May 25, 1943. F. D. STIRLING 2,319,907

BLOW-OFF VALVE

Filed Jan. 30, 1942 2 Sheets-Sheet 1

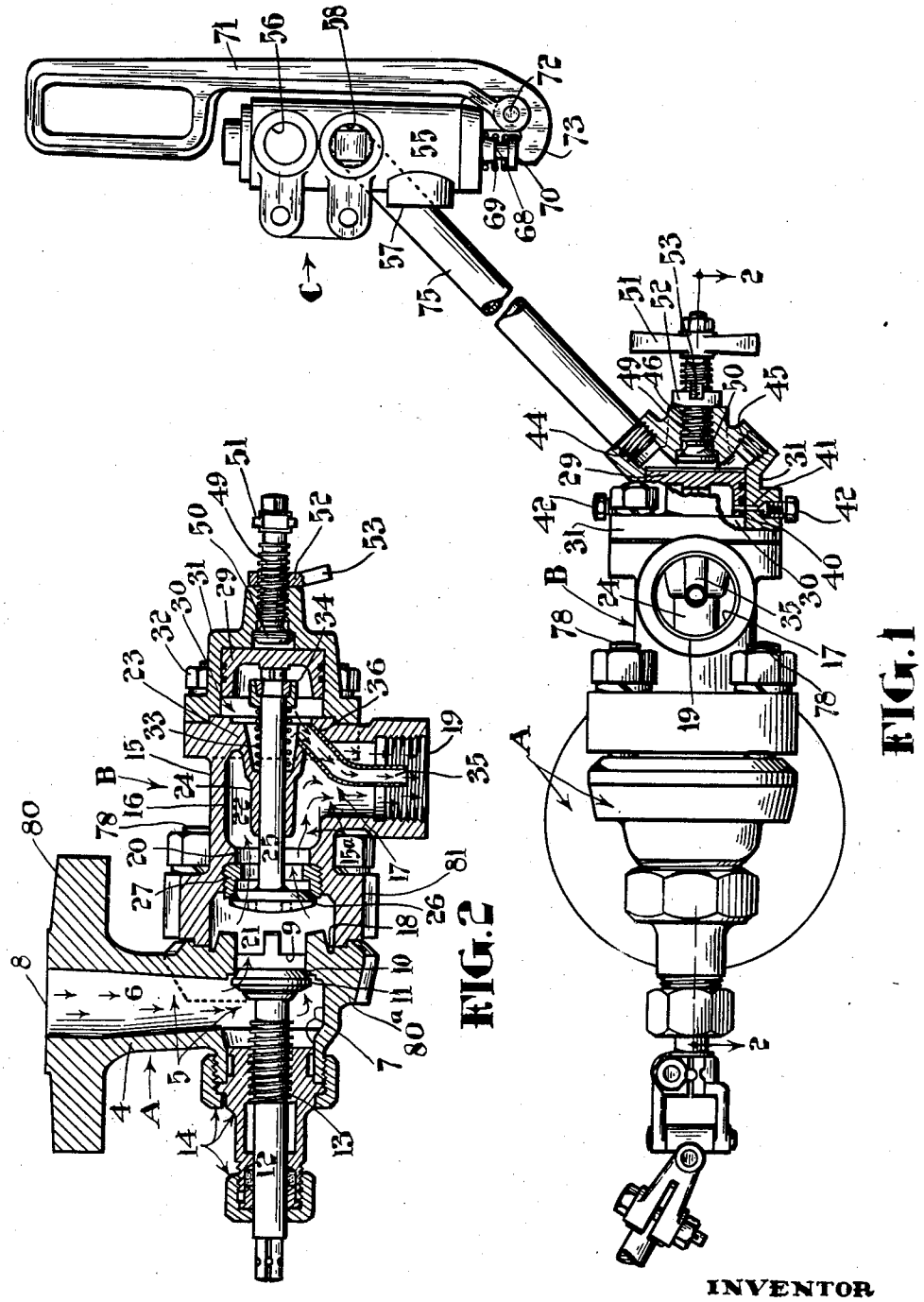


FIG. 1

FIG. 2

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BLOW-OFF VALVE

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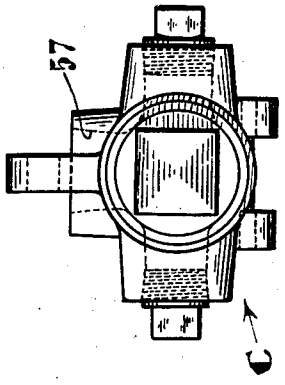


