls below 8 pounds per square inch the valve closes, preventing further loss of gas. In case of RVE equipment excess pressure (over 5 psi) is relieved by a separate relief valve installed on the sump.

IMPORTANT: The reducing valve is a precision instrument and adjustment other than the one mentioned in the previous Note should not be attempted. If the valve does not operate correctly, notify the nearest Westinghouse Office and send the valve to the Westinghouse Electric Corporation, Sharon, Pa., for repair. Repair of reducing valves and high pressure gauges should not be attempted in the field.

A 3000 pound per square inch pressure gauge is connected to the high pressure chamber of the reducing valve, and indicates the nitrogen pressure in the cylinder. The gauge is equipped with electrical contacts which close when the cylinder pressure falls to 200 pounds per square inch, plus or minus 10 percent and thus warns the operator that only 10 percent of a full cylinder of nitrogen is left. (See Fig. 5). The switch ratings are given in Table No. 1. The reducing valve will continue to function, however, until the cylinder is empty.

No vacuum relief is provided as the reducing valve feeds nitrogen into the transformer tank before a vacuum is reached. The slight amount of vacuum which might occur when the cylinder has been shipped away to be refilled will not be detrimental to the transformer or the Inertaire Equipment.

<u>Compound Pressure Gauge.</u> A compound pressure gauge, Fig. 3, mounted on top of the sump, is used to indicate pressure in the transformer gas space. It is of the diaphragm type, with increments of one-tenth psi and major divisions every 1 psi from -10 to +10 psi. The gauge is equipped with two alarm micro-switches, one to operate at abnormal high pressure and the other to operate at vacuum should it occur. Refer to Fig. 5. The standard compound pressure gauge is supplied with normally open contacts (Fig. 5b), but a special compound pressure gauge with normally closed contacts (Fig. 5a) may be supplied on request. The switches are set 8-1/2 psi on the pressure side and -3 psi on the vacuum side (RBE Inertaire). The switch ratings are given in Table No. 1

These values are recommended but if other than the above is required, setscrews on the side of the gauge are provided for adjustment of the switches. These setscrews are hex-head screws and can be turned with a small open-end or box-end wrench.

