No. 662,460. Patented Nov. 27, 1900.

H. T. NICE.

INJECTOR.

(Application filed Sept. 7, 1899.)

(Model.) 2 Sheets—Sheet 1.

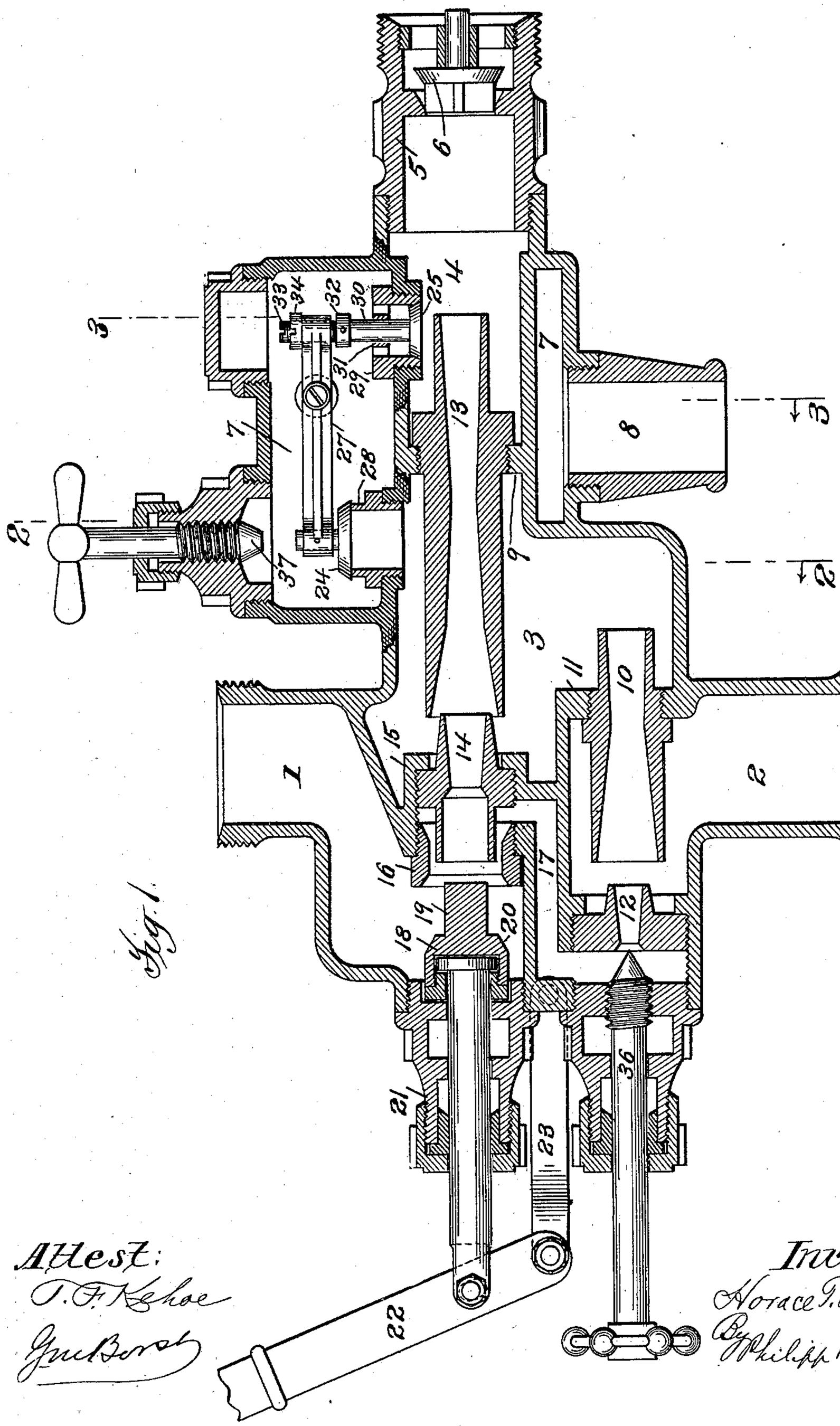

Fig. 1.