FIG. 4

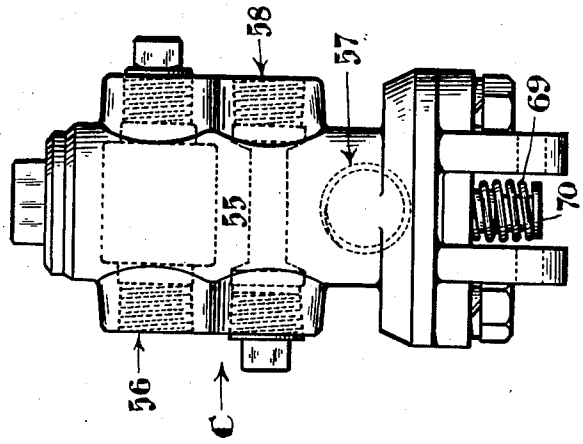


FIG. 3

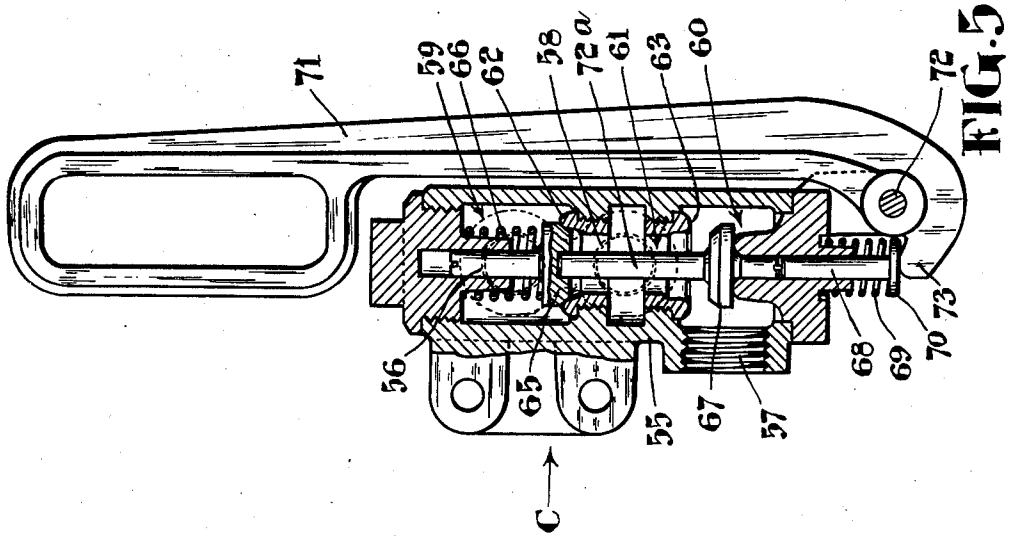


FIG. 5

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BLOW-OFF VALVE

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1 Claim. (Cl. 137—139)

This invention relates to improvements in "blow-off" apparatus for locomotives and other boilers.

The main object of this invention is to provide a more satisfactory and efficient "blow-off" apparatus of the type in which the stem of the "blow-off" valve is connected to an operating piston working in a cylinder to which steam is supplied to open the valve against the resistance of a valve closing spring. In such apparatus various methods of packing the valve stem guide have been resorted to in order to prevent the action of the valve stem and the piston being interfered with by the clogging action of sludge accumulating within the valve stem guide and within the piston cylinder. None of these packing methods has proven entirely satisfactory and considerable difficulty is still experienced in connection with sticking of the valve and/or the valve operating piston due to the clogging action of the sludge which is blown through the valve guide and into the piston cylinder.

