July 6, 1937. P. D. BLANCHARD 2,085,782

CONTROL VALVE

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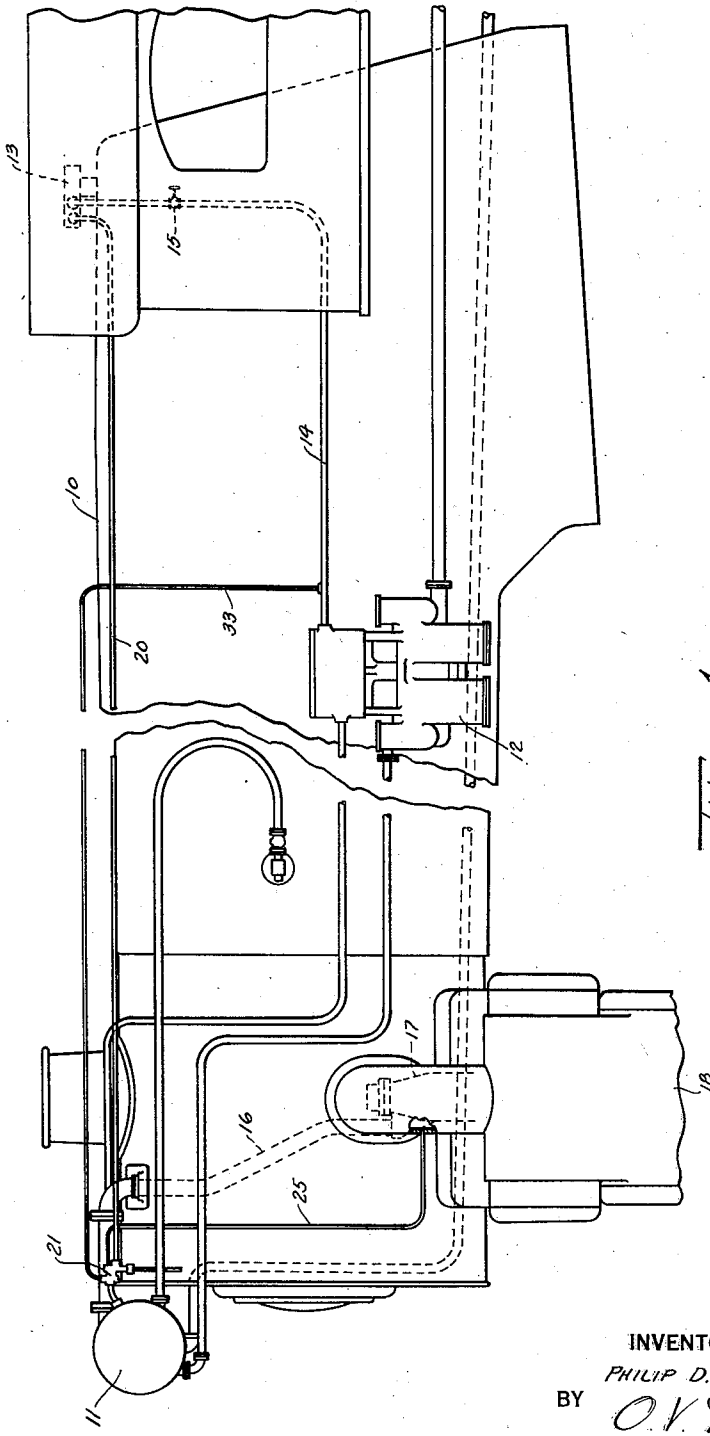

FIG. 1.

