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VALVED INJECTOR NOZZLE

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This invention relates to a valved injector nozzle for injecting steam into the uptake elbow of a coking oven gas offtake to induce a draft for exhausting smoke and flame during periods in which, for example, the coking oven is being charged with coal.

More particularly it is directed to improvements in a steam injector nozzle of the type shown in United States Patent No. 2,343,034, issued February 29, 1944, to Fred A. Weber. As described in greater detail in this patent, such nozzles are permanently mounted in the uptake elbows of coking ovens and respectively have a steam injecting orifice which is closed by a stem-actuated plunger to prevent its becoming plugged with carbon during a carburizing operation of the coke oven when a steam induced draft is not required for removal of by-product gas. While such nozzles have proved eminently satisfactory for the purposes described in the patent, operational disadvantages have developed in use by reason of the fact that a shut-off valve is required in the line supplying steam to the nozzle which must be closed before the nozzle closure plunger can be inserted and retained in the nozzle orifice since the plunger will move out of the orifice under the pressure of steam if it is inserted before closure of the steam valve. With this arrangement, operators frequently neglect to actuate the nozzle plunger to closed position after closing the steam valve and, in such case, carbon clogging of the nozzle orifice will occur during the carburizing operation. Although such clogging can be cleared by ramming the closure plunger into the nozzle orifice, the force required for this purpose is of a nature which may damage the nozzle and render it inoperative.

One of the principal objects of this invention is to provide a steam injector nozzle which eliminates the necessity of the steam-line valve in the patented arrangement described generally above and thus eliminates nozzle orifice clogging incident to operator neglect. A further and related object is to provide a nozzle of this character with a steam valve and a closure plunger which is inserted in the nozzle orifice in response to operation of the steam valve to closed position. Another object is to provide the nozzle with a lever for simultaneously actuating the steam valve and orifice plunger and which indicates by its position whether the steam valve is in open or closed position.

Other objects and advantages of the invention will become apparent from the following description. In the drawings, there is shown a preferred embodiment of the invention. In this showing:

Figure 1 is a diagrammatic sectional view showing the manner in which the injector nozzle of this invention is applied to the uptake elbow of a coking oven gas offtake;

Figure 2 is an enlarged and detailed longitudinal sectional view of the valved nozzle shown in Figure 1;

Figure 3 is an end view looking from the left of Figure 2 but showing the operating lever in the position in which it is shown in Figure 1; and

Figure 4 is an end view of a mounting yoke which is used in the assembly shown in Figures 2 and 3.

Figure 1 of the drawings illustrated the conventional manner in which the vertical gas offtake 1 of a coking oven is connected with a gas collecting main 2 by an

uptake elbow 3. An injector nozzle, designated as a whole by the numeral 4, is permanently mounted in the lower end 5 of the elbow 3 in an angularly inclined position as shown in the drawings for injecting steam to induce a draft for exhausting smoke and flame from the offtake 1 as described in the above mentioned Weber patent. Generally stated, the nozzle is operated to inject steam into the uptake elbow 3 during periods when the coking oven connected to the offtake 1 is being charged with coal and, during other periods in the coking oven operation, a steam orifice in the nozzle 4 is closed by a stem actuated plunger in a manner to be described. The structure of the nozzle 4 and its manner of operation thus far described are the same as set forth in the Weber patent and form no part per se of this invention.

As best shown in Figure 2, the valved injector nozzle 4 of this invention comprises a housing 6 which is constructed to define an opening 7 which extends between opposite ends thereof and in which an operating stem 8 is mounted for axial movement in a manner to be described. The housing 6 is comprised of a cylindrical valve housing 9 and a cylindrical nozzle 10 which has a threaded connection at 11 to the valve housing 9. The nozzle 10 is restricted at its outer end to provide a nozzle orifice 12 and has a cylindrical opening 13 of larger diameter extending inwardly from the orifice 12 which forms a passage through which steam flows to such orifice. The valve housing 9 defines a cylindrical valve chamber 14 and has a laterally extending threaded opening 15 for connection to a steam line (not shown) and through which steam is admitted to the chamber 14. The orifice 12, steam passage 13 and chamber 14 are axially aligned with each other and respectively form part of the axially extending opening 7 referred to above.