According to the present invention the packing usually interposed between the valve stem and the valve stem guide is omitted and means, preferably operating on the ejector principle, is provided for removing from the valve stem guide and the cylinder the sludge which passes into these parts during the open period of the "blow-off" valve.

A further feature of the invention resides in the provision of a "blow-off" apparatus consisting of two units including an emergency shut-down unit and a "blow-off" unit combined in a novel manner to provide for relative angular adjustment thereof, the shut-down unit comprising a screw-down valve contained in a valve body which is fastened in place over the sludge discharge opening of the boiler and the "blow-off" unit comprising a piston actuated "blow-off" valve contained in a separate valve body which is bolted or otherwise fastened to the first mentioned valve body so that the angular relation between the two units may be changed to vary the angular relation between the inlet and outlet ends of a valve-controlled "blow-off" passage conjointly provided by said units.

Another feature of the invention resides in the provision of an improved control unit for controlling the flow of steam or other pressure fluid to and from the operating cylinder of the "blow-off" valve.

The foregoing and other objects, advantages and characteristic features of the invention will be more readily understood from the following detailed description taken in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of a "blow-off" apparatus embodying my invention.

Figure 2 is a longitudinal sectional view taken substantially along the line 2—2 of Figure 1.

Figure 3 is an elevational view of a portion of a control valve assembly forming part of the apparatus appearing in Fig. 1.

Figure 4 is a top plan view of the assembly shown in Figure 3.

Figure 5 is a vertical sectional view of the valve assembly shown in Figs. 3 and 4 with the addition of an operating handle.

As shown in these drawings, my improved "blow-off" apparatus comprises three main units including an emergency "shut-off" unit A, a "blow-off" unit B and a control unit C.

Unit A comprises a valve body 4 provided with a "blow-off" passage 5 consisting of two intersecting bores 6 and 7 arranged at right angles to each other, the end 8 of bore 6 constituting the entrance end of said passage and the end 9 of bore 7 constituting the exit or discharge end of said passage. A valve seat 10 is provided adjacent the discharge end 9 of said passage and is adapted to be engaged, at times, by an emergency "shut-off" valve 11, the latter being provided with an operating stem 12 in threaded engagement 13 with a valve-stem guide and packing gland 14 fitted in the end of bore 7 remote from discharge end 9. The outer end of valve stem 12 is formed so that a hand wheel or other turning device may be applied thereto for turning the stem in either a valve opening or a valve closing direction. Normally the "shut-off" valve 11 is positioned in a retracted or open position with reference to the seat 10 and is closed against the seat only in case of emergency to shut off the discharge of sludge from the boiler through the passage 5.

Unit B comprises a valve body 15 provided with a substantially L-shaped "blow-off" passage 15a formed by two intersecting bores 16 and 17 arranged at right angles to each other, the inlet end of said passage being formed by the end 18 of bore 16 and the outlet end of said passage being formed by the end 19 of bore 17. The bore 16 is provided, intermediate its length, with an inwardly projecting rib 20 dividing said bore into two chambers designated 21 and 22. The end of bore 16 remote from the entrance forming end 18 is closed by a wall 23 provided with a centrally disposed, tubular, valve-stem guide 24 which projects into chamber 22 and across the adjacent

end of bore 17. A valve stem 25 is sildably arranged in guide 24 and is provided, at one end, with a valve 26 which is normally closed against a valve seat member 27, the latter having screw threaded engagement with a wall portion of chamber 21 and being butted against the rib 20. A piston 29 is secured to valve stem 25 at the end remote from valve 26. This piston works in a cylinder 30 formed by a casing 31 which is fastened by stud bolts 32 to valve body 15 so that the inner end of the cylinder is formed by the aforesaid wall 23. Valve 26 is normally held closed by a spring 33 encircling the valve stem 25 between the cylinder end of valve-stem guide 24 and an abutment 34 carried by said stem adjacent its point of connection to piston 29. A bent sludge ejector tube 35 is arranged in bore 17 with the upper end of the tube fitted in an opening 36 provided in the previously mentioned wall 23. Tube 35 is thus in open communication with cylinder 30 and with the cylinder end of valve-stem guide 24.