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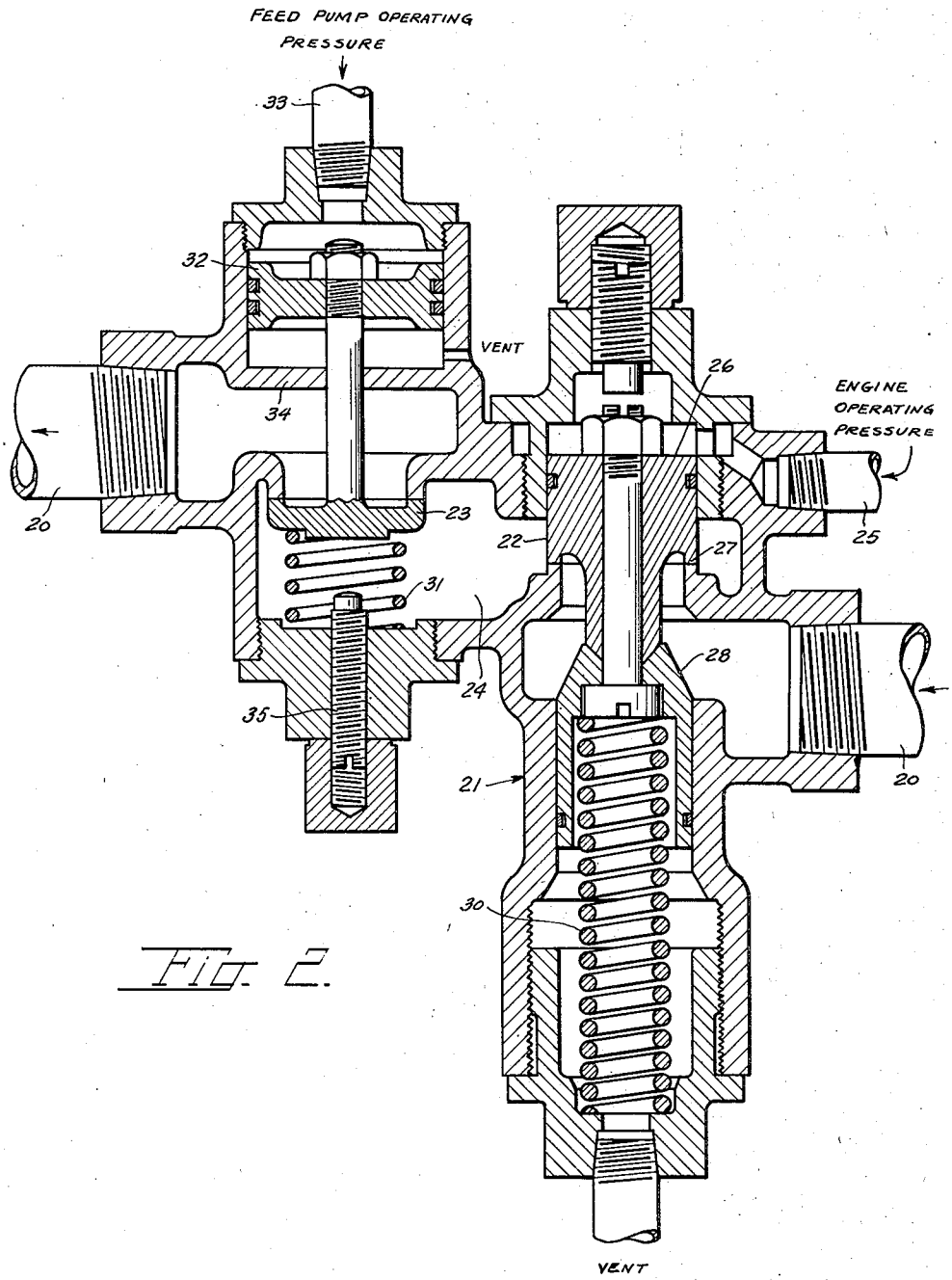

FIG. 2.

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CONTROL VALVE

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8 Claims. (Cl. 122—441)

The present invention relates to feed water heaters and particularly to arrangements for controlling live steam for heating feed water.

It has been proposed to supply live steam to feed-water heaters at times when the supply of exhaust steam for heating is not adequate by providing a live steam line to the heater controlled by an automatic valve that is responsive to exhaust steam pressure. Certain difficulties have been observed in the operation of such live steam controlling arrangements which do not spring from the characteristics of the valves heretofore used, but are due to the piping arrangements and effects of the flow of steam to the heater. The piping arrangements prior to the present invention have usually, and perhaps always, taken the live steam for heating the feed-water heater from the steam line to the feed-pump at a point on the down-stream side of the throttle for the pump. This arrangement has been considered necessary in order that the feed-water heater may not receive steam unless the feed pump is running.

However, such arrangements are disadvantageous in that if, when the feed pump is running slowly, the supply of exhaust steam becomes so low that the automatic valve opens up the line for live steam to the heater, the heater line may draw off so much steam from the pump line as to stop the pump. In fact, the pump may be stopped in this way even when initially running at fairly high capacity. Such stoppage of the feed pump may easily escape the attention of the fireman and so create a crisis due to a low water level. The prior arrangements are subject to another difficulty. In case the pump is running with the live steam line to the heater open and the engineer then opens the main throttle so that there is an adequate exhaust steam supply, the automatic valve then cuts off the flow of live steam to the feed water heater. As a result, the pump speeds up and, unless the fireman is alert, may create a crisis due to a high water level.

