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AUTOMATIC SWITCHING ARRANGEMENT FOR VACUUM PUMPS

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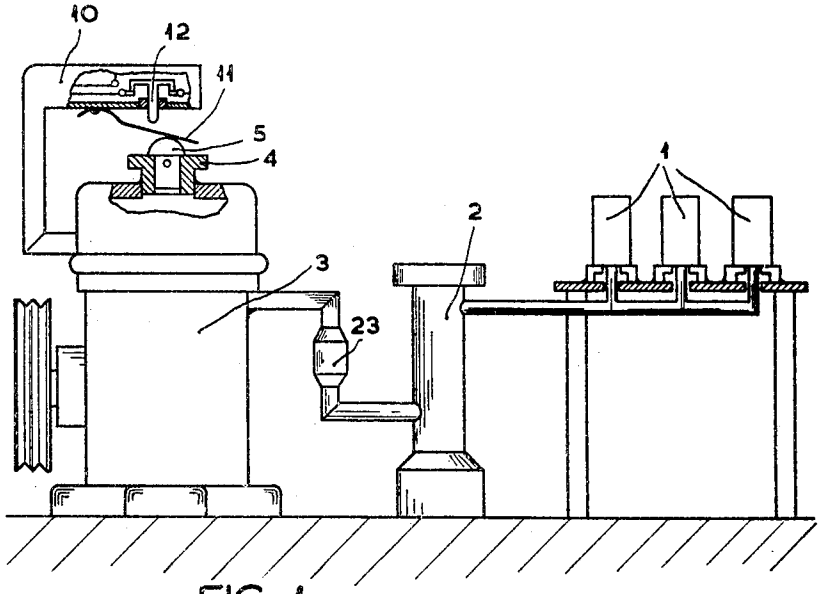


FIG. 1

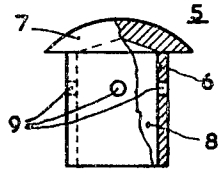


FIG. 2

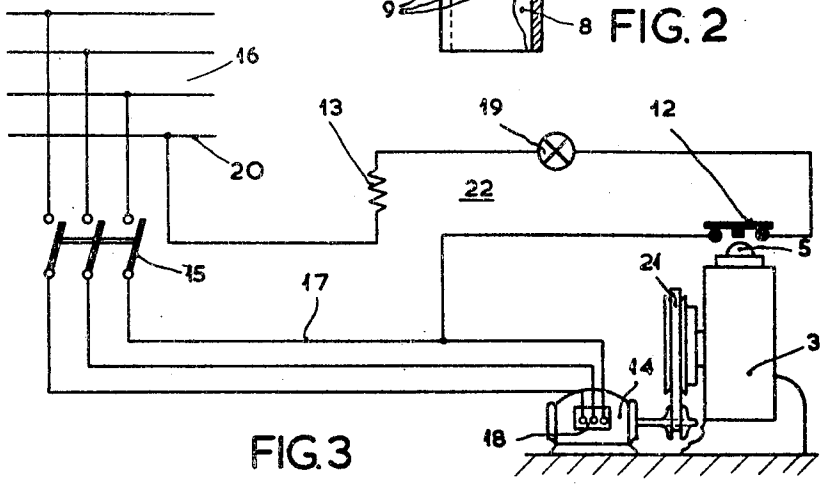


FIG. 3

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AUTOMATIC SWITCHING ARRANGEMENT FOR VACUUM PUMPS

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This invention relates to an arrangement in vacuum pumps for the automatic switching into and out of circuit of the heater of a high-vacuum pump which is connected in the suction pipe between the fore pump and the vessel to be evacuated, in the operation of the pump system.

In general the production of a high-vacuum, for example in electric discharge vessels, is effected with the aid of pump systems comprising a high-vacuum pump, for example an oil diffusion pump, which is preceded by a fore pump. In the evacuation process, a large part of the gas contained in the vessels to be evacuated is drawn off by the fore pump. The residual gas not drawn off by the fore pump is removed by the oil diffusion pump until the desired vacuum is obtained.

If the heater which serves to vaporize the operating medium of the high-vacuum pump is switched into the circuit throughout the entire pumping process, in an oil diffusion pump the oil vapour is entrained by the large amounts of gas passing through this pump and is partly caught in an oil trap but partly finds its way into the fore pump. The oil which has entered the fore pump cannot be returned to the oil diffusion pump since it has become useless for pumping purposes.

The oil losses in the oil diffusion pump can be reduced if the heating system thereof is switched into the circuit only after a comparatively large amount of gas has already been removed from the vessel to be evacuated.

A pump system is known in which a thermo-electric resistor is disposed in the gas stream discharged from the fore pump. The heater current for the heater of the oil diffusion pump is controlled by means of this resistor, the resistance value of which varies with the intensity of the gas flow. However, this method of control is laborious and not sufficiently reliable.