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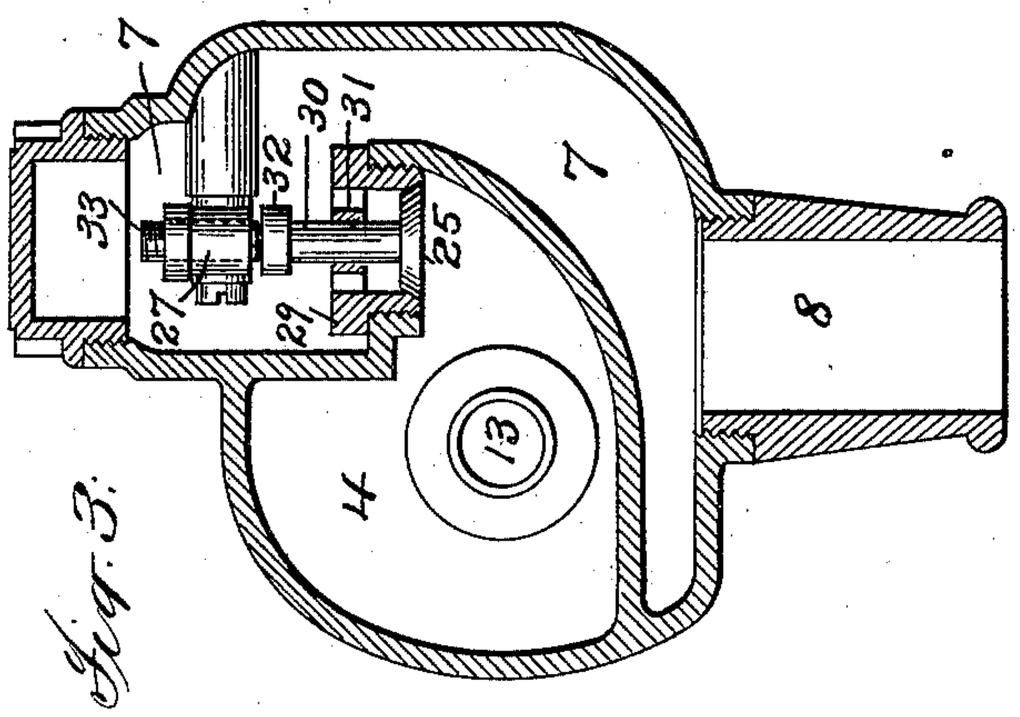

Fig. 3.