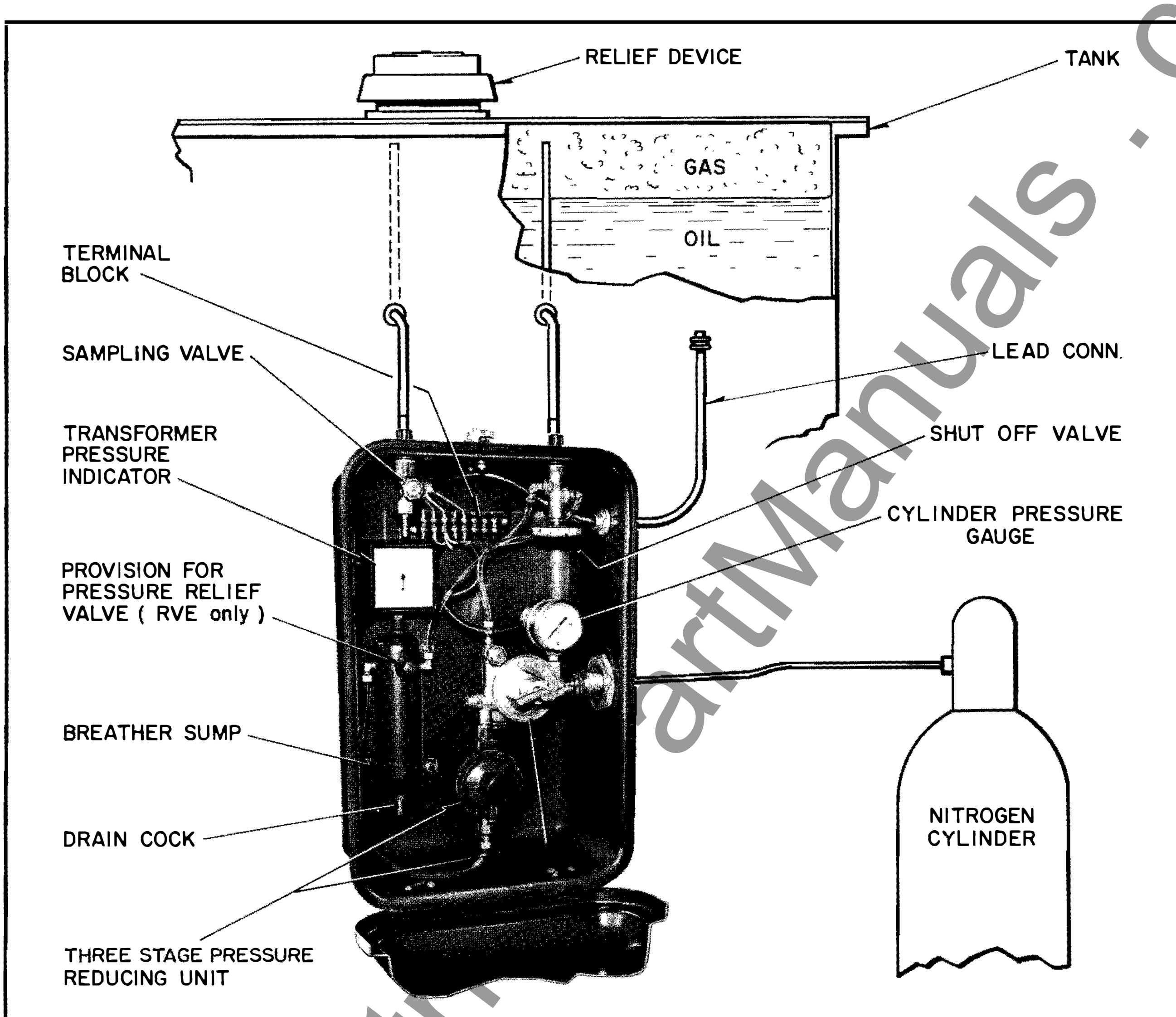

Fig. 4 *Equipment Arrangement*

The differential of the switches is approximately 1/4 psi. That is, if the high alarm operates, the pressure must fall only 1/4 psi before the switch is reset; if the low alarm operates, the pressure must increase 1/4 psi for the switch to reset.

It should be noted that the vacuum switch will never operate except in case the nitrogen cylinder is allowed to become empty. The pressure switch will not operate unless the relief valve should fail to perform its function, or the pressure builds up faster than it can be relieved by the relief valve due to a fault in the transformer.

Shut-off Valve. A three-way shut-off valve with two hose connections, located above the reducing valve, connects the gas space above the transformer oil level to the sump assembly or the test valve on the outlet of the first stage of the reducing valve. The three positions of the valve are as follows:

1. Shut-off (clockwise to limit). This shuts off the gas space and connects the relief valve through the hose to the test valve. This position is used to seal the gas space, and also for testing the operating pressure of the relief valve.

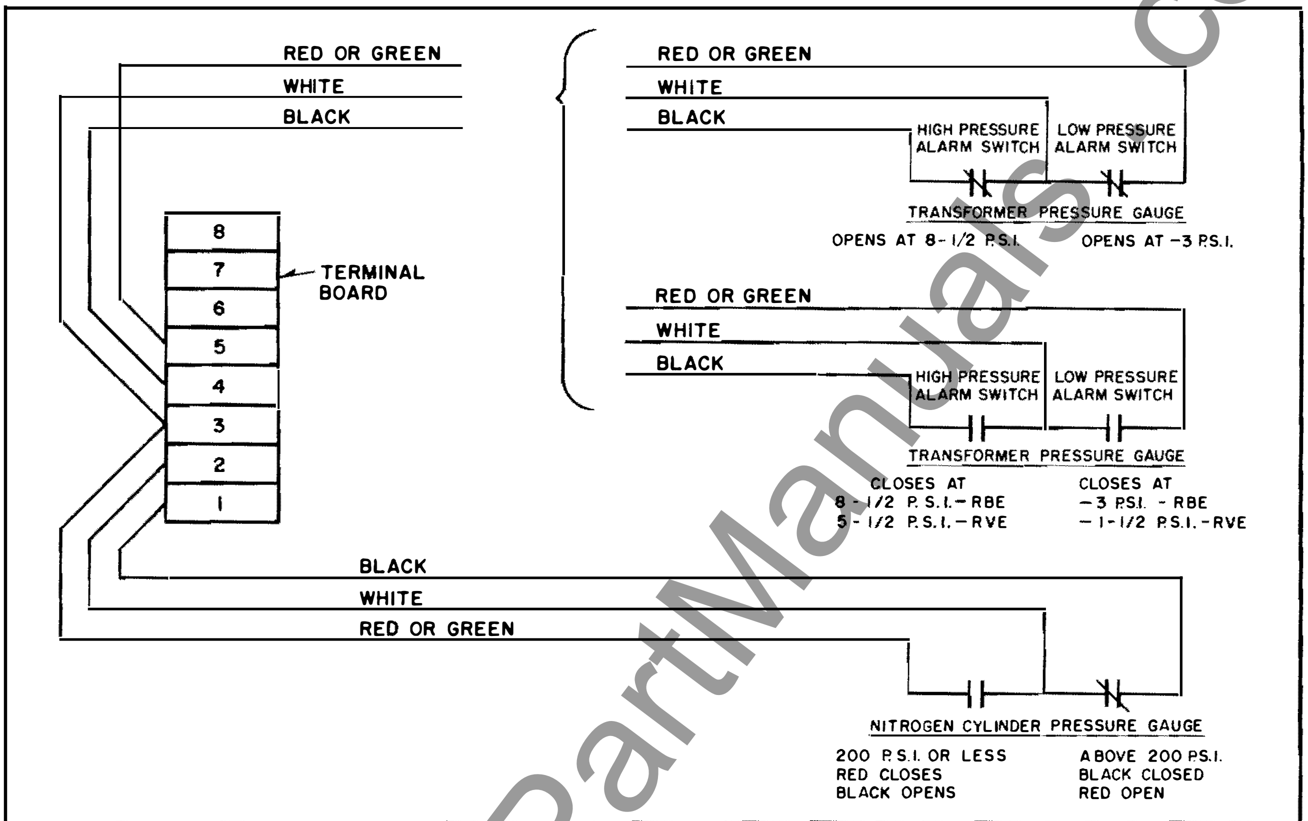

Fig. 5 *Connection Diagram of Pressure Gauge Alarm Switches, Showing Alternate Arrangement*

2. Mid-position (approximately 1-1/2 turns from either limit). In this position of the valve, the gas space, the relief valve, and the test valve are connected together. This position is used when it is desired to purge the oxygen from the gas space initially with dry nitrogen.

