

July 8, 1941.

I. P. PEDRICK

2,248,249

INJECTOR

Filed July 12, 1940

2 Sheets-Sheet 1

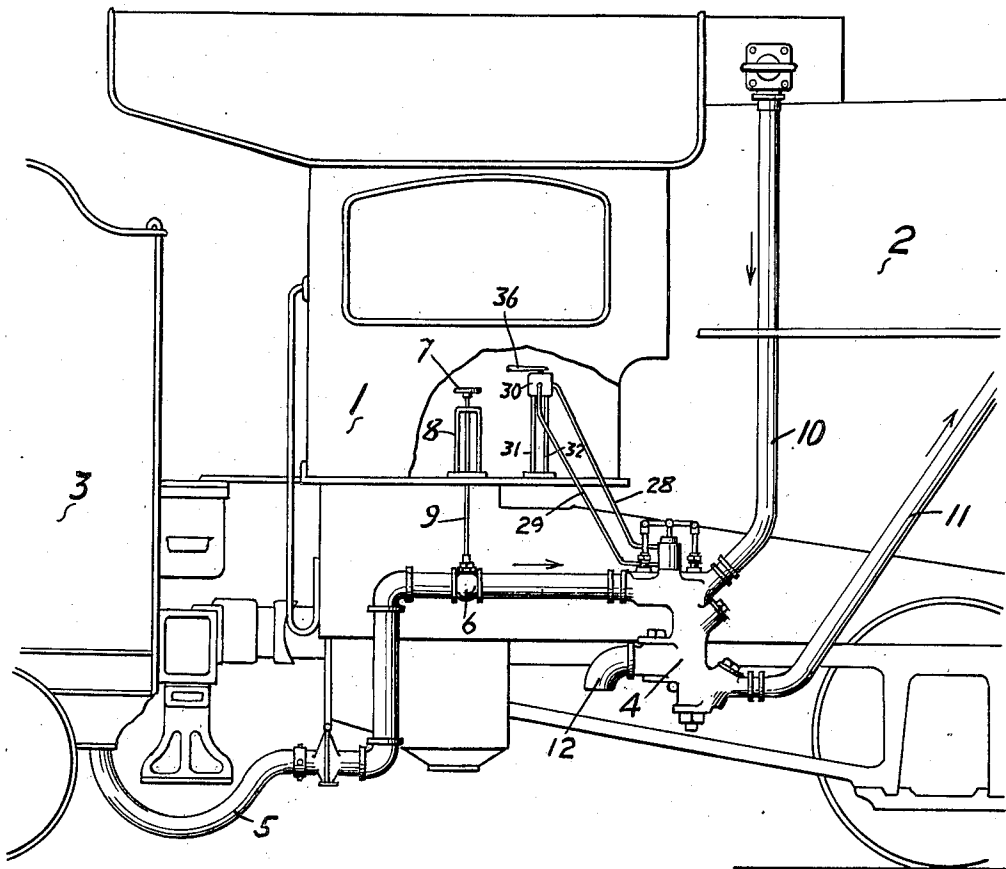


FIG. 1.

WITNESS:

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2 Sheets-Sheet 2

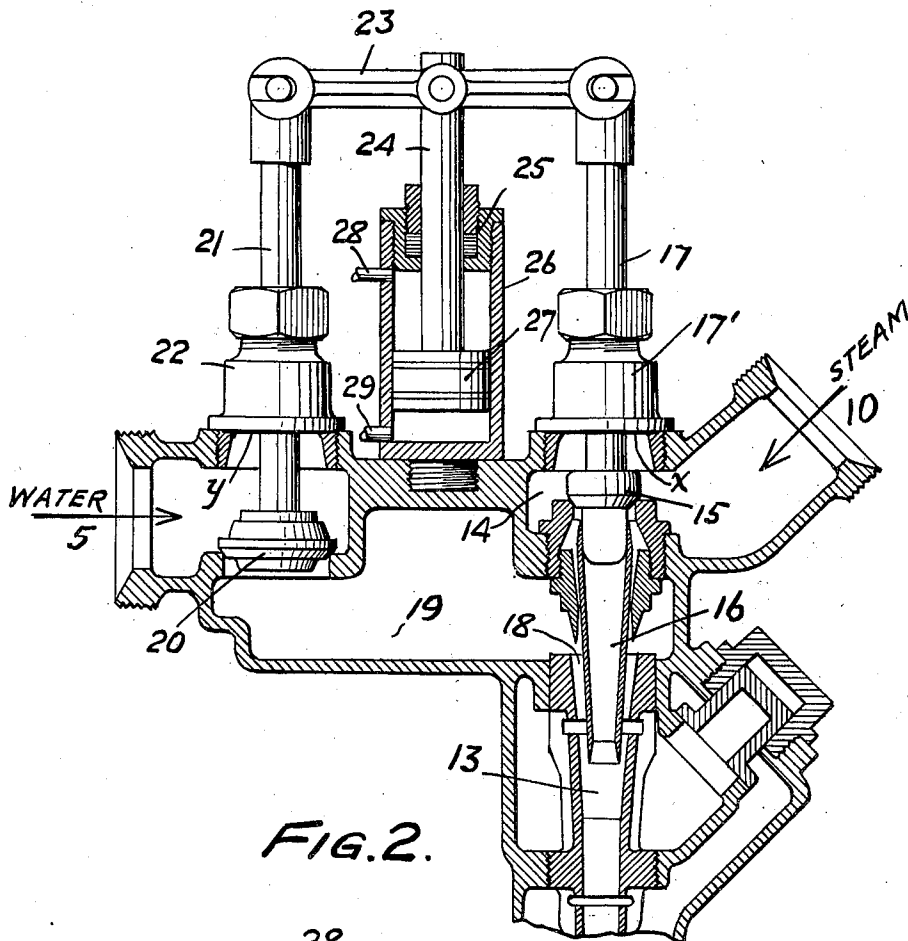


FIG. 2.

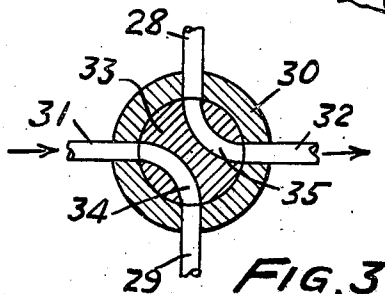


FIG. 3

WITNESS:

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UNITED STATES PATENT OFFICE

2,248,249

INJECTOR

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Philadelphia, Pa., a corporation of Pennsylvania

Application July 12, 1940, Serial No. 345,073

7 Claims. (Cl. 103—270)

This invention relates to an improvement in injectors such as are used in connection with the supply of feed water to steam boilers.

More particularly this invention relates to injectors of the type fully illustrated and described in United States Letters Patent No. 1,069,883, dated August 12, 1913, to Strickland Kneass, and No. 2,012,348, dated August 27, 1935, to Irene P. Pedrick, which are especially adaptable for use in connection with the supply of feed water to steam locomotive boilers.

Injectors of the type shown and described in the two patents referred to above have for many years proved highly efficient for the purpose intended. However, from experience it has been found that under certain circumstances and in certain installations they exhibit certain disadvantages.

It has now been found desirable on certain locomotives where the space beneath the locomotive cab is occupied with other equipment, that the injector be placed in some other location such as ahead of the cab or in such position that manual operation by means of a lever in the cab with extension rod is impractical.

Again, it has been found that where the injector is installed on a locomotive in a position other than more or less directly beneath the position of the starting lever in the locomotive cab, mechanical connection between the starting lever and the water and steam valve levers make for difficulty in operation and enhance the disadvantage pointed out above, and, indeed, sometimes bind or become misaligned and prevent operation.

Now in accordance with this invention an injector of the type indicated is provided which by virtue of its improved structure will be found to have all the advantages and efficiency possessed heretofore with, at the same time, freedom from the disadvantages.

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

Figure 1 is a side view, partly broken away, of the rear end of a locomotive with an injector and its operating mechanism according to this invention installed.

Figure 2 is a cross-sectional view of a portion of the injector and operating mechanism shown in Figure 1.

Figure 3 is a cross-sectional view of a control valve.

In the figures variously 1 indicates a locomotive cab mounted as usual at the rear of the boiler 2 and a tank 3 is coupled to the locomotive and carries a supply of feed water for the boiler.

The injector 4, secured in any well known manner to the locomotive, is connected to the tank through a conduit 5, provided with a shut-off valve 6, connected with an operating lever or wheel 7, suitably supported by a bracket 8 within the cab 1, by a rod 9.