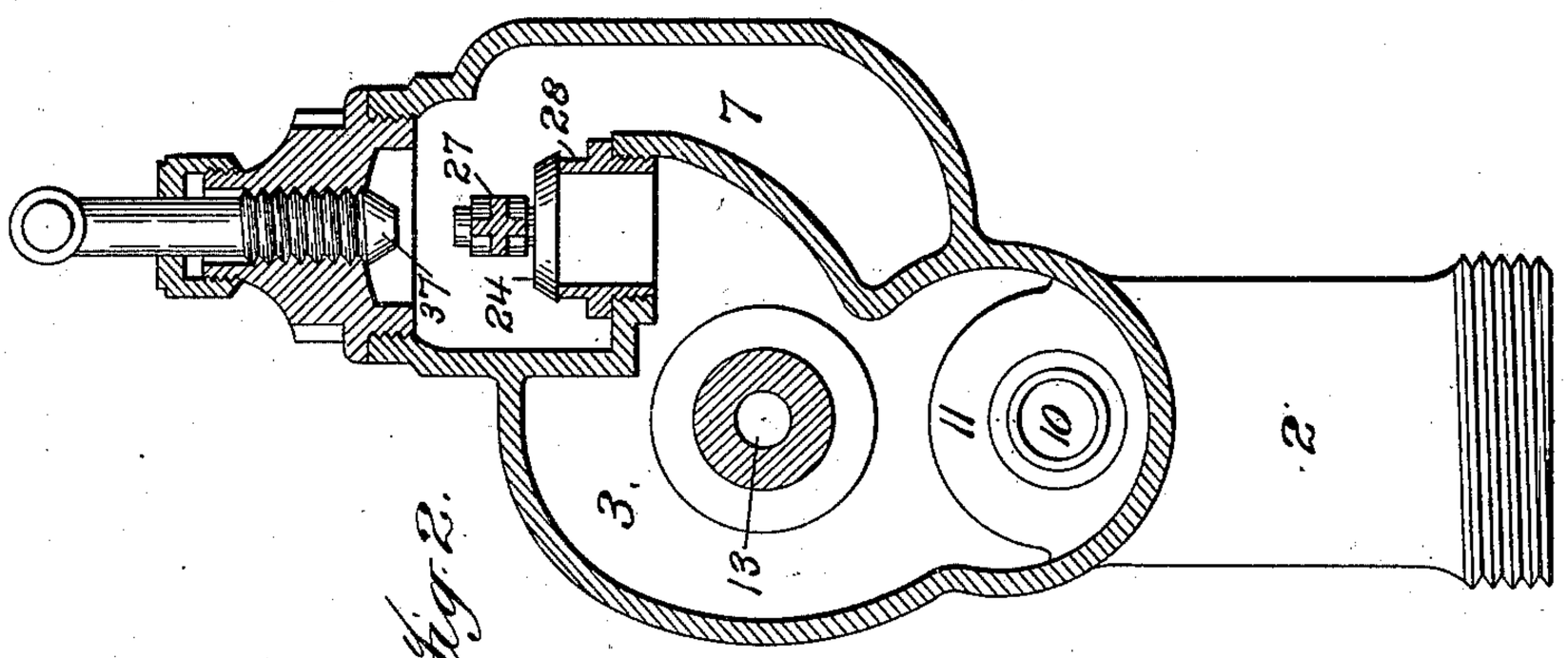

Fig. 2.

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UNITED STATES PATENT OFFICE.

HORACE T. NICE, OF WADSWORTH, OHIO.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 662,460, dated November 27, 1900.

Application filed September 7, 1899. Serial No. 729,690. (Model.)

To all whom it may concern:

Be it known that I, HORACE T. NICE, a citizen of the United States, residing at Wadsworth, county of Medina, and State of Ohio, have invented certain new and useful Improvements in Injectors, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to improvements in injectors, and particularly to valve mechanism therefor, it being the object of the present invention, generally stated, to provide an injector capable of handling extremely hot water, such as required for locomotive use, and which will operate and maintain the stream or jet of steam-forced water under extreme conditions of feed-water and steam.

The improvements of the present invention are applicable to injectors of both the single and double jet types; but as they have been designed with particular reference to injectors of the double-jet type and as they have peculiar advantages in such injectors they will for convenience be hereinafter described in detail in that connection, it being understood, however, that the invention, broadly considered, is not to be so limited.

In the accompanying drawings, Figure 1 is an irregular sectional elevation of an injector of the double-jet type embodying the present invention, parts being broken away, so as to include in this view the overflow valve mechanism of the injector, to which the present invention particularly relates. Fig. 2 is a cross-section on the irregular line 2 of Fig. 1, and Fig. 3 is a cross-section on the irregular line 3 of said figure.

Referring to said drawings, 1 represents the steam-inlet, 2 the water-inlet, and 3 the water-chamber, these parts being located on the receiving side of the injector. On the delivery side of the injector is the delivery-chamber 4, to which is removably connected a boiler connection 5, containing the ordinary check-valve 6. The water-chamber 3 and delivery-chamber 4 communicate through overflow-openings with an overflow-outlet 7, terminating in a waste-nozzle 8, leading to the atmosphere. The water and delivery chambers 3 4 are, as will be observed, separated by a vertical partition 9, and each communicates independently of the other and directly with the overflow-outlet 7, the primary overflow entering an outlet from chamber 3 and the secondary overflow from chamber 4.