3. Operating (counter-clockwise to limit). In this position, the gas space is connected to the relief valve through the oil sump, and the connection to the test valve closed.

Sampling Valve. The sampling valve is a needle valve, connected to the gas space, above the oil, through a pipe attached to the tank wall. It is used for obtaining samples of the gas from the gas space for oxygen content analysis. When sampling for oxygen content, sufficient gas should be allowed to flow to clear the line before taking the sample. This valve may be used also as an exhaust valve when purging the oxygen from the gas space.

RVE Inertaire. In those cases where it is desired to limit the pressure to 5 pounds per square inch, and specifically ordered a diaphragm type of relief valve will be mounted on the oil sump. The relief valve is set at the factory and the pressure screw sealed by solder. The relief pressure is stamped on the pressure screw. Also, the two alarm micro-switches on the compound pressure gauge are adjusted so that one operates at abnormal high pressures (over 5-1/2 psi,) and the other operates at vacuum (minus 1-1/2 psi) should it occur. (See Fig. 5.) Equipment ordered for this special condition is classed as RVE Inertaire. The higher rate of use of nitrogen requires that an extra tank of nitrogen be provided with each unit.

INSTALLATION

Mounting. Inertaire equipment usually is shipped with the assembled cabinet mounted on the transformer tank. The operating nitrogen cylinder, two short flexible low pressure hose assemblies, one flexible high pressure hose assembly and flexible alarm leads are shipped in detail.

If the cabinet is not mounted on the transformer tank, the mounting should be made as follows: Remove the three vibration dampeners from cabinet and mount on the three pads on the transformer tank wall. Set the holes in the cabinet brackets over the studs and tighten down the nuts.

The flexible low pressure hose should be connected between the fittings on the top of the cabinet and the tank Inertaire piping, by means of the union type connections. Care should be taken to make a gas-tight connection. A small amount of thread cement placed on the joining compression surfaces will assist.

Place nitrogen cylinder onto the cylinder support and fasten chain around the cylinder.

In connecting the cylinder to the cabinet assembly, remove cylinder protecting cap and place inside of cabinet. By placing it in the cabinet it will be available when cylinder is sent away for refilling.

Before connecting up the high pressure flexible tubing be sure cylinder valve and tubing is free of any dirt. Open the cylinder valve slightly so that any dirt lodged in its passages may be blown out.

NOTE: Do not have valve opening pointed toward anyone as a small object blown from the valve with such high pressure might cause serious injury.

Next screw the union of the flexible cable onto the valve with the fingers and then open the cylinder valve **very little** letting the gas leak by the threads to blow off any fine dirt that might be on the union seat, in the threads or inside the tubing. Remove the plug from the side of the cabinet and screw tubing into the mounting adapter. Tighten the union nuts with a wrench until the leakage stops and open cylinder valve full.

NOTE: When opening the cylinder valve:

1. Always open the valve very slowly. The sudden shock of high pressure admitted to the reducing valve is likely to injure the high pressure gauge or the reducing valve seat.

2. Always back-seat the valve with as much force as would be used in closing the valve.

Tank Leak Test. If the tank is to be tested for leaks by filling completely with oil and applying an additional oil head, close the shut-off valve (clock-wise) and the sampling valve. When leak test is completed, the oil should be lowered in the following manner: Open the test valve on the reducing valve; open the nitrogen cylinder valve; start to draw down the oil; open the transformer shut-off valve to mid-position (1-1/2 turns). This procedure will blow most of the oil in the connection between the transformer tank and cabinet back into the tank and fill the gas space with pure nitrogen, thus accomplishing the initial deoxygenation of the gas space.

Open the oil sump drain valve on the oil sump assembly and draw off any oil which may have entered the sump; close the sump drain; open sampling valve to drain off the oil in this line. Nitrogen will come out of this valve when line is free of oil. Close the sampling valve. Close the test valve, check relief pressure of relief valve.

Deoxygenation. Inertaire transformers may be installed with air in the gas space for simplicity of installation. However, for the efficient usage of Inertaire equipment, the transformer should be purged with nitrogen. If it is the customer's practice to purge transformers to obtain initial increased protection to the transformer, he should refer to I.L. 48-063-9, "Preparing Transformers for Operation with Nitrogen Gas" for the proper procedure.

Testing for Leaks. If an oil pressure test cannot be conveniently made to check the tightness of the tank and fittings, the following method is suggested:

After the deoxygenation process is completed, close the sampling valve and carefully allow the pressure in the gas space to reach 8 pounds per square inch. (5 psi for RVE Inertaire). Close the nitrogen cylinder valve.

Allow the transformer to stand several hours with this pressure. If the pressure falls off, a leak is present and it can best be found by applying soapy water to all joints and connections. In checking for leaks, the newly-made Inertaire connection should not be overlooked.

CAUTION: Extreme care should be observed, when purging the gas space with nitrogen from a high pressure container, not to seal the transformer off tight until the gas in the gas space has reached ambient temperature. The expansion of nitrogen from a very high pressure (1500 to 2000 pounds per square inch) to atmospheric pressure results in the nitrogen entering the gas space at a very low temperature. Unless the gas is free to expand as it warms up to ambient temperature, the pressure within the tank may increase to such a value as to operate the relief device. If no relief device is provided, the pressure may distort the tank.

If the relief valve assembly is connected to the gas space, it will relieve any pressure in excess of 8 pounds per square inch (5 psi for RVE Inertaire) if the pressure is built up gradually.

