

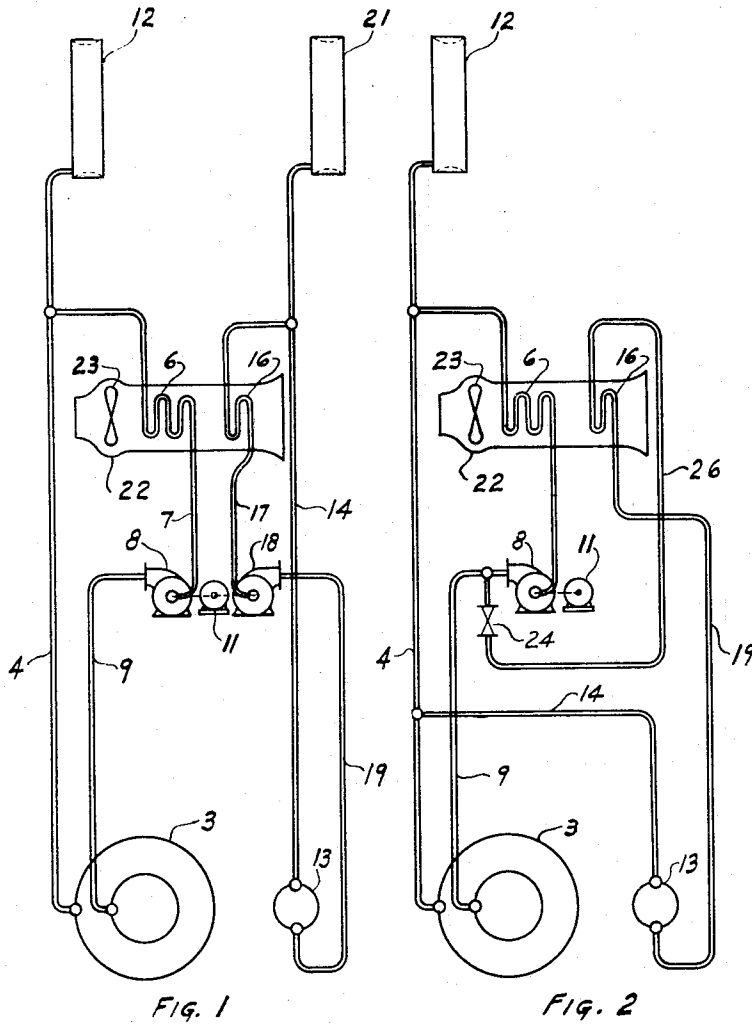
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ELECTRIC POWER RECTIFIER COOLING SYSTEM

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ELECTRIC POWER RECTIFIER COOLING
SYSTEM

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4 Claims. (Cl. 250—27.5)

This invention relates to improvements in electric current rectifying installations of the type utilizing a metallic vapor as the rectifying medium and, more particularly, to the cooling systems employed for power rectifiers of the above character.

Electric power rectifiers are constructed with a double walled, metallic container or tank of relatively large dimensions for the reason that resistance to the flow of the electric arc through the metallic vapor contained therein to produce the rectifying action generates sufficient heat to raise the temperature of the entire structure to a relatively high degree so that a large portion of the metallic cathode is vaporized and tends to cause disturbances in the operation of the rectifier. It is, accordingly, necessary to cause a circulation of a cooling medium through the double walls of the rectifier tank to maintain the temperature, during operation of the installation, at a point sufficiently low to prevent the production of the above mentioned large quantity of metallic vapor. It has been found that temperatures below 60° C. result in the most perfect operation of the device.

It is well known that rectifiers of the metallic vapor type must be exhausted to a high degree of vacuum in order that the metallic vapor within the structure may be as nearly pure as possible which evacuation is also for the purpose of preventing disturbances in the operation of the installation. Vacuum pumps are connected with the rectifying structure for the purpose of producing and maintaining the requisite degree of evacuation. At least one of the pumps generally utilized for the purpose of maintaining the vacuum in the rectifier structure is usually of the molecular type in which a vaporizable medium, upon vaporization, entrains the gases and upon condensation of the vaporized medium releases the gases. It is, accordingly, necessary to provide a system for circulating a cooling medium about the working chamber of such high vacuum pump to permit condensation of the vaporized medium to obtain the most rapid and efficient operation of the pump.