The present invention avoids this disadvantage in that in an arrangement in vacuum pumps for the automatic switching into and out of circuit of the heater of a high-vacuum pump, for example an oil diffusion pump, connected in the suction pipe between the fore pump and the vessel to be evacuated, in operation, in the pressure nozzle of the fore pump there is inserted a sealing member which can be lifted from the pressure nozzle by the gas flowing out and which acts upon the switching means so that the heating can be switched off for the period of time during which the member is lifted. The arrangement in accordance with the invention is simple and is very reliable in operation.

In order that the invention may readily be carried out, an embodiment thereof will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which

FIG. 1 shows a pump system provided with an arrangement in accordance with the invention,

FIG. 2 shows a sealing member for the pressure nozzle of the fore pump, and

FIG. 3 illustrates the operation of the arrangement with reference to a switching diagram.

In the pump system of FIG. 1, reference numeral 1 denotes vessels to be evacuated, 2 denotes an oil diffusion pump and 3 a fore pump. A mushroom-shaped stopper 5 shown in FIG. 2 is removably inserted into a pressure nozzle 4 of the fore pump 3. This stopper 5 is provided

in the direction of length of its stem 6 with a bore 8 which extends into its hood 7. The wall of the stem 6 is further provided, in the proximity of the hood, with a number of radial ducts 9 arranged on a circle. When the pumping system is switched off, the rim of the hood 7 of the stopper 5 rests on the pressure nipple 4. When the system is switched on, the fore pump 3 exhausts such an amount of gas from the vessel 1 through the oil diffusion pump 2 that the stopper 5 in the pressure nozzle 4 is raised and the gas escapes through the bore 8 and the ducts 9. When the stopper 5 is raised, it engages a leaf spring 11 secured to a support 10 and this spring operates a switch 12 which is provided on the same support and controls the heater 13 of the oil diffusion pump 2.

In the circuit arrangement of FIG. 3, a driving motor 14 for the fore pump is connected to a mains 16 through a power switch 15. The lead for the heater 13 is connected to a phase 17 of the motor terminals 18, and, through the switch 12, a pilot lamp 19 and the heater 13 to the neutral conductor 20 of the mains 16. The mechanical coupling between the driving motor 14 and the fore pump 3 may consist of a V-belt 21.

If the driving motor 14 is switched out of circuit, the heater 13 is also switched off, even if the switch 12 for the heater circuit 22 is closed. At the instant at which the driving motor 14 of the fore pump 3 is switched on, the switch 12 for the heater 13 of the oil diffusion pump 2 remains closed. A short time after the pump system is switched into the circuit, however, the gas flowing out of the pressure nozzle 4 lifts the stopper 5. Hence, the switch 12 is opened and breaks the heater circuit 22. At the instant at which the stopper 5 is lifted, the oil in the oil diffusion pump 2 is not yet vaporized so that the strong gas current forced through the pump 2 cannot yet carry along oil vapour to the oil trap 23 and the fore pump 3. If the capacity of the fore pump 3 is exhausted so that the gas flow abates, the stopper 5 again sinks down upon the pressure nozzle 4. Consequently, the switch 12 closes the circuit for the heater 13 of the oil diffusion pump 2 so that this pump is started. Since at this instant no longer large amounts of gas are drawn off, the oil vapour can condense on the walls of the oil diffusion pump.

The operation of the oil diffusion pump 2 can always be controlled on a control panel of the system by means of a pilot lamp 19 connected in the heater circuit. If, for example, leaks occur in the pipes or in the vessels 1 to be evacuated, the pilot lamp 19 does not light up in operation or is prematurely extinguished, since in this event the oil diffusion pump 2 is immediately rendered inoperative owing to the stopper being raised. It is important for the oil diffusion pump 2 to be immediately rendered inoperative in the case of gas leaks since thus decomposition of the boiling oil and formation of an emulsion can be avoided.

In this specification, the high-vacuum pump used is an oil diffusion pump. However, the invention can be applied to advantage in high-vacuum pumps containing other operating media, for example mercury diffusion pumps.

What is claimed is:

1. A high vacuum pumping system comprising, a diffusion pump including a heater adapted to be connected to a vessel to be evacuated, a fore pump having an outlet pressure nozzle, said fore pump connected on its intake side with the discharge of said diffusion pump, a freely movable sealing member slideably seated in the pressure nozzle of said fore pump, said sealing member normally held in closed position by differential pressure and opened by differential pressure betwen atmosphere and the discharge pressure of said fore pump, a switching means

connected to said heater and operatively associated with said sealing member to disconnect said heater when said sealing member is an in opened position.

2. Apparatus according to claim 1 wherein said sealing member comprises a mushroom-shaped stopper having a stem portion, said stem portion being provided with a longitudinal bore and a plurality of radial ducts, said ducts communicating said fore pump with atmosphere when said sealing member is elevated by pressure within said fore pump in excess of atmospheric pressure and said stopper sealingly engaging said nozzle to maintain subatmospheric conditions within said system.

3. Apparatus according to claim 1 wherein said switching means comprises an electric circuit connected to said heater and an electric switch in said circuit mounted on said fore pump in operative relation with said sealing member.

4. Apparatus as claimed in claim 2 further comprising a spring attached to a part of said fore pump and engaging said stopper, the later acting upon said switch means through said spring.

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