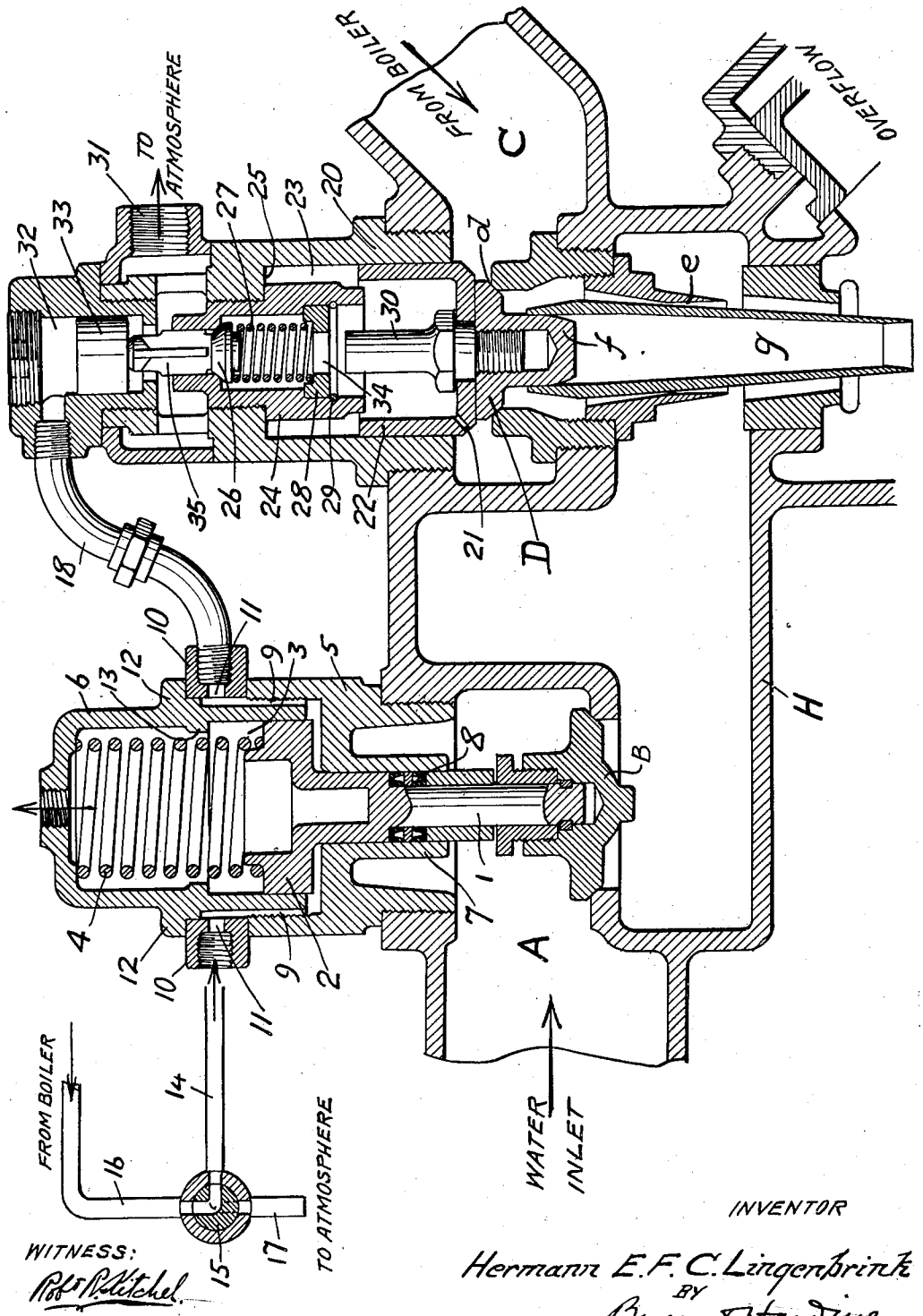
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INJECTOR

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WITNESS:
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INJECTOR

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5 Claims. (Cl. 103—271)

This invention relates to an improvement in injectors used for the supplying of feed water to steam boilers.

More particularly, this invention relates to the provision of novel and highly efficient means for operating the steam and water valves of injectors through the medium of fluid pressure.

In general this invention is applicable to injectors of various types. However, it has been found efficient in connection with injectors of the type illustrated and described, for example, in United States Letters Patent No. 1,069,883, dated August 12, 1913, to Strickland L. Kneass and No. 2,012,348, dated August 27, 1935, to Irenee P. Pedrick, with reference to which type of injector this invention will be hereinafter described for purposes of illustration without, however, limitation of the scope of the invention thereto.