It is frequently necessary or desirable to operate an electric power rectifier in locations in which the amount of cooling medium, which is usually water, is limited, because of the cost of obtaining the same or because the quality of the water obtainable is not such as to permit continuous circulation without causing clogging of the cooling system. In such cases it is necessary that the heat abstracted from the rectifier and

the pump be radiated to the atmosphere by means of a heat exchanging device in order that the same quality of water may be continuously circulated at such temperature as is necessary to maintain the rectifier and the pump at the most efficient operating temperature. The best operating temperatures of the rectifier being below 60° C. and that of the high vacuum pump being below 40° C., it is most desirable that the cooling systems of the two devices be separated so that the circulation and the temperatures of the cooling water of the one do not affect the circulation and the temperature of the other.

It is, therefore, among the objects of the present invention to provide a cooling system for electric power rectifying installations in which the cooling system for the rectifier itself is separate from the cooling system for the high vacuum pump connected with the rectifier.

Another object of the invention is to provide a cooling system or systems for electric power rectifying installations in which the quantity of water in the system remains substantially undiminished so that the same water may be continuously circulated through the installation for cooling purposes.

Another object of the invention is to provide a cooling medium circulating system for an electric power rectifying installation in which the circulating means is common to both the rectifier and the high vacuum pump connected therewith and in which different temperatures are obtainable in the water delivered to the rectifier and to the pump.

Objects and advantages, other than those above set forth, will be apparent from the following description and the drawing, in which,

Figure 1 diagrammatically shows the cooling medium circulating system of an electric power rectifying installation of the metallic vapor type in which the circulating systems for the rectifier and for the pump are entirely separated systems, and

Fig. 2 diagrammatically shows a cooling system similar to that above referred as shown in Fig. 1 with the exception that a common circulating means is utilized for both the rectifier cooling system and the pump cooling system.

Referring more particularly to the drawing by characters of reference, the reference numeral 3 indicates a rectifier structure which is formed with double walls which are connected by means of a pipe line 4 with a heat exchanging structure 6 which is connected by means of a pipe line 7 with a rotary pump 8 connected in turn by a pipe

line 9 with the rectifier 3. The rotary pump 8 is operated by any suitable means such as the electric motor 11. An expansion tank 12, the purpose of which will appear hereinafter, is connected with the highest point of pipe line 4 and is arranged at a higher elevation than the remainder of the cooling medium circulating system described immediately above.

An evacuating pump 13, of the molecular type capable of producing a high vacuum, is connected by a pipe line 14 with a heat exchanger 16 which is in turn connected by a pipe line 17 with a rotary circulating pump 18 discharging into a pipe line 19 connected with the vacuum pump 13. The rotary pump 18 is preferably driven by the same driving means 11 as is utilized for driving the circulating pump 8 in the rectifier cooling medium circulating system above described. An expansion tank 21 is connected with the highest point of pipe line 14 and is arranged at an elevation higher than the remainder of the cooling medium circulating system for the vacuum pump 13.

The heat exchangers 6 and 16 are enclosed within a casing 22 through which air is drawn by means of a fan 23 driven by any suitable means. It will be seen that the heat exchanger 16 is arranged within the end of casing 22 through which the air enters so that the rate and degree of cooling of heat exchanger 16 is relatively greater than that of heat exchanger 6.

The water heated by circulation through the double walls of the rectifier 3 flows through pipe line 4 to heat exchanger 6 in which heat is transferred from the water, by conduction and radiation thereof to the air drawn through the heat exchanger by the fan 23, so that the temperature of the water leaving the heat exchanger 6 is materially lower than the temperature of the water discharged thereinto from the rectifier. The cooled water in the heat exchanger 6 is withdrawn therefrom by the circulating pump 8 which forces the water to flow to the uppermost point of the rectifier 3 from which the circulation as above described again takes place. If the temperature of the water in the circulating system for the rectifier increases to such extent that the water expands beyond capacity of the elements of the system already described, the circulating water may expand into expansion tank 12 which is vented to the atmosphere as is usual in tanks of this character.