The principal object of the invention is to provide a combined piping arrangement and valve means which avoids the above-mentioned difficulties by rendering the rate of pump operation independent of the supply of live steam to the heater and further to inhibit flow of live steam to the feed water heater both when the supply of exhaust steam is above a predetermined point and when the pressure of the steam for the feed pump is below a predetermined point.

Fig. 1 is a diagrammatic side elevational view of a locomotive embodying the invention; and

Fig. 2 is an enlarged sectional view of the valve means employed in Fig. 1.

Referring to the drawings, the numeral 10 designates the boiler of a locomotive having a feed water heater 11 connected to receive water from a feed pump 12. Pump 12 is operated by live steam supplied from the steam turret 13 through a pipe 14 controlled by a valve 15. Exhaust steam is normally furnished to the interior of heater 11 through a conduit 16 connected, for example, to the exhaust nozzle 17 for supplying steam while the engines 18 are in operation. Whenever the supply of exhaust steam, whatever its source, is insufficient to heat the feed water, live steam may be supplied to heater 11 through a pipe 20 connected to turret 13 and controlled by valve means 21.

The valve means 21, as shown in Figure 2, comprises a casing provided with seats for two valves 22 and 23 having their outlet and inlet sides, respectively, communicating with a common chamber 24 so that the valves are in series between the inlet and outlet connections to the live steam line 26. The valve 22 is, preferably, of the type disclosed in the copending application of Emanuel Rawson, Ser. No. 705,841 filed January 9, 1934, now Patent No. 2,029,505, issued February 4, 1936, or of equivalent construction. As more fully disclosed in said application a pipe 25 conducts the engine operating pressure to the piston portion 26 of valve 22 for maintaining it closed to cut off the flow of live steam through pipe 20 so long as the engine throttle is open enough to supply the required amount of exhaust steam to the heater 11. The parts 27 and 28 of the valve which are exposed to steam flowing therethrough are relatively proportioned so that the valve is fully balanced; that is unresponsive to changes of pressure in steam flowing in pipe 20. A spring 30 is adapted to open valve 22 at a certain engine pressure less than the full operating pressure and, due to the balancing of valve 22, the spring 30 acts at a constant predetermined engine pressure regardless of changes of pressure in pipe 20.

However, the pressure of steam admitted to chamber 24 when valve 22 is open, assisted by closing spring 31, acts on valve 23 to maintain it closed unless overcome by the pressure in pump line 14 acting on the associated piston 32 through pipe 33. The piston 32 and valve 23 are so proportioned that valve 23 is maintained closed unless the steam pressure in pump line 14 is sufficient to operate pump 12 for supplying feed water to heater 11 at a desired rate.

To minimize chattering of valve 23 the piston

32 is located at one side of the partition 34 through which the valve stem extends. An adjustable stop 35 engageable by valve 23 limits its opening movement for regulating the amount of live steam passing to the heater 11.

In operation, valve 22 automatically opens to allow live steam from turret 13 to reach valve 23 whenever the engine steam chest pressure falls to a predetermined point at which the available exhaust steam is deemed insufficient for heating the feed water. On opening of valve 22 the pressure in line 20 acts to maintain valve 23 closed to prevent live steam reaching the heater 11, thus avoiding waste, unless and until pump 12 is operating at a rate to supply a determined amount of water to the heater. The pump steam line pressure then acts to open valve 23 also for allowing the live steam to reach the heater 11 from turret 13.

With the arrangement described the live steam for heating the feed water is taken directly from the turret 13 rather than from the pump steam line 14 as heretofore. Consequently, the opening of valves 22 and 23 for admitting live steam to the heater does not result in depriving pump 12 of steam required for operating it at a desired rate with resulting slowing down and possible creation of a crisis due to low water level. Nor does the automatic closing of valve 22 when the supply of exhaust steam becomes adequate result in speeding up the pump to feed more water than intended and the creation of a high water level.

Furthermore, the present arrangement has the advantage that live steam is supplied to the feed water heater at a definite engine operating pressure which does not vary inasmuch as the opening point of the valve means is not affected by variations in the pressure of live steam in the line supplying the heater. Consequently, the control valve means of the present invention may readily be applied to boilers operating at varying pressures without requiring adjustment because of such variations. Likewise when installed in a particular boiler the valve means does not require adjustment when the boiler pressure is varied or fluctuates.