Checking the Relief Pressure of Relief Valve. Having completed the test for leaks, the relief pressure of the relief valve should be checked. This is done by first isolating the gas space from the Inertaire equipment (turn shut-off valve clockwise to the limit). With the test valve set for a very small gas flow build the pressure up slowly in the relief valve. Gas will escape from the relief valve when the proper pressure is reached.

IMPORTANT: This pressure must not exceed 8 ± 1/4 psi (5 ± 1/4 psi for RVE Inertaire equipment). The relief valve for RVE Inertaire is sealed and no attempt should be made to adjust the pressure setting. The nearest Westinghouse office should be notified if the valve does not operate correctly. If the relief valve for the RBE Inertaire does not operate at the proper pressure an exception may be made to the "no adjustment" rule mentioned under "Description" of the "Reducing Valve and High Pressure Gauge". This exception allows for field adjustment of the relief valve by following these steps (beginning at the completion of test for the relief pressure):

1. Close test valve and return second stage adjusting handle back to its original position.

2. Reduce pressure in sump to less than 6 psi by opening and then closing oil drain valve at bottom of oil sump.

3. Remove die cast cap over third stage valve adjusting screw.

4. Remove the outer threaded adjustment nut which is the 1/2 psi reducing valve adjustment. Count number of turns to remove this adjustment nut so it may be replaced exactly same as before.

5. Remove flat, solid, round washer and compression spring. This exposes the relief valve adjusting screw.

6. By means of an 11/32" socket wrench, unscrew the adjusting screw to lower the relief pressure. One quarter turn gives approximately 1 psi difference in pressure. Do not exert side pressure on the adjusting screw as it may cause the metal valve part to slide on the rubber valve seat preventing proper seating subsequently.

7. Reassemble compression spring, flat washer and adjustment nut and cap exactly the same as originally found.

8. Retest for relief pressure as given above.

9. If different than 8 psi repeat adjustments and tests as given above until proper relief pressure is obtained.

10. After the correct relief pressure is obtained the relief valve should be checked for leaks.

a. Return second stage adjusting handle to original position. (Approximately 6 psi).

b. Reduce pressure in sump to less than 6 psi and close sump drain valve.

c. Open test valve until pressure in sump is steady (Approx. 6 psi). Close test valve and record pressure in sump. A drop of 1/2 psi in 1/4 hour will indicate a leak. Apply soapy water at relief vent and at sump drain valve and watch for leaks.

11. If no leaks are present, return three-way shut-off valve to operating position (counter-clockwise to limit).

The equipment is now ready for normal operation and the purging cylinder should be replaced by the operating cylinder. To do this, seal off the gas space (turn shut-off valve clockwise to the limit) close nitrogen cylinder valve and disconnect cylinder from reducing valve. Remove purging cylinder from its support.

Remove valve protecting cap from the operating cylinder. Wipe off any dirt on the cylinder valve and then slightly crack open the valve to blow out any dirt which may be lodged in the valve. It is imperative that absolutely no dirt gets into reducing valve. Do not have valve opening pointed toward anyone as a small object blown from the valve with such high pressure might easily cause serious injury.

IMPORTANT: When checking circuits through the instruments it is necessary to follow Table No. 1. This means that a low voltage bell ringer cannot be used unless switched through a high impedance relay. An indicating light type device is generally recognized as best for checking circuits through instruments containing micro-switches or switches of similar capacities.

Table No. 1

VOLTAGE	NON-INDUCTIVE LOAD-AMPS.	INDUCTIVE LOAD AMPS. L/R = .026*
125 A-C	10	10
250 A-C	5	5
125 A-C	0.5	0.05
250 D-C	0.25	0.025

*Equal to or less than .026. If greater refer to factory for adjusted rating.

MAINTENANCE

Westinghouse Inertaire transformers are designed to require very little maintenance and attention on the part of the customer. Since the tank is nearly always under a positive pressure of at least 1/2 pound per square inch, there is small likelihood of the oxygen or moisture content becoming high.

The amount of nitrogen used by the transformer and the frequency of cylinder replacement will depend on the tightness of the tank as well as the load cycle. In order to be sure that the equipment is operating correctly and that there are no leaks in the system, it is recommended that the following readings be taken during the first month of operation:

1. Weekly oxygen content-analysis to determine when the additional purging is necessary. This should be done before the oxygen content reaches 7 percent, which is the permissible upper limit which will prevent explosions in the gas space.

If the flue gas analyzer is not obtainable, the use of Fyrite Oxygen Indicator, S#1408 196 is recommended. This may be purchased from the Westinghouse Electric Corporation, Sharon Plant. Complete instructions for determining the oxygen content is supplied with each analyzer.

Additional purging may be accomplished in the same manner as previously described.

2. For the first week, take daily readings of nitrogen cylinder pressure, transformer tank pressure as indicated by the tank pressure gauge, transformer oil temperature and ambient temperature. Weekly readings of the above will suffice for the remainder of the month.

After the first month of observation has shown that the equipment is functioning properly, no further readings are necessary except that check-analysis of the oxygen content should be made in about three months. During normal operation, the oxygen content should remain below 1 percent.

Nitrogen Cylinders. Since the nitrogen used in Inertaire equipment will last a relatively long time, it is not feasible to rent cylinders from a nitrogen supplier. The cylinders which are used with the equipment are shipped to the customer with the transformer and becomes the property of the customer. These cylinders are painted gray so that they may be easily identified.