The water-inlet 2 and water-chamber 3 (the injector shown being of the double-jet type) are connected by a lifter-tube 10, secured in a screw-threaded opening in the partition 11, separating said inlet and chamber, said lifter-tube being provided with a steam-nozzle 12, similarly secured in position in the injector-casing. The water-chamber 3 and delivery-chamber 4 are connected by a forcer-tube 13, secured in the partition 9, these two chambers being closed to each other, except through this forcer-tube. The forcer-tube 13 is also provided with a steam-nozzle 14, secured in a screw-threaded opening in the partition 15, separating the water-chamber 3 from the steam-inlet 1, and inclosed at its tubular receiving end, which opens into the steam-inlet 1 by a valve-seat ring 16, similarly secured in the injector-casing, there being provided between said valve-seat ring 16 and the tubular receiving end of the steam-nozzle 14 an annular space forming a continuation of the passage 17, through which the lifter steam-nozzle 12 communicates with the steam-inlet 1. Communication between the lifter and forcer steam-nozzles 12 14 is controlled by a spindle-valve 18, provided with a plug 19, adapted to enter the tubular receiving end of the forcer steam-nozzle 14, and with a shoulder 20, adapted to engage a correspondingly-shaped seat formed in the valve-seat ring 16, the spindle of this valve projecting through a stuffing-box 21, secured to the injector-casing, and being connected by a pin-and-slot connection to a hand-lever 22, fulcrumed in a bracket 23, secured to the injector-casing. The plug 19 and shoulder 20 of the valve 18 and the forcer steam-nozzle 14 and valve-seat ring 16 are so constructed and arranged relatively to each other that during the first part of the rearward movement of the hand-lever 22 the shoulder 20 will be withdrawn from its seat against the valve-seat ring 16, thereby opening communication between the steam-inlet 1 and the lifter steam-nozzle 12. The plug 19 of the valve, however, still remains in the tubular receiving end of the forcer steam-nozzle 14 and shuts off communication between that

nozzle and the steam-inlet, communication between the forcer steam-nozzle 14 and steam-inlet 1 not being established until the hand-lever 22 has been moved to substantially its rearmost position and the hand-lever not being so moved until after the lifter has been established, or, in other words, until the water-chamber 3 has been supplied by the operation of the lifter with the required quantity of water for the operation of the forcer.

The overflow-openings from water-chamber 3 and delivery-chamber 4 are provided with overflow-valves 24 25, respectively, adapted to be actuated, respectively, by the primary overflow from chamber 3 and by the steam-forced water in delivery-chamber 4 as the forcer is established, each of these valves when so actuated in turn actuating the other through connections which will now be described. These connections consist of a lever 27 of the first class fulcrumed in the injector-casing, the primary overflow-valve 24 being preferably connected to one end of this lever and the connection being sufficiently loose to insure proper seating of the valve. The secondary overflow-valve 25 is preferably disconnected from the opposite end of the lever 27, but occupies such a position relatively thereto that as said valve 25 is closed by the pressure of the steam-forced water in the delivery-chamber 4 it will engage that end of the lever 27, and thereby rock said lever and close the primary overflow-valve 24, and when the latter valve is opened by the primary overflow from water-chamber 3 valve 25 will in turn be opened by the lever 27. The valves 24 25 rest against valve-seat rings 28 29 in the overflow-openings.