A conduit 10 leads from the boiler 2 to the injector for the supply of live steam thereto and a conduit 11 connects the delivery end of the injector to the boiler for the delivery of feed water thereto. The conduit 12 is connected with the overflow chamber of the injector.

The injector 4, of the type shown in the Kneass and Pedrick patents referred to above, comprises the usual forcing tubes 13 into which live steam is discharged from steam chamber 14 through steam nozzle 16 controlled by the steam valve 15, having a stem 17 extending without the injector casing through a suitable gland 17'. Water is supplied to the tubes 13 from water chamber 19, through the annular orifice 18 between the steam nozzle 16 and the tubes 13. The admission of water to the water chamber 19 is controlled by the water valve 20, having a stem 21 extending without the injector casing through a suitable gland 22. The ends of a lever 23 are pivotally connected to the stems 17 and 21 of the water and steam valves, respectively, and the lever is pivotally connected intermediate its ends to the end of a piston rod 24 extending through a gland 25 into a power cylinder 26, within which it is connected to a piston 27. The cylinder 26 is conveniently mounted on the injector casing between the valve stems 17 and 21, or may be mounted independent of the injector such as on a bracket attached to the locomotive directly above the injector.

Conduits 28 and 29 lead from the opposite ends of the cylinder 26 to a valve chamber 30, mounted conveniently in the cab 1, which is in turn connected to a supply of fluid under pressure, as, for example, air from the brake system or steam from the boiler 2, through a conduit 31 and with atmosphere through an exhaust conduit 32. Within the valve chamber 30 is a cylindrical control valve 33 provided with passages 34 and 35 and connected to a manipulating handle or lever 36. The passages 34 and 35 in valve 33 are so arranged that on turning of the valve by manipulation of lever 36 either end of the cylinder 26 may be connected with fluid under pressure, while, at the same time, the other end will

be connected with exhaust, or the fluid pressure may be shut off from cylinder 26.

As will be observed from an inspection of Figure 2, the steam valve 16 in its opening movement is stopped when the head of the valve strikes the stop *x* formed by the lower end of gland 18, while similarly the water valve 20 in its opening movement is stopped when the head of the valve strikes the stop *y* formed by the end of gland 22. And it will be further noted that the stroke or distance of travel of the water valve 20 is greater than that of the steam valve 16. By way of example of an efficient structure, the water valve 20 may be arranged to have a stroke or travel of about 1.5 inches while the stroke or travel of the steam valve is about $\frac{3}{4}$ inch.

Assuming now that the injector is out of operation with the water valve 20 and the steam valve 16 closed and the lever 36 to be in a neutral position, as shown in Figure 2, when it is desired to start the injector the lever 36 will be moved to position the control valve 33 to admit fluid under pressure, for example steam, into the lower end of cylinder 26 beneath the piston 27 and connect the upper end of the cylinder to exhaust, with the result that the piston and its rod 24 will move upwardly. The upward movement of rod 24 will cause lever 23 to turn on its connection with the stem 17 of the steam valve 16, as a fulcrum, due to the greater holding effect of the pressure of live steam on the steam chamber 14 on the top of the steam valve as compared with the water pressure on the top of the water valve 20. Such movement of lever 23 will effect opening of the water valve 20 and will continue until the water valve in full open position strikes the stop *y*.

When movement of the water valve is stopped by the stop *y*, continued upward movement of the rod 24 will cause lever 23 to turn on its connection with the stem 21 of the water valve 20 as a fulcrum. Such movement of lever 23 will result in an opening movement of the steam valve 16, which will continue until the steam valve reaches its full open position and it is stopped by the stop *x*.

As has been noted above, the stroke of the water valve is greater than that of the steam valve. Hence, the water valve being fully opened before the opening movement of the steam valve begins, the water valve cannot be closed by the shorter opening movement of the steam valve even though, as sometimes happens, the steam valve, after being cracked, slams open with exertion of a closing action on the water valve.

When it is desired to shut the injector down, as will, it is believed, be obvious, it is only necessary to manipulate the lever 36 to position valve 33 to connect the upper end of cylinder 26 with fluid under pressure and the lower end with exhaust. The resultant downward movement of piston 27 and its rod 24 will, through lever 23, first move the water valve and then the steam valve to closed position, since in the closing movement the lever 23 will first turn on its connection with the stem of the steam valve, which will be held open under steam pressure, and then, when the water valve is closed, on its connection with the water valve.