Generally speaking this invention comprehends the provision of fluid pressure actuated means for the control of the water and steam valves of an injector for the control of the operation thereof and so arranged that in starting the injector the water valve will be opened before the steam valve is opened and that in shutting off the injector the steam valve will be closed before the water valve is closed.

More particularly, the fluid pressure actuated means will be so designed and arranged that fluid pressure, remotely controlled by a single operating handle, will be admitted to fluid pressure actuated means to open the water valve and passing from such means will operate on fluid pressure actuated means to permit opening of the steam valve. Again, in the closing of the valves the means will be so arranged that on shutting off the fluid pressure, by manipulation of the operating handle, the steam valve will close ahead of the water valve.

Having now indicated in a general way the nature and purpose of this invention, I will proceed to a detailed description of a preferred embodiment thereof with reference to the accompanying drawing in which:

The single figure is a cross-sectional view of the water and steam valve portions of an injector equipped with fluid actuating means according to this invention.

In the drawing A indicates the water inlet of an injector provided with a water valve B. C indicates the steam inlet to the injector provided with a steam valve D. The steam valve D is adapted to seat on a seat *d*, to control the entry of steam to the steam nozzle *e*, and is provided with an extension *f* which enters and controls the entry of steam to the main steam nozzle *g*. The water and steam valves are enclosed in a casing H, which encloses the usual mixing and forcing tubes. Attached to the water valve B is one end of a rod or stem 1 having at its opposite end a piston 2 adapted to work in a cylinder 3 against a spring 4. The cylinder 3 is formed of a lower member 5, threaded into an aperture in the casing H above the water valve B, and an upper member 6, threaded into the member 5. The upper member 6 is vented to the atmosphere at its top. The lower member 5 provides a guide 7 for the rod or stem 1, which is provided with sealing rings 8 within the guide, while the upper member 6 is provided in its periphery with opposite vertical grooves or passages 9, 9, communicating with the lower end of the cylinder. A ring 10, provided with opposite ports 11, 11 and adapted for the reception of pipe ends in line with the ports, is clamped between the lower member 5 and a flange 12 on the upper member 6, with the ports 11, 11 in line with the grooves 9, 9.

The rod or stem 1 is of such length that the piston 2 is clear of the bottom of the cylinder when the water valve B is fully closed and when the water valve is fully open the upper end of the piston is adapted to bear against an annular flange 13 within the cylinder to form a seal against leakage of pressure by the piston.

To one side of the ring 10 is connected a pipe 14 leading from a three way valve 15 adapted to be manually controlled and to connect pipe 14 with pipe 16 leading to a boiler, or with pipe 17 leading to atmosphere. To the opposite side of the ring 10 is connected a pipe 18, which leads to fluid pressure actuated mechanism for operation of the steam valve D.

To the steam valve D is secured a piston 22 adapted to work in a cylinder 20, the lower end of which is open to the pressure in the steam inlet C. The piston 22 is provided with a passage 21 for the equalization of pressure on its opposite sides. In the open position of the steam valve D the skirt of the piston 22 is adapted to enter an annular space 23 formed between the wall of the cylinder and a centrally apertured member 24 let into the cylinder and its end is adapted to bear against the annular flange 25.

Within the member 24 is formed a valve seat on which a valve 26 is adapted to be seated by a spring 27 bearing on the valve and a spring seat 28 supported within the member 24 by a ring 29. The spring seat 28 is provided with a

central aperture 34 for the passage of a stem 30 extending from the piston 22. The valve 26 controls communication between the cylinder 20 and a vent 31 to atmosphere. Above the valve 26 is a cylinder 32 within which is a piston 33 bearing against the fins 35 of the valve 26, for its operation to open position against its spring 27.

The pipe 18 is connected with the upper end of the cylinder 32.

In practice, utilizing this invention as described above, in connection, for example, with an injector on say a locomotive, the three way valve 15 will be located in any convenient location in the cab of the locomotive, while the injector will be located at any convenient place on the locomotive outside the cab. The three way valve will, of course, be arranged for manual control through the medium of any suitable lever.

As shown in the drawing, the steam and water valves of the injector are in closed position and the injector is out of operation. When now it is desired to operate the injector, the three way valve will be turned to the full line position shown in the drawing to admit steam from the boiler through pipe 16 to pipe 14, from whence it will pass through the port 11 and passage 9 to the cylinder 3 beneath the piston 2, causing the piston to move to its upper position against the action of spring 4, with opening of the water valve B. The spring 4 is a spring of little strength, being required only to have sufficient strength to effect closing of the water valve B when pressure is released from beneath the piston 2.

