

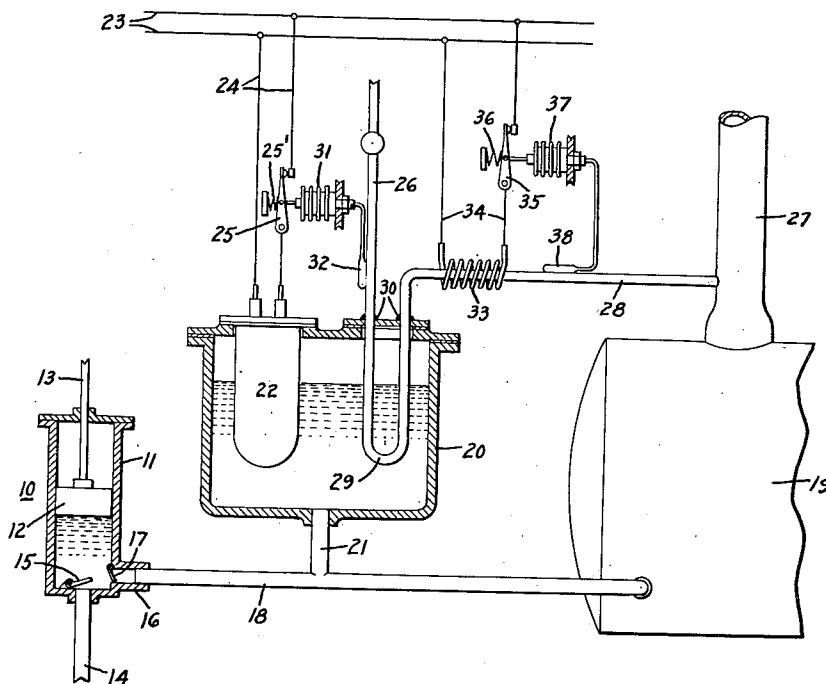
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J. H. DORAN

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PRESSURE EQUALIZING ARRANGEMENT FOR RECIPROCATING PUMPS

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Inventor:
John H. Doran,
by *Harry E. Dunham*
His Attorney.

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PRESSURE EQUALIZING ARRANGEMENT
FOR RECIPROCATING PUMPSJohn H. Doran, Scotia, N. Y., assignor to Gen-
eral Electric Company, a corporation of New
York

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This invention relates to fluid pressure equalizing arrangements and devices. Such devices are provided, for example, in connection with reciprocating pumps to equalize, reduce or minimize fluctuations or pulsations in pressure of the fluid discharged by reciprocating pumps. The pulsations of the fluid discharged by reciprocating pumps have an intensity depending upon the number of cylinders of the pump. For instance, with a five cylinder pump, the variation in flow is of the order of about 8% of the normal or average flow. The fluctuations tend to increase with a decreasing number of cylinders, reaching a maximum in the case where but a single cylinder is provided for forcing the fluid through a conduit. These fluctuations or pulsations are undesirable and often lead to considerable vibration of the conduits which may result in the breaking thereof.

The object of my invention is to provide an improved construction and arrangement of pressure equalizing devices whereby fluctuations or pulsations in pressure of a fluid forced through a conduit are substantially reduced, damped or equalized.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawing.

Referring to the drawing, the arrangement comprises a reciprocating pumping means or pump 10 having a cylinder 11 and a piston 12 movably arranged within the cylinder. This piston is connected to a stem 13 which is reciprocated by any suitable means, not shown. The cylinder has an inlet or suction conduit 14 with an inlet or suction valve 15 and an outlet or discharge conduit 16 with an outlet or discharge valve 17. The outlet 16 is connected to a conduit 18 which communicates with the elastic fluid generator, or steam boiler 19. During operation, upward movement of the piston 12 creates a vacuum in the cylinder whereby fluid, such as water, flows through the inlet conduit 14 into the cylinder, the valve 15 being open during upward movement whereas valve 17 is closed. As the piston 12 is moved downwardly, the inlet valve 15 closes and the discharge valve 17 opens whereby the fluid is forced through the outlet 16 into the conduit 18.

In order to reduce pulsations in pressure of the fluid discharged from the reciprocating pump, I provide, in accordance with my invention, means for equalizing the pressure fluctuations. This means includes a cylinder or chamber 20, the

lower or bottom portion thereof communicating with the conduit 18 through a connecting pipe or member 21 in close proximity to the pump 10.