Westinghouse cylinders for regular use with Inertaire equipment may be identified as follows:

a. Each Westinghouse cylinder is painted gray and is marked with black letters about 1-1/2 inches high, "Westinghouse Inertaire Nitrogen".

b. Each cylinder is provided with a tag, Form # 17212.

c. Each cylinder is originally shipped from the Sharon Plant with the transformer.

When the pressure in the operating cylinder drops to between 150 and 200 pounds per square inch, it should be replaced with a full cylinder of nitrogen. The nitrogen used on Inertaire transformers must be dry. Commercial nitrogen is not always free from moisture; therefore, only oil pumped nitrogen or nitrogen supplied under a guarantee that the moisture content is less than 0.03% by weight, and impurity content is less than 0.3% by volume, should be used. Nitrogen can be ordered from suppliers as Westinghouse nitrogen, PDS 6306. **Do not use any other grade of nitrogen or any other gas.**

The reducing valve is left supported on the adapter while the cylinder is being refilled.

During the time the nitrogen cylinder reducing valve is not connected, the union on the high pressure hose should be closed by a plug supplied for this purpose. The plug is located within the cabinet. If the plug is not used, lowered pressure in the tank may cause the reducing valve to open, permitting more or less free breathing through the reducing valve. Dirt may also become lodged on the threads of the union. These cylinders can be properly refilled only by the listed suppliers.

Since it is usual for nitrogen suppliers to exchange cylinders, it is suggested that the customer's requisition for normal operating gas read as follows: "Refill cylinder, Serial No. 000000 with Westinghouse Inertaire Nitrogen, PDS #6306 and return same cylinder to purchaser." The serial number will be found stenciled on the side of the gray and black operating cylinder.

Drain the oil sump once a year to prevent any appreciable oil coming in contact with the regulator.

Check the relief pressure of the relief valve to determine if any change has occurred since last inspection. Refer to paragraphs under Installation for instruction.

Send orders and cylinders to address given on following pages, unless otherwise specified.

LIST OF RECOMMENDED NITROGEN SUPPLIERS

ALABAMA
Air Reduction Co.
2825 No. 29th Ave.
N. Birmingham 7, Ala.
Send cylinders to Fairfield, Ala.

ARKANSAS
National Cylinder Gas Co.
700 Wheeler Ave.
Ft Smith, Ark.

CALIFORNIA
Air Reduction Pacific Co.
Park Ave. & Halleck St.
Emeryville 8, California

Air Reduction Pacific Co.
2423 E. 58th St.
Los Angeles, California

National Cylinder Gas Co.
11705 S. Alameda St.
Los Angeles 2, California

National Cylinder Gas Co.
P.O. Box 427
Wilmington, California

CONNECTICUT
National Cylinder Co.
Main Street
South Meriden, Conn.

FLORIDA
National Cylinder Gas Co.
P.O. Box 2849
Jacksonville 3, Florida

GEORGIA
National Cylinder Gas Co.
471 Peters Street, S.W.
Atlanta, Georgia

ILLINOIS
Air Reduction Company
3100 So. Homan Avenue
Chicago 23, Ill.

National Cylinder Gas Co.
1501 W. 44th Street
Chicago, Illinois

National Cylinder Gas Co.
10305 Torrence Ave.
South Chicago, Illinois

National Cylinder Gas Co.
P.O. Box 350
LaGrange, Illinois

National Cylinder Gas Co.
P.O. Box 627
Peoria 1, Illinois

INDIANA
National Cylinder Gas Co.
P.O. Box 784
Evansville 1, Indiana

National Cylinder Gas Co.
3209 Madison Ave.
Indianapolis, Indiana

National Cylinder Gas Co.
601 Erie Avenue
Logansport, Indiana

IOWA
Air Reduction Co.
2561 State St.
Bettendorf, Ia.

KANSAS
National Cylinder Gas Co.
1614-26 State Ave.
Kansas City 2, Kansas

KENTUCKY
Air Reduction Co.
550 So. 5th St.
Louisville 1, Ky.

Send cylinders to 1256 Logan St.
Louisville, Ky.

LOUISIANA
Air Reduction Co.
1406 So. Rendon St.
New Orleans 2, La.

National Cylinder Gas Co.
569 Felicity St.
New Orleans 9, La.

National Cylinder Gas Co.
P.O. Box 284
Shreveport, Louisiana

MARYLAND
Air Reduction Co.
1310 N. Calvert St.
Baltimore 2, Md.

Send cylinders to 4501 E. Fayette St.
Baltimore, Md.

National Cylinder Gas Co.
1700 S. Newkirk Street
Baltimore 24, Maryland

MASSACHUSETTS
Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston, Mass.

National Cylinder Gas Co
205 Medford Street
Malden 48, Mass.

MICHIGAN
Air Reduction Co.
2994 E. Grand Blvd.
Detroit 2, Mich.

Send cylinders to
7991 Hartwick St.
Detroit, Mich.

National Cylinder Gas Co.
P.O. Box 30
Ferndale 20, Michigan

National Cylinder Gas Co.
P.O. Box 35, Roosevelt Sq.
Grand Rapids 9, Mich.

MINNESOTA
Air Reduction Co.
1111 Nicollet Ave.
Minneapolis 2, Minn.

Send cylinders to
327 25th St. S.E.
Minneapolis, Minn.

