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LIQUID FLOW REGULATORS

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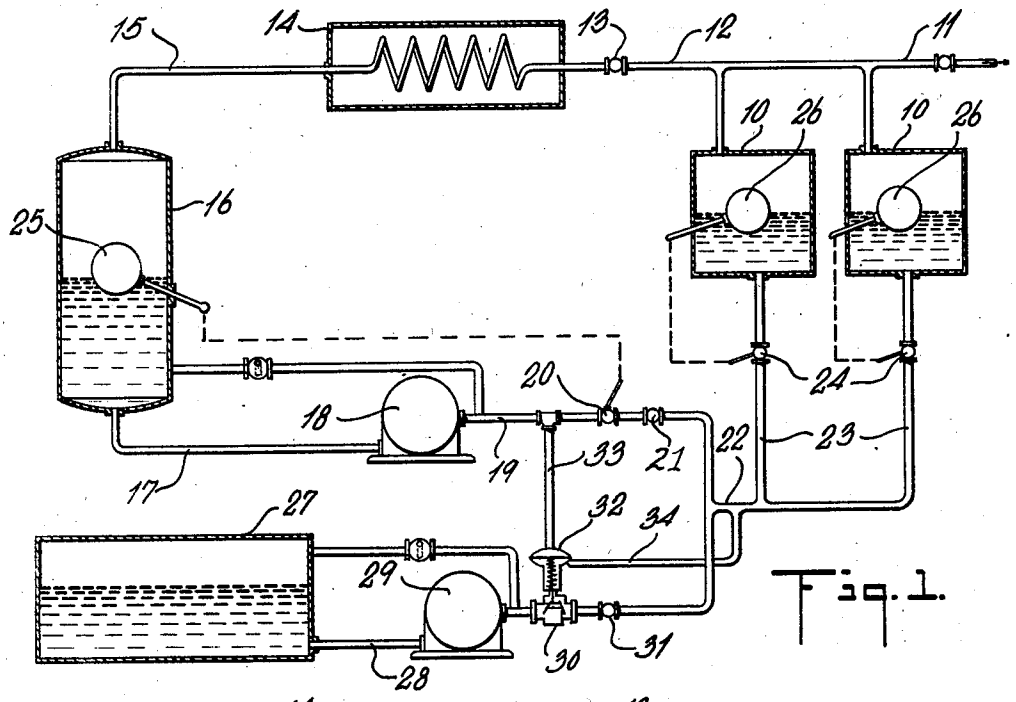



Fig. 1.

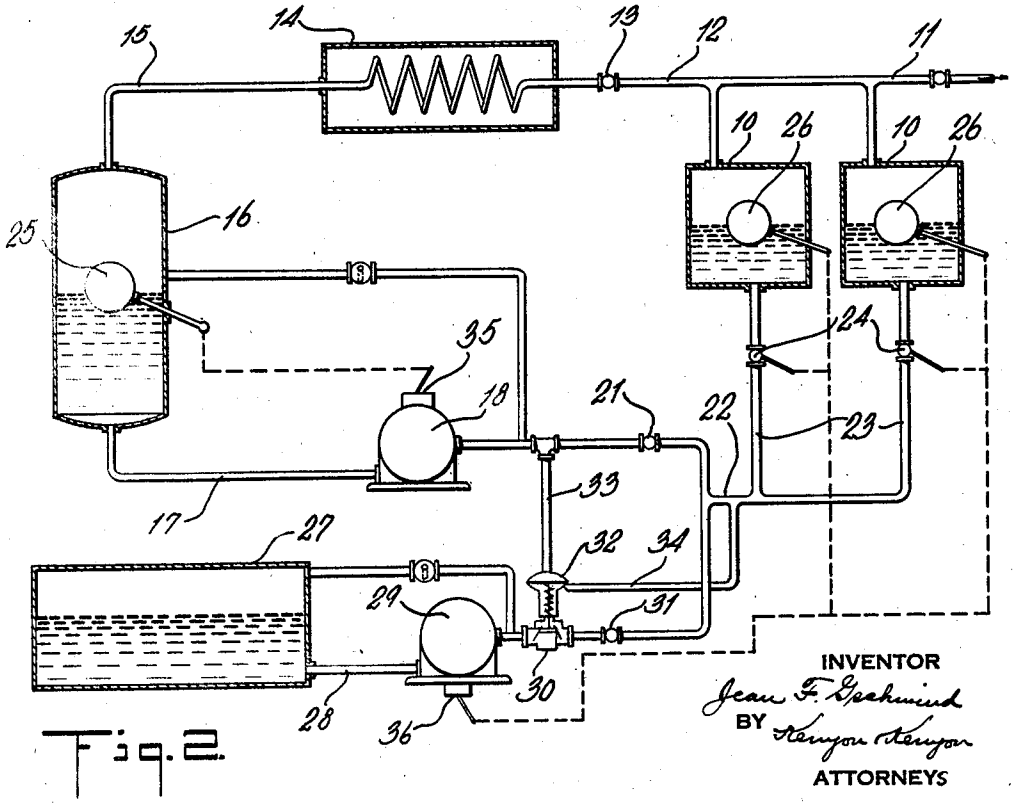



Fig. 2.