Steam operating to move the piston 2 will pass through passage 9 and port 11 into pipe 18 and from thence into cylinder 32, the building up of pressure in cylinder 32 being somewhat delayed by the expansion permitted in cylinder 3 by the upward moving of the piston 2 in the opening of the water valve.

When the steam valve D is in closed position, it will be noted that pressure on the piston 22, connected to the steam valve, is balanced due to the passage of steam from the steam inlet C through the passage 21 to the inside of cylinder 20, it being noted that escape of steam from cylinder 20 is prevented by the fact that the valve 26 is closed under the influence of its spring 27. When pressure is built up in cylinder 32, the piston 33 is driven downward and, through the medium of the fins 35, opens the valve 26 against its spring 27. When the valve 26 opens, pressure within the cylinder 20 is released through the vent 31 and the steam valve opens under the pressure in the steam inlet C acting on the underside of piston 22. The opening movement of the steam valve is cushioned when the stem 30 enters the central aperture 34 in the spring seat 28, it being noted that the pressure built up above the piston may then escape only between the stem 30 and the wall of aperture 34.

As the steam valve D opens, the skirt of the piston 22 enters the annular space 23 and ultimately its end bears against the flange 25, thus sealing the escape of steam around the piston.

When it is desired to shut off the injector, the three way valve 15 is moved to a position to connect pipe 14 with pipe 17 leading to atmosphere, whereupon pressure is released from the pistons 2 and 33. The spring 27 is made sufficiently strong so that on slight reduction in the pressure on the piston 33, it will act to close the valve 26, enabling the pressure on piston 22 to be balanced through the building up of pressure within the cylinder 20 through the passage 21, with resultant closing of the steam valve.

On complete release of pressure from the piston 2, the spring 4 plus the weight of the piston cause the water valve B to close. The closing of valve 26 and the balancing of the pressure on piston 22 with resultant closure of the steam valve under its own weight will occur before the pressure is reduced on piston 2 to an extent sufficient to enable the water valve B to be closed. Thus, the steam valve will close just ahead of the water valve in comparison with, as above, the water valve opening ahead of the steam valve when pressure is admitted for operation upon pistons 2 and 33.

It will be appreciated that if desired a retarding device, as a reduced section or a check valve, provided with a permanent restricted opening, may be interposed between the fluid actuated means for opening the water valve and that controlling the steam valve.

It will be understood that it is not intended that this invention shall be limited by the above description and accompanying drawing, since it will be appreciated that various modifications in detail may be made therein without departing from the scope of the claims appended hereto. It is further not intended that this application shall be limited to any particular type of injector, since it will be appreciated that it is applicable to injectors of various types having water and steam valves.

What I claim and desire to protect by Letters Patent is:

1. In an injector, in combination, a water valve, a steam valve subject to operating steam pressure, means to balance the steam pressure on said steam valve, fluid pressure operated means for opening said water valve, fluid pressure operated means to unbalance the steam pressure on said steam valve and permit its opening under the pressure of operating steam, means for the introduction of fluid pressure to said means for opening the water valve, and means affording communication for fluid pressure between said means for opening the water valve and said means to unbalance the steam pressure on said steam valve.

2. In an injector, in combination, a water valve, a steam valve subject to operating steam pressure, means to balance the steam pressure on said steam valve in its closed position, fluid pressure operated means for opening said water valve, fluid pressure operated means to unbalance the steam pressure on said steam valve and permit its opening under the pressure of operating steam, manually controlled means for the introduction of fluid pressure to said means for opening the water valve, and means affording communication for fluid pressure between said means for opening the water valve and said means to unbalance the steam pressure on said steam valve.

3. In an injector, in combination, a water valve, a cylinder, a piston in said cylinder connected to said water valve, a steam valve, a chamber above said steam valve, a passage through said steam valve opening into said chamber, a vent connecting with said chamber, a spring-closed valve for controlling said vent, a cylinder, a piston in said cylinder connected to said vent controlling valve, means for controlling the admission of fluid pressure to said first mentioned cylinder and means affording communication between said

first mentioned cylinder and said last mentioned cylinder.

4. In an injector, in combination, a water valve, fluid pressure operated means for opening the water valve, a balanced steam valve, fluid pressure operated means for unbalancing the steam valve, and means for affording access of fluid under pressure to operate said means for unbalancing the steam valve after the water valve is opened.

5. In an injector, in combination, a water valve, fluid pressure operated means for opening the water valve, a balanced steam valve, fluid pressure operated means for unbalancing the steam valve, said means for opening the water valve and for unbalancing the steam valve being arranged so that the latter will receive fluid under pressure from the former.

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