A tapered valve 16 in the chamber 14 is formed on the stem 8 at a point intermediate the ends thereof for seating engagement with an annular tapered valve seat 17 on the nozzle 10 at the inner end of its passage 13 and which faces in an axial direction toward the valve chamber 14 and the valve 16. A spring 18 in the valve chamber 14 bears against the valve 16 and provides a bias for movement of the stem 8 in an axial direction to the right as viewed in Figure 2 to a closed position in which the valve 16 has seating engagement with the valve seat 17. In this closed position of the valve 16, the steam chamber 14 is disconnected with respect to the steam flow passage 13 to interrupt the flow of steam to the orifice 12.

The end portion 20 of the stem 8 which projects into the passage 13 has a diameter less than the diameter of the passage 13 so that it is ineffective to interfere with the flow of steam therethrough. It has a cylindrical plunger 21 on its outer end which is adapted to have a snug slide fit in the orifice 12 and a length such that the plunger 21 moves into the orifice 12 when the valve 16 is moved to its closed position engaging the valve seat 17. A plurality of lugs 22 project outwardly from the stem portion 20 and have sliding engagement with the internal surface of the passage 13 to guide the axial movement of the stem therein and to maintain it in a position of axial alignment in the opening 7.

The other end portion 23 of the stem 8 has a slide fit in the portion of the opening 7 which is formed in a threaded collar 24 of reduced dimension which projects axially outwardly at one end of the valve housing 9. A seal against leakage of steam from the chamber 14 is provided by sealing rings 25 which are held in position by a nut 26 threaded on the end of the collar 24. The end portion 23 of the stem 8 projects axially outwardly from the nut 26 to provide an operating part 27 for controlling the axial movement of the stem 8 in the opening 7.

Axial movement of the stem 8 in the opening 7 is controlled by a manually operable lever 28 which is connected with the operating part 27 and is mounted for rotational movement between the two angular operating positions which are spaced 180° apart as respectively shown in Figures 1 and 2. In the position of the lever 28 shown in Figure 2, the stem 8 has been actuated to the left against the biasing action of the spring 18 to move the valve 16 to open position and to withdraw the plunger 21 from the orifice 12 as illustrated. In the position of the lever 28 shown in Figures 1 and 3, the stem 8 is released for movement by its biasing spring 18 to the right as viewed in Figure 2 to its closed position in which the valve 16 is seated against the valve seat 17 and disconnects the valve chamber 14 from the flow passage 13 and in which the plunger 21 forms a closure for the orifice 12.

The mounting for the operating lever 28 on the valve housing 9 includes a yoke 29 which is comprised of a base plate 30, a cam plate 31, and a bridging member 32 connecting the plates 30 and 31 in axially spaced relation. The bridging member 32 is formed integrally with the cam plate 31, as shown in Figure 2, and has a welded connection to the base plate 30. As shown in Figure 4, the base plate 30 has a bifurcated construction to provide a pair of laterally spaced arms 33 which in the assembled position shown in Figure 2, straddle the inner end of the valve housing collar 24. A nut 34 threaded on the collar 24 has clamping engagement with the base plate 30 and its arms 33 to mount the yoke 29 on the housing 6. As shown in Figure 4, the cam plate 31 also has a bifurcated construction to provide a pair of laterally spaced arms 35 defining an opening 36 through which the operating part 27 of the stem 8 projects when the yoke 32 is in the assembled position shown in Figure 2. A wear plate 37 is fastened to the cam plate 31 to provide a camming surface 38 which extends transversely of the operating part 27.

The inner end of the lever 28 is bifurcated to provide a pair of laterally spaced cams 39. As shown in Figure 2, each of the cams 39 has a semi-circular camming surface 40 at its outer end and stop surfaces 41 and 42 along its side edges which are parallel to the lever 28. A pivot pin 43 extending through aligned openings in the cams 39 and the operating part 27 completes the rotatable connection of the lever 28 with the operating part 27 and its mounting on the valve housing 9. The axis of the pin 43 is parallel to the axis of the cam surfaces 40 but has an eccentric location with respect thereto such that it is positioned closer to the stop surface 42 than to the stop surface 41. The differences in the distances between the axis of the pin 43 and the stop surfaces 41 and 42 control the amount of opening movement imparted to the stem 8 upon rotation of the lever 28 between the positions shown in Figures 1 and 2.