National Cylinder Gas Co.
965 North Lexington Parkway
St. Paul 3, Minnesota

MISSOURI
Air Reduction Co.
2701 Warwick Traficway
Kansas City 8, Mo.

Send cylinders to
100 W. 26th St.
Kansas City, Mo.

Air Reduction Co.
630 So. 2nd Street
St Louis, Mo.

National Cylinder Gas Co.
1520 S. Vandeventer Ave.
St Louis 10, Missouri

NORTH CAROLINA
National Cylinder Gas Co.
2414 S. Boulevard
Charlotte 3, N.C.

NEW JERSEY
Air Reduction Co.
181 Pacific Avenue
Jersey City 4, N.J.

National Cylinder Gas Co.
2136—85th Street
North Bergen, N.J.

NEW YORK
Air Reduction Co.
730 Grant Street
Buffalo 13, N.Y.

National Cylinder Gas Co.
South & Front Streets
Hornell, N.Y.

National Cylinder Gas Co.
Buffalo Ave. & 53rd St.
Niagara Falls, N.Y.

OHIO
National Cylinder Gas Co.
4620 Este Avenue
Cincinnati 32, Ohio

Air Reduction Co.
1210 W. 69th St.
Cleveland, Ohio

National Cylinder Gas Co.
765 Woodrow Ave.
Columbus 7, Ohio

Air Reduction Co.
P.O. Box 923
Dayton 1, Ohio
Send cylinders to Sellers Rd. at
Springboro Pike
(Moraine City)
Dayton, Ohio

National Cylinder Gas Co.
1151 East 222nd St.
Euclid 17, Ohio

National Cylinder Gas Co.
P.O. Box 86
Lowellville, Ohio

OKLAHOMA

National Cylinder Gas Co.
P.O. Box 1534
Oklahoma City 1, Oklahoma

National Cylinder Gas Co.
P.O. Box 168
Tulsa 3, Oklahoma

OREGON

Air Reduction Pacific Co.
430 N.W. 10th Ave.
Portland 9, Oregon

Send cylinders to
2949 N.W. Front Ave.
Portland, Oregon

National Cylinder Gas Co.
2720 North West Yeon Ave.
Portland 10, Oregon

PENNSYLVANIA

National Cylinder Gas Co.
P.O. Box 7
Conshohocken, Pa.

National Cylinder Gas Co.
Davis Island Yards
McKees Rocks, Pa.

Air Reduction Co.
Allegheny Ave. & 17th St.
Philadelphia 40, Pa.

Send cylinders to
Germantown & Allegheny Aves.
Philadelphia, Pa.
or
Bethlehem, Pa.

Air Reduction Co.
2010 Clark Building
Pittsburgh 22, Pa.

Send cylinders to
Midland, Pa.
or
1116 Ridge Ave.
Pittsburgh, Pa.

RHODE ISLAND

Air Reduction Co.
122 Mt. Vernon St.
Upham's Corner
Boston 25, Mass.

Send cylinders to
Central Falls, R. I.

TENNESSEE

National Cylinder Gas Co.
1329 Chesnut Street
Chattanooga 2, Tenn.

National Cylinder Gas Co.
P.O. Box 3545
Memphis, Tenn.

TEXAS

National Cylinder Gas Co.
P.O. Box 5416
Dallas, Texas

National Cylinder Gas Co.
319 N.E. 23rd Street
Ft. Worth 6, Texas

Magnolia Airco Gas Products Co.
2405 Collingsworth Ave.
Houston 6, Texas

National Cylinder Gas Co.
P.O. Box 2106
Houston 1, Texas

National Cylinder Gas Co.
P.O. Box 1557
Lubbock, Texas

VIRGINIA

Air Reduction Co.
P.O. Box 1192
Richmond 9, Va.

Send cylinders to Bickerstaff Rd.
East of Osborne Tpke.
Richmond, Va.

WASHINGTON

Air Reduction Pacific Co.
3623 East Marginal Way
Seattle, Washington

National Cylinder Gas Co.
5510 East Marginal Way
Seattle 4, Washington

WEST VIRGINIA

Air Reduction Co.
94—29th St.
Wheeling, W. Va.

WISCONSIN

National Cylinder Gas Co.
6313—31st Avenue
Kenosha, Wisconsin

Air Reduction Co.
818 W. Winnebago St.
Milwaukee 5, Wisc.

Send cylinders to
3435 No. Buffum St.
Milwaukee, Wisc.

National Cylinder Gas Co.
2615 West Greves Street
Milwaukee 3, Wisconsin

Westinghouse Electric Corporation
Sharon Plant, Transformer Divisions, Sharon, Pa.

Printed in U.S.A. (T.P.)