When, as in the present case, the valve 25 is disconnected from the lever 27, its stem 30, which passes through a guide 31 in the valve-seat ring 29, will preferably be provided at its upper end with a collar 32, which by engagement with the upper side of said guide 31 will limit the downward movement of said valve 25. By means of these connections the primary overflow-valve 24 is closed and held closed positively by the pressure on the delivery side of the injector and is not affected by variations which may occur in the pressure or temperature of steam or water on the receiving side of the injector. This is of peculiar advantage in double-jet injectors, as in such injectors the overflow valve mechanism when closed is constantly subjected to the pressure of the lifter, which has a tendency to unseat the overflow valve or valves.

Means are provided whereby the relative positions of the valves 24 25 and lever 27 may be adjusted to compensate for wear in any of these parts or for other purposes, the means employed preferably consisting of a set-screw 33, threaded in the end of the lever 27 and engaging and engaged by valve 25, which set-screw may be adjusted to any desired position with relation to valve 25 and held in such adjusted position by a jam-nut 34.

As the pressure on the receiving and delivery sides of the injector at starting and restarting are equal and as the pressure on the delivery side when the forcer is established is many times in excess of that on the receiving side, it is necessary that overflow-valves 24 25 should be so constructed or arranged relatively to each other that the valve 24 may be opened and held open (the valve 25 being also held open thereby) by the primary overflow against the pressure on the delivery side of the injector until the forcer is established and be closed and held closed by the valve 25 when the forcer is established against the pressure on the receiving side of the injector. Heretofore in injectors employing two overflow-valves on opposite sides of the injector it has been necessary in order that the valves may be operated in turn and at the proper time to vary the sizes of the two valves relatively to each other, or, in other words, to make the secondary overflow-valve smaller in area than the primary overflow-valve, and in addition to this to make the valves and their overflow-openings of sufficient size to permit the proper amount of overflow to establish the lifter and forcer. This has been difficult, as it has not always been found possible to construct the valves so as to meet both of these conditions, as it frequently happens that the valves, though of the proper size relatively to each other, are not each of the proper size for the amount of overflow required, and vice versa. In double-jet injectors this difficulty is particularly serious, as in such injectors the primary valve is constantly subjected to the pressure of the lifter, which has a tendency to unseat it. This difficulty is entirely overcome in the present case by the provision of the lever 27, which in addition to the advantage before referred to of causing the primary overflow-valve 24 to be held closed positively by the valve 25 against the pressure on the receiving side of the injector and variations in such pressure has the further important advantage that by its employment the primary and secondary overflow-valves may be constructed without reference to the relative pressures on opposite sides of the injector and solely with reference to the amount of overflow required. To adapt the valves 24 25, which, as shown, are substantially of the same area, to the pressures on opposite sides of the injector, the lever 27 is fulcrumed at one side of its center and toward the valve 25, the position of the fulcrum being determined by the relative areas of the valves 24 25. With the fulcrum in this position the valve 24, and through it the valve 25, is readily opened and held open by the primary overflow until the establishment of the forcer, when it is closed and held closed by the valve 25, actuated by the pressure of the steam-forced water on the delivery side of the injector.

The operation of the apparatus is as follows: Normally the secondary overflow-valve 25 will