In operation, rotation of the lever 28 to the position shown in Figure 2 is effective to open the valve 16 and clear the plunger 21 from the orifice 12. As the lever 28 is rotated to this position, the cam surfaces 40 slide over the cam surface 38 and the stem 8 is cammed outwardly against the action of its biasing spring 18. Final movement of the lever 28 into the position shown in Figure 2 causes the stop surfaces 41 to move into engagement with the cam surface 38 in such manner that the tension on the biasing spring 18 is effective to hold the lever 28 against movement out of this operating position. Return movement of the lever 28 to the position shown in Figures 1 and 3 results in movement of the stop surfaces 42 into engagement with the cam surface 38 and renders the spring 18 effective to move the stem 8 axially in the nozzle opening 7 to a position in which the valve 16 has seated engagement with the valve seat 17 and interrupts the flow of steam to the passage 13 and nozzle 12, and in which the plunger 21 is received in and forms a closure for the nozzle orifice 12. In this position, the spring 18 is of course effective to resist movement of the operating lever

28 out of the operating position shown in Figures 1 and 3. By reason of the fact that the operating lever 28 has two operating positions which are spaced apart by an angle of 180°, it will be apparent that it furnishes an indication to the operator of the operating condition of the injector nozzle. Attention is also directed to the fact that the specific arrangement of lever 28 and yoke 32 is effective to prevent heating of the lever 28 by the operating parts of the nozzle so that it can be operated by an operator without injury by burning.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. A valved injector nozzle comprising a housing having an axially extending opening which includes a valve chamber and a flow passage in adjoining relation, one end of said opening being restricted to provide a nozzle orifice at the outer end of said flow passage, an annular valve seat at the junction of said passage and chamber and facing in an axial direction toward said chamber, a valve in said chamber for engagement with said valve seat to disconnect said flow passage with respect to said chamber, an operating stem extending through said housing opening and movable axially with respect thereto, said valve being mounted on said stem at a point intermediate its ends for movement thereby to and from a position in seating engagement with said valve seat, a spring in said chamber biasing the movement of said valve and stem to a closed position in which said valve is engaged with said valve seat, a clean-out plunger on one end of said stem received in said orifice with a snug slide fit when said valve is in its seated position, the other end of said stem projecting outwardly from said housing at the outer end of said chamber and providing an operating part, and means for manually actuating said operating part to move said stem and valve axially from said position against the action of said biasing spring to unseat said valve and withdraw said plunger from said orifice.

2. A valved injector nozzle comprising a housing having an axially extending opening which includes a valve chamber and a flow passage in adjoining relation, one end of said opening being restricted to provide a nozzle orifice at the outer end of said flow passage, an annular valve seat at the junction of said passage and chamber and facing in an axial direction toward said chamber, a valve in said chamber for engagement with said valve seat to disconnect said flow passage with respect to said chamber, an operating stem extending through said housing opening and movable axially with respect thereto, said valve being mounted on said stem at a point intermediate its ends for movement thereby to and from a position in seating engagement with said valve seat, a spring in said chamber biasing the movement of said valve and stem to a closed position in which said valve is engaged with said valve seat, a clean-out plunger on one end of said stem received in said orifice with a snug slide fit when said valve is in its seated position, the other end of said stem projecting outwardly from said housing at the outer end of said chamber and providing an operating part for moving said stem and valve against the action of said biasing spring, and means for actuating said part comprising a pivot pin extending transversely of and connected with said operating part, a semi-circular cam having an eccentric connection with said pin for rotation through an angle of 180°, and a lever for manually rotating said cam.

References Cited in the file of this patent

UNITED STATES PATENTS

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1,661,150	Birkenmaier	Feb. 28, 1928
2,343,034	Weber	Feb. 29, 1944