Instructions for Forced-Air Cooling Equipment Unit Fan Assembly

I.L. 48-063-13B

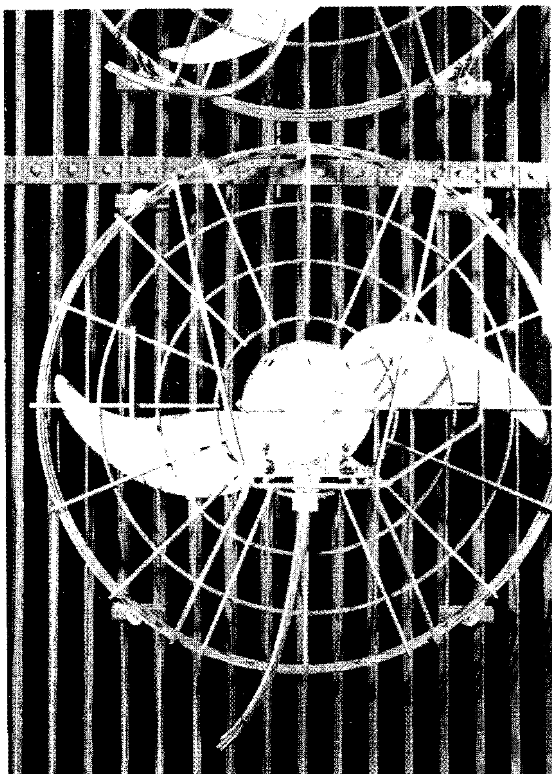

Fig. 1 *Fin Type Radiator Forced-Air Equipment*

Westinghouse manufactures two types of cooling equipment for use on OA/FA and OA/FOA (oil-insulated air-cooled, forced air-cooled, forced oil-forced air-cooled) transformers: The banked fin type radiators and the flattened tube type assembly. The control equipment and fan assemblies are the same for both types. An occasional inspection and lubricating of the fan motors is required after installation as described later.

Standard unit fan assemblies are furnished with single phase or three phase motors. The single phase motors are capacitor-start, capacitor-run, with the capacitor mounted in a housing attached to the motor. Both the single and three phase motors are equipped with self resetting "Thermoguard" overload protection.

Transformers shipped to a destination having a 3 phase auxiliary power supply may have single phase fans evenly distributed on the 3 phase supply.

Rotation of the fan blade is counterclockwise when looking at the motor from the lead end. Vent holes are provided on the underside of the motor to drain any condensation that may form in the motor. These vents are covered during shipment with a small adhesive decal which should be removed before operating the motors.

BANKED FIN TYPE RADIATOR FORCED-AIR EQUIPMENT

The radiator bank assembly consists of a number of fin type radiators mounted side by side in a group. A number of fans are mounted on the side of the first radiator in the group so air can be forced horizontally between the fins of each radiator in the bank. The Westinghouse fin type radiator with its preformed cooling elements arranged in parallel rows provides a group of continuous ducts. The flow of air from the fans is directed through this duct system, thereby greatly increasing the normal convection characteristics. One fan of such an arrangement is shown in Figure 1.

The fans are connected together electrically by one of two different methods:

(1) The individual fan cords may be plugged into special neoprene molded blocks which are located between fans and interconnected with neoprene cable. This molded wire harness type of assembly provides a good, weathertight assembly and will permit connecting or disconnecting individual fans without disconnecting power to the other fans. When plugging these molded items together it is recommended that the mating pieces be coated with a light film of silicone grease to overcome the friction between the rubber components. The male part must be fully inserted so that the O-ring portion in the female connector will lock into the groove on the male connector and form a good, weathertight joint.

(2) The individual fan cords may be plugged into special receptacles located in a vertical run of conduit. It is possible to connect or disconnect individual fans without disconnecting power to the rest of the fans.

Effective September, 1975 Supersedes I.L. 48-063-13A, December, 1962

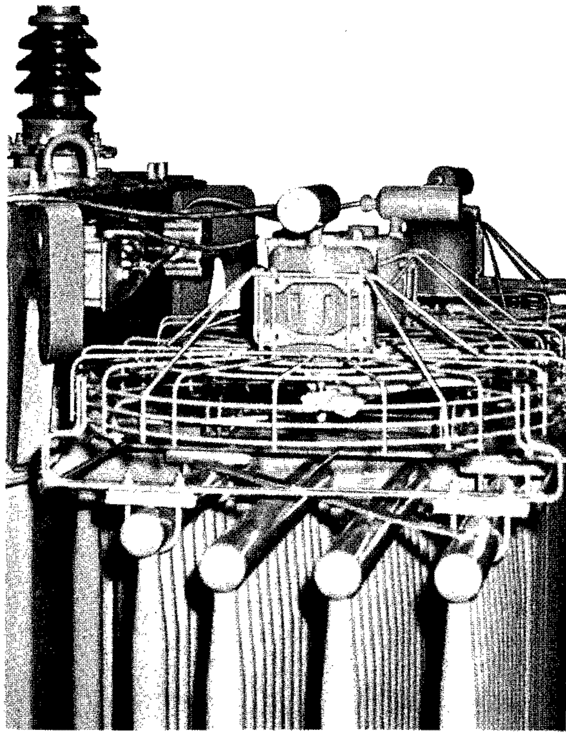

Fig. 2 *Typical Fan Assembly used on Tube Coolers*

FLATTENED TUBE TYPE FORCED AIR EQUIPMENT

The flat tube cooler assembly consists of a number of vertical, flattened steel tubes arranged in parallel, welded to headers at top and bottom. These headers may be welded to the transformer tank wall in groups to form a bank of tube coolers, or groups of 3 or 4 may be welded to small headers which in turn may be flanged and bolted to a valve for removal during shipment.

Fan assemblies will normally be mounted above tube coolers, to blow air downward on the warmest surfaces; but they can be mounted on the side or underneath, if necessary, to meet special requirements. Note that in any case the motor vent holes must be in the lower side of the motor as it is mounted.

When flat tube coolers are grouped and bolted to flanged valves (tubular radiators), the fans will normally be mounted on the side, as on the fin type radiators, to blow air horizontally through the bank.