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## LIQUID FLOW REGULATOR

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8 Claims. (Cl. 122—451)

This invention relates to liquid flow regulators.

In certain types of installations, a pressure vessel is supplied with liquid from two different sources and it is desired that so long as one source is capable of supplying the demand for liquid, liquid from said source be used to the exclusion of liquid from the other source.

An example of an installation to which the invention is applicable is one in which one or more boilers are supplied with feed water from a receiver containing condensate produced from some of the steam supplied by the boilers after such steam has been used for heating purposes or the like and make-up feed water is supplied from another source when the condensate is insufficient for the purpose. As long as condensate is available, it is fed to the boiler to maintain the required water level therein. When the condensate is exhausted, make-up feed water is supplied directly to the boiler from the remaining source until such time as the supply of condensate is sufficiently replenished.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawing, wherein:

Fig. 1 is a schematic view of one installation embodying the invention;

Fig. 2 is a schematic view of another installation embodying the invention.

Referring now to Fig. 1, a battery of boilers 10 supply steam to various users thereof through pipes 11 and 12. The pipe 12 supplies steam through a valve 13 to a unit 14 of such character that the steam is condensed therein. From the unit 14, a pipe 15 leads to a vessel 16 in which the condensate is collected. From the bottom of the vessel 16, a pipe 17 leads to the inlet of a pump 18 and a pipe 19 leads from the outlet of the pump 18 through a valve 20 and check valve 21 to a conduit 22 having branches 23 leading to the boilers 10. In each branch 23 is provided a valve 24. The valve 20 is actuated by a float 25 in the vessel 16, the arrangement being such that the valve 20 is open with the liquid in the vessel 16 above a predetermined level and is closed when the liquid level in the vessel 16 drops below a lower predetermined level. The valves 24 are controlled by floats 26 in the boilers 10, the arrangement being such that the valves 24 are automatically opened and closed to maintain a predetermined level of water in the boilers.

A tank 27 is connected by a pipe 28 with the inlet of a pump 29, the outlet of which is connected through a valve 30 and a check valve 31 with the conduit 22. The valve 30 is provided with a diaphragm-type actuator 32 and one chamber of the actuator is connected through a pipe 33 to the pipe 19 in such manner as to be subject to the output pressure of the pump 18 while the other chamber is connected through the pipe 34 to the conduit 22 to be subjected to the pressure in said conduit. The actuator 32 is suitably adjusted that the valve 30 is maintained open whenever the differential between the output pressure of the pump 18 and the pressure in the conduit 22 exceeds a predetermined value. The pumps 18 and 29 are of the by-pass type so that they maintain constant output pressure while operated.

Assume that the boilers have sufficient water and the level of the condensate in the vessel 16 is sufficiently high to keep open the valve 20 and the pumps 18 and 29 are in operation. However, no water is flowing in the system since the valves 24 are closed. Upon opening of one of the valves 24, feed water is supplied to a boiler through the conduit 22 but the differential between output pressure of the pump 18 and the pressure in the conduit 22 is sufficiently low to keep the valve 30 closed so that only condensate is supplied to the boiler. Should the flow of condensate to a boiler continue until the level of the condensate in receiver 16 reaches its predetermined lower limit, the valve 20 closes with consequent drop of pressure in the conduit 22, thereby sufficiently increasing the pressure differential between the chambers of the actuator 32 that the valve 30 is opened and feed water supplied from the tank 27 to the boilers, either until sufficient feed water is supplied thereto or there is established in the actuator 32 the proper pressure differential to close the valve 30.

Referring now to Fig. 2, the general arrangement is the same except that the float 25 actuates a switch 35 to start and stop the pump 18 and each valve 24 actuates a switch 36 to start and stop the pump 29. Also, the valve 20 is omitted. In the operation of this modification, the pump 18 operates except when the level of the condensate in the receiver 16 drops below the predetermined level while the pump 29 operates only when one of the valves 24 is open to a predetermined extent. The valve 30 remains closed so long as the pump 18 is operating to supply the required pressure differential to the actuator 32. However, when the condensate level in the receiver 16 drops to such an extent that the pump 18 stops, then the pressure differential in the actuator 32 increases suf-

ficiently to open the valve 30. If the pressure of the pump 18 exceeds the pressure of the pump 29 the valve 30 remains open so long as the pump 18 is not operating, but when this pump operates to establish the predetermined pressure differential between the two chambers of the actuator 32, the valve 30 is closed and only condensate is supplied to the boilers. If the pressure of the pump 29 exceeds the pressure of the pump 18 the pump 29 will continue to furnish water until after closure of the valves 24 with resulting sufficient increase of pressure in the conduit 22 to establish the proper pressure differential between the two chambers of the actuator 32 to effect closure of the valve 30.