It will be understood that the apparatus according to this invention as described above in detail and as illustrated in the accompanying drawings may be variously modified in detail without departing from the scope of this inven-

tion as defined by the claims appended hereto.

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

1. In an injector, in combination, a water valve and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, stems for said valves, a cross-head pivotally connected to said valve stems, means connected to said cross-head and adapted to move it on its connection with the stem of the steam valve, when the steam valve is closed, to fully open the water valve and subsequently, when the water valve is open, on its connection with the stem of the water valve to open the steam valve, the water valve being arranged to have a stroke of greater extent in its opening and closing movement than that of the steam valve in its opening and closing movement, whereby closing of said water valve in the opening movement of the steam valve will be avoided.

2. In an injector, in combination, a water valve and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, stems for said valves, a cross-head pivotally connected to said valve stems, fluid pressure operated means actuatable in one direction for moving the cross-head on its connection with the stem of the steam valve when the steam valve is closed to effect full opening of the water valve and subsequently, when the water valve is open, on its connection with the stem of the water valve to effect opening of the steam valve and actuatable in the opposite direction for moving said cross-head to effect closing of said valves.

3. In an injector, in combination, a water valve and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, stems for said valves, a cross-head pivotally connected to said valve stems, fluid pressure operated means for moving the cross-head on its connection with the stem of the steam valve, when the steam valve is closed, to effect full opening of the water valve and subsequently, when the water valve is open, on its connection with the water valve to effect opening of the steam valve, the water valve being arranged to have a stroke of greater extent in its opening and closing movement than that of the steam valve in its opening and closing movement, whereby closing of said water valve in the opening movement of the steam valve will be avoided.

4. In an injector, in combination, a water valve and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, stems for said valves, a cross-head pivotally connected to said valve stems, a cylinder arranged adjacent to said valves, a piston in said cylinder, a piston rod extending without said cylinder and pivotally connected to said cross-head intermediate its ends, means for admitting fluid under pressure into one end of said cylinder to move the cross-head on its connection with the stem of the steam valve while it is closed to effect full opening of the water valve and subsequently, when the water valve is open, on its connection with the stem of the water valve to effect opening of the steam valve, and means for admitting fluid under pressure into the other end of said cylinder to move the cross-head to effect closure of said valves.

5. In an injector, in combination, a water valve

and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, stems for said valves, a cross-head pivotally connected to said valve stems, a cylinder arranged adjacent to said valves, a piston in said cylinder, a piston rod extending without said cylinder and pivotally connected to said cross-head intermediate its ends and means for admitting fluid under pressure into said cylinder to move the cross-head on its connection with the stem of the steam valve while it is closed to effect opening of said water valve and subsequently to effect opening of said steam valve to move the cross-head on its connection with the stem of the water valve, the water valve being arranged to have a stroke of greater extent in its opening and closing movement than that of the steam valve in its opening and closing movement, whereby closing of said water valve in the opening movement of the steam valve will be avoided.

6. In an injector, in combination, a water valve and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, stems for said valves, a cross-head pivotally connected to said valve stems, fluid pressure operated means actuatable in one direction for moving the cross-head on its connection with the stem of the steam valve, when the steam

5 valve is closed, to effect full opening of the water valve and subsequently, when the water valve is open, on its connection with the stem of the water valve to effect opening of the steam valve and actuatable in the opposite direction for moving said cross-head to effect closing of said valves, the water valve being arranged to have a stroke of greater extent in its opening and closing movement than that of the steam valve in its opening and closing movement, whereby closing of said water valve in the opening movement of the steam valve will be avoided.

10 7. In an injector, in combination, a water valve and a steam valve arranged to open in the same directions respectively against water pressure and against steam pressure higher than the water pressure, actuating means pivotally connected to said valves and adapted to move on the pivotal connection with the steam valve, when the steam valve is closed to fully open the water valve and subsequently, when the water valve is open, on its pivotal connection with the water valve to open the steam valve, the water valve being arranged to have a stroke of greater extent in its opening and closing movement than that of the steam valve in its opening and closing movement, whereby closing of said water valve in the opening movement of the steam valve will be avoided.

IRENEE P. PEDRICK.