INSTALLATION

The fin type radiators and the large tubular radiator assemblies are removed for shipment due to railroad clearance limitations. Before installing the cooling equipment, a careful study of the outline drawing and transformer should be made. The fans will be shipped properly located and attached to one or more radiators, depending upon the number of banks.

All shipments of assembled fans and motors are made with the fan shaft restrained to prevent movement during shipment. Be sure all shipping straps and tie downs are removed and that the fan turns freely before it is put in operation. Remove decals from the vent holes on the bottom side of the motor to permit condensation to drain out.

MAINTENANCE

Lubrication:

The motors have either ball or sleeve bearings which are designed to operate for long periods of time without lubrication. As a general rule motors which operate more than 50% of the time, or are subjected to climatic conditions as they exist in the southern half of the United States should be lubricated more frequently. Excessive lubrication, however, can be an invitation to trouble.

Motors with Flip Lid Oilers:

These motors have sleeve bearings with a large oil reservoir containing a self-wicking material having superior oil-storage properties. The bearings have circumferential oil grooves which assure a forced oil lubrication across the entire bearing length.

The following rules will provide a guide for bearing re-lubrication. (1) Motors mounted with the shaft horizontal should be lubricated every one to three years, (2) Motors mounted with the shaft vertical should be lubricated annually.

When lubricating add 30 to 40 drops (22 drops ≈1cc) of Electric Motor Oil or SAE No. 10 automotive oil to each bearing.

Motors with Pressure Grease Fittings:

These motors are designed with a grease fitting and a relief fitting at both bearings to prevent over greasing. The motors have ball bearings with a seal on the winding side of the bearing and a shield on the opposite side. These motors should be regreased every one to two years depending on duty cycle and operating conditions.

For greasing this type of motor use a high grade of grease, such as Esso Beacon 325 (MILG3278). This grease can be obtained from the Lima Motor Division through the nearest Westinghouse office.

Motors with Sealed Ball Bearings:

These motors have neither type of lubrication fitting described above. The bearings have been permanently lubricated and sealed at the factory and require *no* lubrication.

Painting

Good practice dictates that apparatus should be kept protected with paint. The entire air blast assembly, *except the propeller*, should be painted at regular intervals.

Inspection

A regular, thorough inspection should be made of the equipment to insure the best service.

RENEWAL PARTS

When ordering renewal parts, send a complete description of the particular part and the transformer serial number to the nearest Westinghouse office.

Westinghouse

THE LEADER OF THE TRANSFORMER INDUSTRY

Westinghouse • Sharon Transformer Division • Sharon, Pennsylvania

Printed in U.S.A.

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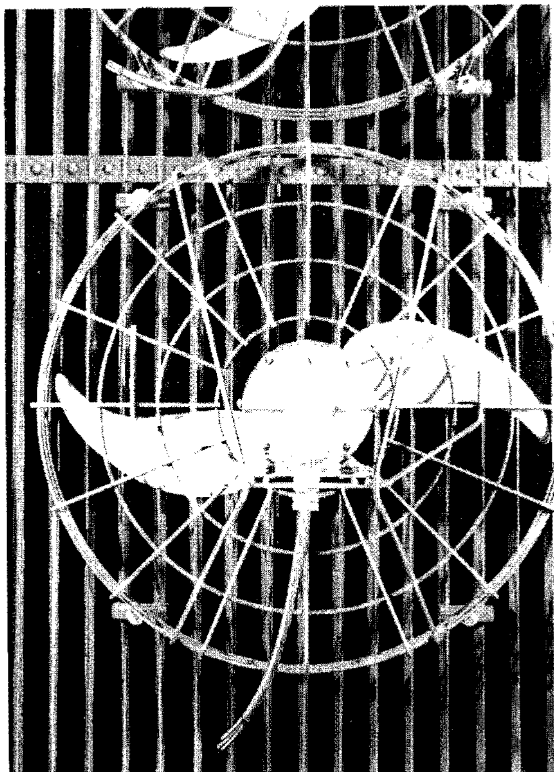

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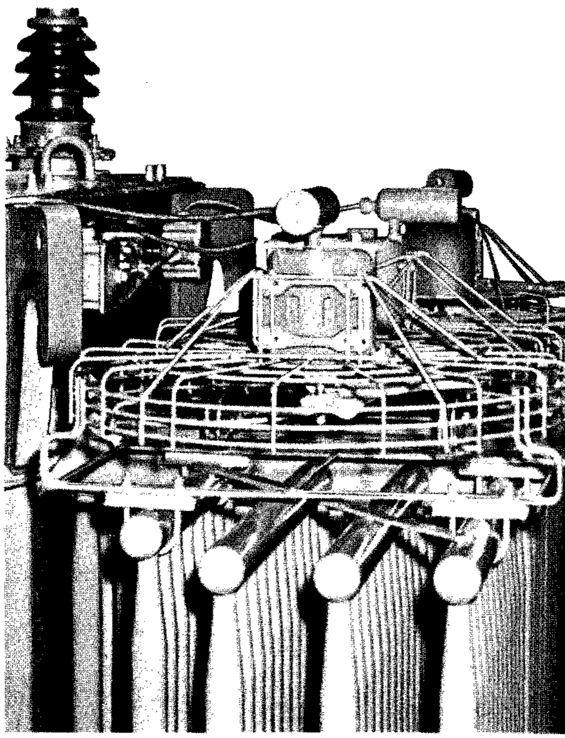

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