Although pumps have been shown in both modifications, it is to be understood that the required pressure may be obtained in other ways. For example, the vessel 16 and tank 27 may be arranged at sufficiently high elevation to provide the required pressure.

It is of course to be understood that various modifications may be made in the structure above described without in any way departing from the spirit of the invention as defined in the appended claims.

I claim:

1. In combination, two sources of liquid under pressure, a pressure vessel, connections from each liquid source to said pressure vessel including a common conduit, means responsive to the amount of liquid available at one source for regulating flow therefrom, means responsive to the liquid requirements of said vessel for regulating flow thereto, and means for preventing flow from one source into said vessel except when the differential between the pressure of the other source and the pressure in said common conduit exceeds a predetermined value.

2. In combination, a boiler, a steam heated unit connected thereto, a condensate receiver connected to said unit, a source of liquid, connections including a common conduit for supplying liquid from said source and condensate from said receiver directly to said boiler, means responsive to the liquid requirements of said boiler for regulating flow thereinto, and means for preventing flow from said liquid source into said boiler except when the differential between the pressure in the condensate supply and the pressure in said common conduit exceeds a predetermined value.

3. In combination, a first and second source of liquid under pressure, connections from each source to said pressure vessel including a common conduit, means responsive to the liquid requirements of said vessel for regulating flow thereto, a valve for each liquid source controlling flow therefrom to said pressure vessel, means responsive to a reduction of said first liquid source to close the valve therefor and to an increase thereof to open said valve, and means for maintaining said second source valve open whenever the differential between the pressure of the first source and the pressure in said conduit exceeds a predetermined value and maintaining said last named valve closed for pressure differentials below said predetermined value.

4. In combination, a boiler, a steam heated unit connected thereto, a condensate receiver connected to said unit, a source of liquid, connections including a common conduit for supplying liquid from said source and condensate from said receiver directly to said boiler, a valve controlling flow from said receiver to said boiler, a second valve controlling flow from said source to said boiler, means responsive to the liquid requirement of said boiler for regulating flow thereinto, means responsive to the liquid level in said reeciver to actuate said first valve and means for maintaining said second valve open whenever the differential between the condensate supply pressure and the pressure in said conduit exceeds a predetermined value and maintaining said valve closed for pressure differentials below said predetermined value.

5. In combination, a first and a second source of liquid, a pressure vessel, connections from each liquid source to said vessel including a pump for each source and a common conduit, means responsive to a reduction of said first liquid source to stop said first source pump and to an increase to start said pump, a first valve controlling flow into said pressure vessel, means responsive to liquid requirements of said vessel to actuate said first valve to maintain substantially constant quantity of liquid in said vessel, a second valve controlling flow from said second source to said pressure vessel, means for starting said second source pump upon opening of said first valve to a predetermined extent, and means for maintaining said second valve open whenever the differential between the pressure of said first pump and the pressure in said conduit exceeds a predetermined value and maintaining said last named valve closed for pressure differentials below said predetermined value.

6. In combination, a boiler, a steam heated unit connected thereto, a condensate receiver connected to said unit, a source of liquid, connections from said receiver and said source to said boiler including a pump for the receiver and a pump for the source together with a common outlet conduit, a first valve controlling flow into said boiler, means responsive to the liquid requirements of said boiler to actuate said first valve to maintain substantially constant quantity of liquid in said boiler, a second valve controlling flow from said source to said boiler, means for starting said source pump upon opening of said first valve to a predetermined extent, means for maintaining said second valve open whenever the differential between the pressure of the first pump and the pressure in said conduit exceeds a predetermined value and maintaining said last named valve closed for pressure differentials below said predetermined value, and means responsive to condensate level in said receiver to start and stop said receiver pump.

7. In combination, a first and a second source of liquid under pressure, a pressure vessel, connections for supplying liquid to said vessel from each source, a valve for interrupting flow from said first source of liquid to said pressure vessel, means for closing said valve upon predetermined reduction of said first liquid source, means responsive to the liquid requirements of said vessel for regulating flow thereto and means for preventing flow from said second source into said vessel except when the differential between the pressures on the opposite sides of said valve exceeds a predetermined value.

8. In combination, a first and second source of liquid, a pressure vessel, connections from each liquid source to said vessel including a pump for each source and a check valve, means responsive to a reduction of said first liquid source to stop said first source pump and to an increase to start said pump, a first valve controlling flow into said pressure vessel, means responsive to liquid re-

quirements of said vessel to actuate said first valve to maintain substantially constant quantity of liquid in said vessel, a second valve controlling flow from said second source to said pressure vessel, means for starting said second source pump upon opening of said first valve to a predetermined extent and means for maintaining said second valve open whenever the differential between the pressures on the opposite side of said first source relief valve exceeds a predetermined value and maintaining said last named valve closed for pressure differentials below said predetermined value.

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