What I claim is:

1. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, a connection between said boiler and pump for supplying live steam to the latter, piping between said boiler and heater for supplying live steam to the latter, and a valve in said piping responsive to the engine operating pressure and adapted to open when the supply of exhaust steam from said engine is inadequate to heat the feed water; a second valve in said piping; means acting on said second valve to maintain it closed to prevent live steam passing through said piping to said heater; and means responsive to the pressure of steam operating said pump for opening said second valve when the pump operates at a determined rate.

2. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, and a connection between said boiler and said pump for supplying live steam to the latter; piping between said boiler and heater for supplying live steam to the latter; a valve controlled by the engine operating pressure and adapted to open in response thereto when the supply of exhaust steam is inadequate to heat the feed water; a second valve; means acting on said second valve to normally maintain it closed; and means responsive to the pressure of steam operating said pump for opening said second valve when the pump operates at a determined rate, said valves being connected in series in said piping and said second valve being located between said first valve and said heater so that live steam may flow thereto only when said pump operates at or above said predetermined rate.

3. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, and a connection between said boiler and said pump for supplying live steam to the latter; piping between said boiler and heater for supplying live steam to the latter; a valve in said piping adapted to open when the supply of exhaust steam from said engine is inadequate to heat the feed water; a second valve in said piping connected in series with said first valve and arranged so that upon opening of the latter the pressure of live steam in said piping acts to urge said second valve to closed position; and means responsive to the pressure of steam operating said pump for opening said second valve to permit live steam to flow to said heater when said pump operates at a determined rate.

4. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, and a connection between said boiler and said pump for supplying live steam to the latter; piping between said boiler and heater for supplying live steam to the latter; and valve means in said piping responsive to a predetermined engine operating pressure and to a predetermined pump-operating steam pressure for enabling live steam to flow to said heater only when the pressure of steam operating said engine is such that the supply of exhaust steam therefrom is inadequate to heat the feed water and the pressure of steam operating said pump is at or above said predetermined pressure therefor.

5. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, and a pump connected to feed water to said boiler through said heater, piping between said boiler and heater for supplying live steam to the latter; a valve in said piping; means responsive to a determined engine operating pressure maintaining said valve closed when the engine operating pressure is above a predetermined value; means for opening said valve when said pressure falls below said value; and a separate connection between said boiler and pump for supplying live steam for operating the latter so that the rate of pump operation is independent of the opening and closing of said valve.

6. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, a steam line between said boiler and said pump for supplying live steam to the latter, and a throttle valve in said piping for regulating the rate of pump operation; piping between said boiler and heater for supplying live steam to the latter; a valve in said piping controlled by the engine operating pressure and adapted to open in response thereto when the supply of exhaust

steam is inadequate to heat the feed water; a second valve in said piping connected in series with said first valve; a piston cylinder and a piston therein connected with said second valve; and a connection between said pump steam line and said cylinder for subjecting said piston to the pressure of steam operating said pump as controlled by said throttle valve for opening said second valve to permit the flow of steam to said heater through said piping when said pump is operating at a determined rate and said first valve is open.

7. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, and a steam line between said boiler and said pump for supplying live steam to the latter; piping between said boiler and heater for supplying live steam to the latter; a valve in said piping responsive to the engine operating pressure and adapted to open then the supply of exhaust steam from said engine is inadequate to heat the feed water; a second valve in said piping connected in series with said first valve and arranged so that upon opening of the latter the pressure of live steam in said line urges said second valve to closed position; a piston cylinder and a piston therein connected with said second valve; and a connection between said pump steam line and said cylinder for subjecting said piston to the pressure of steam operating said pump for opening said second valve when said pump is operating at a determined rate.

8. In a boiler having a feed water heater normally supplied with exhaust steam from an engine deriving steam from the boiler, a pump connected to feed water to said boiler through said heater, and a steam line between said boiler and said pump for supplying live steam to the latter; piping between said boiler and heater for supplying live steam to the latter; a valve in said piping balanced to be unaffected by the pressure of live steam therein; a piston connected with said valve and subject to the engine operating pressure for normally maintaining said valve in closed position; spring means acting on said valve in opposition to said engine operating pressure for moving it to open position at a definite engine operating pressure irrespective of the pressure of live steam in said piping; a second valve in said piping; a piston cylinder and a piston therein connected with said second valve; and a connection between said pump steam line and said cylinder for subjecting said piston to the pressure of steam operating said pump for opening said second valve when said pump is operating at a determined rate.

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