As shown more particularly in Fig. 1, piston 29 is provided with drain openings 40 which register with similar openings 41 of cylinder casing 31 when the piston is in the valve closing position shown in the drawings. The outer ends of the drain openings 41 are normally closed by removable drain plugs 42.

The end wall of cylinder casing 31 is also provided with three openings designated 44, 45 and 46. Opening 44 constitutes a steam inlet opening through which steam is supplied to the outer end of cylinder 30 to move piston 29 to a valve opening position against the resistance of valve closing spring 33. Opening 45 is a drain opening for the outer end of cylinder 30 and is intended to be connected to a suitable form of normally closed automatic drain valve (not shown) which opens when pressure in cylinder 30 drops below a predetermined value due to condensation of steam which occurs in the supply line connected to steam inlet 44 when said inlet is connected to drain to permit the piston 29 to return to a valve closing position after being actuated to a valve opening position. Opening 46 is a threaded opening through which is threaded a manually operable valve actuating plunger 49 provided at its inner end with a head 50 for engagement with the piston 29. When it is desirable or necessary to effect manual opening of the "blow-off" valve 26, this may be accomplished by screwing the plunger 49 inwardly so that the head 50 will engage and force the piston 29 to a valve opening position against the resistance of spring 33. To facilitate operation thereof the plunger 49 is provided with handle means 51 at its outer end and is also threaded through a nut 52 which bears against the cylinder casing 31 and is provided with a suitable handle extension 53.

Unit C comprises a valve casing 55 provided with an upper steam inlet port 56, a lower drain port 57 and an intermediate port 58. Ports 56 and 57 open, respectively, into upper and lower chambers 59 and 60. Port 58 opens into a vertical passage 61 which connects the chambers 59 and 60, the upper end of passage 61 being provided with a valve seat 62 and the lower end of passage 61 being provided with a valve seat 63. Communication between chamber 59 and passage 61 is normally disrupted by a valve 65 which is closed against the valve seat 62 by a valve closing spring 66. Chamber 60 contains a normally open valve 67 which, at times, is closed against the seat 63 by moving a valve opening plunger 68 in a valve closing direction against the resistance of a spring 69 which is confined between the lower end of casing 55 and an enlargement 70 provided at the lower end of the plunger or stem 68. The plunger 68 is moved to a valve closing position against the resistance of spring 69 by means of an operating handle 71 which is pivoted to casing 55 as indicated at 72 and is provided with a valve operating finger or projection 73 engaging the enlargement 70 at the lower end of stem or plunger 68.

A stem 72*a* is interposed between the valves 65 and 67 so that, through the agency of said stem, the valve 65 is raised from its seat 62 when the valve 67 is closed against its seat 63. Steam inlet port 56 of control unit C is connected to receive steam from the locomotive boiler or any other suitable source while the intermediate port 58 of said unit is connected by pipe 75 to the steam inlet opening 44 of cylinder casing 31. When the component parts of control unit C are arranged as shown in Fig. 5, the steam inlet port 44 of cylinder casing 31 is connected to drain through pipe 75 and port 58, passage 61, and chamber 60 of control unit C. In these circumstances there is no steam pressure in the right hand end of cylinder 30 and the "blow-off" valve 26 is held closed by the spring 33. When it is desired to open the "blow-off" valve the handle 71 of control unit C is operated to close valve 67 and to open valve 65. This permits steam supplied to the inlet port 56 of unit C to flow through chamber 59, passage 61, and port 58 of unit C and through pipe 75 to the right hand end of cylinder 30 so that the steam pressure thus developed in the right hand end of said cylinder causes piston 29 to be moved to the left to open the "blow-off" valve 26.