be in its lowermost position, which it assumes by gravity when disconnected from the lever 27, as in the present case, so that the injector-casing is open to the atmosphere, and thus cooled. Normally also the valve 18 is in engagement with the valve-seat ring 16 and forcer steam-nozzle 14, thus shutting off communication between the forcer and lifter steam-nozzles 12 14 and the steam-inlet 1. To start the apparatus, the hand-lever 22 is moved to the left, Fig. 1, sufficiently to disengage the shoulder 20 of said valve from the valve-seat ring 16, thus opening communication between the steam-inlet 1 and the lifter steam-nozzle 12. Communication still remains cut off, however, between the steam-inlet and the forcer steam-nozzle by the plug 19. The steam passing through the lifter steam-nozzle 12 and lifter-tube 10 will enter the water-chamber 3 and raising the valve 24 will pass into the overflow-outlet 7, and thence to the atmosphere through the nozzle 8. As soon as water appears at the outlet 8 or it is otherwise indicated to the attendant that the injector is supplied with the proper quantity of water he will move the hand-lever 22 to its rearmost position, thus opening communication between the steam-inlet 1 and forcer steam-nozzle 14. Steam passing through the forcer-tube 13 will enter the delivery-chamber 4 and at first escape through the overflow-opening therein, the valve 25 being maintained in its open position through the lever 27 by the valve 24. As soon as the jet of steam-forced water is established through the forcer 13 the pressure in delivery-chamber 4 will be so increased as to raise the valve 25, and thus arrest the overflow from that chamber and at the same time through the lever 27, which the valve 25 engages when it is thus moved, close the valve 24, and thus arrest the overflow from the water-chamber 3. So long as the jet is maintained the valve 24 and valve 25 will be maintained in their closed position positively by the pressure in the delivery-chamber 4, no matter what change in pressure may take place in the water-chamber 3. Should the injector "break" or "fly off," the pressure in the delivery-chamber 4 and in the water-chamber 3 will become equalized and the overflow from both again opened by the opening of the valve 24 and through the lever 27 of the valve 25. The valves 24 and 25 will remain in this open position, as in starting, until the proper conditions are reëstablished in the injector-casing, when the injector will automatically restart. To stop the operation of the apparatus, all that is necessary to be done is to move the steam-valve 18 into position to shut off communication between both the lifter and forcer steam-nozzles and the steam-inlet 1.

The injector will preferably be provided with a spindle-valve 36 for regulating the supply of steam to the lifter steam-nozzle 12. It will also preferably be provided with a valve 37 for engaging and locking the overflow-valve 24 in closed position, so that the steam admitted to the injector may be forced down the water-inlet 2 for the purpose of heating the water-supply.

What I claim is—

1. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of lever connections between the valves, substantially as described.

2. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of a lever of the first class between the valves, substantially as described.

3. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of a lever of the first class between the valves, the fulcrum thereof being located at one side of its center and toward the secondary overflow-valve, substantially as described.

4. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of adjustable connections between the valves, substantially as described.

5. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of adjustable lever connections between the valves, substantially as described.

6. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of a lever of the first class between the valves but disconnected from one of them, and adjustable engaging means between said lever and said valve, substantially as described.

7. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of a lever of the first class between the valves but disconnected from the secondary valve, and adjustable engaging means between said lever and said valve, substantially as described.

8. In an injector, the combination with a primary overflow-valve adapted to be opened by overflow on the receiving side of the injector and a secondary overflow-valve adapted to be closed by the pressure of the delivery side as the forcer is established, of a lever of the first class between the valves but disconnected from the secondary valve, and adjustable means borne by the lever for engaging said valve, substantially as described.

9. The combination with water-chamber 3 and delivery-chamber 4, of overflow-valves 24, 25, and lever 27 between said valves, substantially as described.

10. The combination with water-chamber 3 and delivery-chamber 4, of overflow-valves 24, 25, and lever 27 between said valves and having its fulcrum at one side of its center and toward the valve 25, substantially as described.

11. The combination with water-chamber 3 and delivery-chamber 4, of overflow-valves 24, 25, and lever 27 between said valves, the valve 25 being disconnected from but adapted to engage said lever, substantially as described.

12. The combination with water-chamber 3 and delivery-chamber 4, of overflow-valves 24, 25, and lever 27 between said valves, the valve 25 being disconnected from but adapted to engage said lever, and said lever being provided with set-screw 33, substantially as described.

13. The combination with water-chamber 3 and delivery-chamber 4, of overflow-valves 24, 25, and lever 27 between said valves, the valve 25 being disconnected from but adapted to engage said lever, the fulcrum of said lever being at one side of its center and toward the valve 25, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HORACE T. NICE.

Witnesses:
CHAS. AMMERMAN,
W. H. NICE.