An electric heater 22 is disposed in the upper portion of the cylinder and during normal operation is immersed in the fluid therein. The heater is connected with the electric supply circuit 23 by a circuit 24 having therein a control switch 25 which is normally biased to a closed circuit position by a spring 25'. As soon as the pump is started, part of the fluid discharged thereby is forced through the connecting pipe 21 and into the cylinder 20. Immersed in this fluid, the heater 22 will vaporize part of it forming a vapor cushion in the upper part of the cylinder. This vapor cushion damps the pressure fluctuations of the fluid discharged by the pump, that is, as long as the pressure near the connection between the pipe 21 and the conduit 18 increases, fluid is forced into the cylinder 20 causing compression of the vapor cushion in the upper portion of the cylinder. Thereafter as the pressure in the conduit 18 near its connection with the pipe 21 decreases, fluid is forced out of the cylinder 20 by the expansion of the vapor cushion.

As the elastic fluid generator or steam boiler 19 reaches its normal operating condition, elastic fluid or steam is fed therefrom to any suitable consuming apparatus through the feed main 27. A conduit 28 in communication with the supply of the generator 19, as through the main 27, has a continuous looped portion 29 thereof disposed within the upper end of the cylinder 20. This loop, which passes through the openings in the top of the cylinder 20 and is sealed thereto as by welds 30, is partly immersed in the fluid in the cylinder and forms a second heating unit therefor. Thus, assuming that the elastic fluid generator 19 is of the superheating type, as it reaches its normal operating condition, sufficient vaporization of the fluid in the cylinder 20 is caused by the heating unit 29 to maintain a sufficient vapor cushion in the upper portion of the pressure equalizer. When such a condition obtains, provision is made for the deenergization of the electric heater 22. Connected with the switch 25 in the control circuit for the electric heater is a temperature responsive switch actuating mechanism 31 having connected thereto a bulb 32 containing thermo-expansible fluid arranged in thermal communication with the elastic fluid outlet 26. So long as the temperature of the elastic fluid circulating through the elastic fluid heater unit 29 is too low to properly maintain a sufficient vapor cushion in the upper portion of the cylinder, 55

the switch 25 is held in its closed circuit position whereby the heater 22 acts to maintain a sufficient vapor cushion. As soon as the temperature of the elastic fluid passing through the heater 29 reaches the normal operating temperature, the switch operating mechanism 31 acts to deenergize the electric heater 22.

While I have described above a pressure equalizing system which is thoroughly satisfactory in operation, in the preferred embodiment I add an additional electric heater 33 disposed around or adjacent to the elastic fluid conduit 28 near the inlet thereof to the cylinder 20. Though I have shown in this instance this heater as comprising a resistance unit encircling the conduit 28, of course, it is obvious that any heating means might be employed. This heater is connected to the electric source of supply 23 by a control circuit 34 having a switch 35 disposed therein. Switch 35 is normally biased to a closed circuit position by a spring 36 and has connected thereto a temperature responsive actuating mechanism 37 which has connected thereto a bulb 38 containing thermo-expansible fluid arranged in thermal communication with the conduit 28 between the elastic fluid generator 19 and the heater 33. Before the elastic fluid generator 19 reaches its normal operating condition of temperature and pressure, that is, before the temperature of the elastic fluid flowing through the heating coil 29 reaches a sufficiently high value for maintaining a proper vapor cushion in the pressure equalizer, the elastic fluid flowing through the conduit 28 is superheated by the auxiliary heater 33 to raise the temperature thereof a predetermined amount. As soon as the superheated elastic fluid discharging from the heating coil 29 reaches a predetermined temperature during which condition prevailing a proper vapor cushion will be maintained in the pressure equalizer, the relatively large electric heater 22 will be deenergized by the operation of the thermal responsive device 31. The vapor cushion within the pressure equalizer will then be maintained solely by the heating coil 29 as augmented by the superheater 33 which superheater will in turn be deenergized as the elastic fluid generator 19 reaches its normal operating condition. Thus, during the transition of control of the pressure equalizer from the electric heater 22 to the elastic fluid heater 29 a substantially constant condition of the vapor cushion is maintained with a minimum consumption of electrical energy.

In the event that the pressure equalizer is used in conjunction with an elastic fluid generator which is not of the superheating type, it is obvious that the temperature of the elastic fluid generated thereby will be below the temperature required for forming steam in the chamber 20 the pressure in which is greater than in the boiler 19. In such case the heater 22 will be deenergized, as before, as soon as the elastic fluid flowing through the coil 29 superheated by the heater 33 reaches a temperature sufficient for maintaining the proper vapor cushion in the pressure equalizer. But because the relatively low temperature of the boiler output during normal operation requires the continual energization of the superheater 33, the switch 35 will not be opened and may in fact be dispensed with or be substituted by any other suitable type of control switch.