In the use of this apparatus the units A and B are secured together by bolts 78 so that the "blow-off" passage 15*a* of unit B constitutes a continuation of the "blow-off" passage 5 of unit A. Unit A is provided at the entrance end 8 of "blow-off" passage 5 with a flange 80 which is adapted to be bolted to the locomotive boiler so that the entrance end of "blow-off" passage 5 registers with the boiler sludge discharge opening. Unit A is also provided with an attaching flange 80*a* which surrounds the discharge end 9 of passage 5 and is fastened by the bolts 78 to a flange 81 which surrounds the entrance end 18 of the "blow-off" passage 15*a* of unit B. The number and arrangement of the fastening bolts 78 and the bolt receiving openings provided in coupling flanges 80*a* and 81 of units A and B is preferably such that these units may be bolted together so that the axis of bore 17 of unit B extends in the same direction as the axis of bore 6 of unit A or in such manner that the axis of bore 17 extends in a direction at right angles to the direction of the axis of bore 6. The last mentioned arrangement is sometimes resorted to when it is necessary or desired that the discharge end of the complete "blow-off" passage conjointly provided by units A and B be directed at right angles to the inlet end of said passage. Assuming that "shut-down" valve 11 is in its normally open position and that "blow-off" valve 26 has been operated to open position either by the admission of steam to the right hand end of cylinder 30 or by operation of the emergency screw plunger 49, the direction of flow of sludge through the complete "blow-off" passage conjointly provided by units A and B will be substantially as represented by the ar-

rows in Fig. 2. Since there is no packing in the valve-stem guide **24**, a portion of the sludge will pass through this guide and into cylinder **30**. However, as the "blow-off" steam from the boiler passes through chamber **22** and bore **17** it expands and increases in velocity so that as this high velocity steam passes the discharge end of the ejector tube **35** it creates sufficient suction in the tube to withdraw therethrough the sludge which has entered cylinder **30** through valve-stem guide **24**. In practice it has been found that, with this arrangement, the valve-stem guide and the cylinder are kept sufficiently clear of accumulated sludge to prevent interference with the action of the valve **26** and the piston **29**.

When the valve **26** is in closed position the boiler pressure acting through the passage **5** of valve body A assists the spring **33** in holding the valve tightly against its seat **27**. It will be noted, however, the area of valve **26** is less than the area of piston **29**. Consequently, the boiler pressure acting to hold valve **26** in its closed position will not prevent the opening of this valve by the boiler pressure steam which is supplied to cylinder **30** to move piston **29** in a valve opening direction.

Any suitable packing may be arranged between the flanges **80***a* and **81** of the units A and B and, if desired, between flange **80** of unit A and the portion of the boiler to which said flange is secured.

Having thus described what I now consider to be the preferred embodiment of this invention it will be understood that various modifications may be resorted to within the scope and spirit of the appended claim.

Having thus described my invention, what I claim is:

"Blow-off" apparatus comprising a valve body provided with a bore having one end open and the other end closed by an end wall provided with a valve-stem guide which extends from one side of said wall toward the open end of said bore, a valve seat arranged in said bore between said valve stem guide and the open end of the bore, a second bore provided in said valve body and arranged to extend at an angle to said first mentioned bore, said second mentioned bore being open at both ends and having one end communicating with the first mentioned bore adjacent said end wall, an ejector tube arranged in said second mentioned bore with one end of the tube fitted in an opening in said end wall and the other end of the tube directed away from said first mentioned bore, a casing secured to said end wall to form a cylinder located at the side of said end wall remote from the valve-stem guide, the interior of said cylinder being in communication with said second mentioned bore through said tube, a piston working in said cylinder, a valve stem working in said valve-stem guide and having one end secured to said piston, a valve secured to the opposite end of said valve stem, biasing means normally holding said valve in a closed position against said seat and means for supplying steam to said cylinder to move said piston to a valve opening position against the resistance of said biasing means.

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