The water heated in flowing through the high vacuum pump 13 is discharged, by means of pipe line 14, to heat exchanger 16 from which it is withdrawn, after having been cooled by passage of the air through heat exchanger, by the circulating pump 18 which returns the cooled water to the evacuating pump 13. Excessive expansion of the heated water in the evacuating pump cooling system makes use of the tank 21 as was above described with reference to expansion tank 12.

It may, however, be necessary or desirable to provide only a single circulating pump for operation by the driving means 11 in which event it is no longer possible to construct entirely separated cooling systems for the rectifier and for the evacuating pump as was above described. In such case, the discharge pipe line 14 from the evacuating pump 13 is connected with the discharge line 4 of the rectifier 3 so that the heated cooling water from both the rectifier 3 and the pump 13 passes through heat exchanger 6 and circulating pump 8 from which the greater portion of the water is returned to the rectifier by means of pipe line 9.

A small portion of the water discharged by

the circulating pump 8 is, however, withdrawn from the pipe line 9 by means of a valve 24 and is conducted through a pipe line 26 and through the heat exchanger 16 from which it is returned through pipe line 19 to the evacuating pump 13. It is possible, by such double circulation of the evacuating pump cooling water through both the heat interchangers 6 and 16, to reduce the temperature of the water required for the evacuating pump below that required for cooling the rectifier itself and, therefore, to obtain the necessary difference of temperature in the cooling water systems. In the case in which only one circulating pump is used, it will be apparent that only a single expansion tank as at 12 need be supplied for the reason that all of the cooling water passes through a pipe line connected therewith.

It will be understood, of course, that if the rectifier installation is insulated from the ground that the cooling systems must also be insulated and that if the evacuating pump is not insulated from the ground that the systems must be properly insulated from each other.

Although but two embodiments of this invention have been illustrated and described, it will be understood that various other embodiments are possible, and that various changes may be made without departing from the spirit of the invention or the scope of the claims.

The invention claimed is:

1. In an electric power rectifying installation including a rectifier of the metallic vapor type and cooling means therefor, a pump for evacuating the said rectifier, cooling means for the said pump, each said cooling means including a circulatory cooling medium and a heat exchanger, a casing enclosing said heat exchangers and forming an air-guiding duct, means for causing the flow of air through the said casing in direction to contact first with the heat exchanger associated with the said pump and thereafter to contact with the heat exchanger associated with the said rectifier to thereby reduce the medium circulating through the heat exchanger associated with the said pump to a temperature below the temperature of the medium circulating through the heat exchanger associated with the said rectifier and a device for causing flow of the said cooling medium through the said heat exchangers and delivery thereof to the said rectifier and to the said pump.

2. In an electric power rectifying installation including a rectifier of the metallic vapor type, cooling means for said rectifier including a heat exchanger, a pump for evacuating the said rectifier, cooling means for the said pump including a heat exchanger, a circulatory cooling medium, a casing enclosing said exchangers and forming an air-guiding duct, a device for effecting flow of said cooling medium through the first said heat exchanger and delivery of a portion thereof to the said rectifier and for delivery of a portion thereof through the second said heat exchanger to the said pump, and means for causing flow of air through the said casing into contact with the said heat exchangers in a direction to contact first with the heat exchanger for the said pump whereby the cooling medium is delivered to the said pump at a temperature below the temperature of the cooling medium delivered to the said rectifier from the first said heat exchanger.

3. In combination with an electric current rectifier, an evacuating device therefor, and a cooling system comprising a cooling medium for circulation about the said rectifier and about the

said device, of means operable to cause the circulation of one portion of said medium about the said rectifier and the circulation of another portion of said medium about the said device, and means operable to cool said one portion of said medium and to simultaneously cool the said another portion thereof to a temperature below the temperature of said one portion of said medium.

4. In combination with an electric current rectifier, an evacuating device therefor, and a cooling system comprising a pair of heat exchangers and a cooling medium for circulation about said rectifier and for circulation about said device, of means operable to cause the flow of a

portion of said medium through one of said heat exchangers and about said device and another portion thereof through the other of said heat exchangers and about said rectifier, and means operable to cause the circulation of a cooling fluid into contact first with the said one heat exchanger and thereafter into contact with the said other heat exchanger to thereby reduce the portion of said medium for circulation about the said device to a temperature below the temperature of the said portion of said medium for circulation about the said rectifier.

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