Having described the method of operation of my invention, together with the apparatus which

I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In an elastic fluid generator plant, a pulsating fluid pump, an elastic fluid generator, a conduit for conveying fluid from said pump to said generator, a chamber in communication with said conduit adjacent said pump for equalizing fluctuations in pressure caused by said pump, a conduit for conveying elastic fluid from said generator to heat fluid in said chamber to form a vapor cushion in the upper portion of said chamber, auxiliary heating means associated with said chamber, means for controlling said auxiliary heating means upon a predetermined temperature obtaining in said elastic fluid conduit adjacent said chamber.

2. The combination of a reciprocating pump, a conduit connected to the outlet of the pump for conducting liquid to an elastic fluid generator, a device connected to the conduit in close proximity to the pump for equalizing fluctuations in pressure of the liquid discharged by the pump into the conduit, said device comprising a closed chamber communicating with the conduit, a conduit extending from said elastic fluid generator for conveying elastic fluid therefrom, a loop of said elastic fluid conduit disposed within an upper portion of said chamber and partly immersed in the liquid in said chamber during normal operating conditions, an electrical resistance heater disposed around said elastic fluid conduit adjacent the inlet to said chamber for heating the elastic fluid passing through said loop, an electric circuit for said heater having a switch therein biased to closed position, means for opening said switch in response to a predetermined temperature of the elastic fluid in said conduit between said heater and said steam generator, an electrical resistance heater disposed within an upper portion of said chamber and partly immersed in the liquid in said chamber during normal operating conditions, an electric circuit for said heater, a switch biased to closed position in said electric circuit for said last mentioned heater and means for opening said last mentioned switch in response to a predetermined temperature of the elastic fluid in said conduit adjacent the outlet end thereof from said chamber.

3. The combination of a reciprocating pump, a conduit connected to the outlet of said pump for conducting liquid to an elastic fluid generator, a device connected to the conduit in close proximity to the pump for equalizing fluctuations in pressure of the liquid discharged by the pump into the conduit, said device comprising a closed cylinder communicating with the conduit, a conduit extending from said elastic fluid generator for conveying elastic fluid therefrom and having a looped portion thereof disposed within an upper portion of said cylinder and partly immersed in liquid during normal operating conditions, an electrical resistance heater disposed within an upper portion of the cylinder and partly immersed in liquid during normal operating conditions, an electric supply circuit for said heater, a switch in the electric supply circuit for said heater and means responsive to a predetermined temperature of the elastic fluid in said conduit for actuating said switch.

4. The combination of a reciprocating pump, a conduit connected to the outlet of said pump

for conducting liquid to an elastic fluid generator, a device connected to the conduit in close proximity to the pump for equalizing fluctuations in pressure of the liquid discharged by the pump into said conduit, said device comprising a closed chamber communicating with said conduit, a conduit for conveying elastic fluid from said elastic fluid generator having a looped portion disposed within an upper portion of said chamber and partly immersed in liquid therein during normal operating conditions, an electrical heating means adjacent the inlet of said last mentioned conduit to said chamber for heating the elastic fluid within said conduit, an electrical supply circuit for said electrical heating means having a switch therein, means responsive to a predetermined temperature of the elastic fluid within said conduit between said heating means and said elastic fluid generator for actuating said switch.

5. The combination of a reciprocating pump, a conduit connected to the outlet of said pump for conducting liquid to an elastic fluid generator, a device connected to the conduit in close proximity to the pump for equalizing fluctuations in pressure of the liquid discharged by the pump into said conduit, said device comprising a closed chamber communicating with said conduit, a conduit for conveying elastic fluid from said elastic fluid generator having a looped portion thereof extending into an upper portion of said chamber and partly immersed in said liquid, electrical heating means adjacent the in-

let of said conduit to said chamber, an electrical supply circuit for said last mentioned heating means, means responsive to a predetermined temperature of the supply of said elastic fluid from said generator for actuating said switch, an electrical heating means disposed within an upper portion of said chamber and partly immersed in the liquid in said chamber during normal operating conditions, an electrical supply circuit for said heating means, a switch in the supply circuit for said last mentioned heating means and means responsive to a predetermined temperature of the elastic fluid in said conduit adjacent the outlet portion thereof from said chamber for actuating said last mentioned switch.

6. In a boiler feed liquid pumping system, a pulsating feed liquid pump, an elastic fluid generator, a conduit for conveying feed liquid under pressure from said pump to said elastic fluid generator, a pulsation damping chamber in communication with said conduit adjacent said pump, electric heating means associated with said chamber for forming a vapor cushion in the upper portion thereof upon the starting of said system, a conduit for conveying elastic fluid from said generator for heating liquid in said chamber, means for superheating the elastic fluid in said conduit for maintaining the vapor cushion in said chamber, and means responsive to a predetermined superheated condition of the elastic fluid in said conduit for deenergizing said electric heating means.

JOHN H. DORAN.