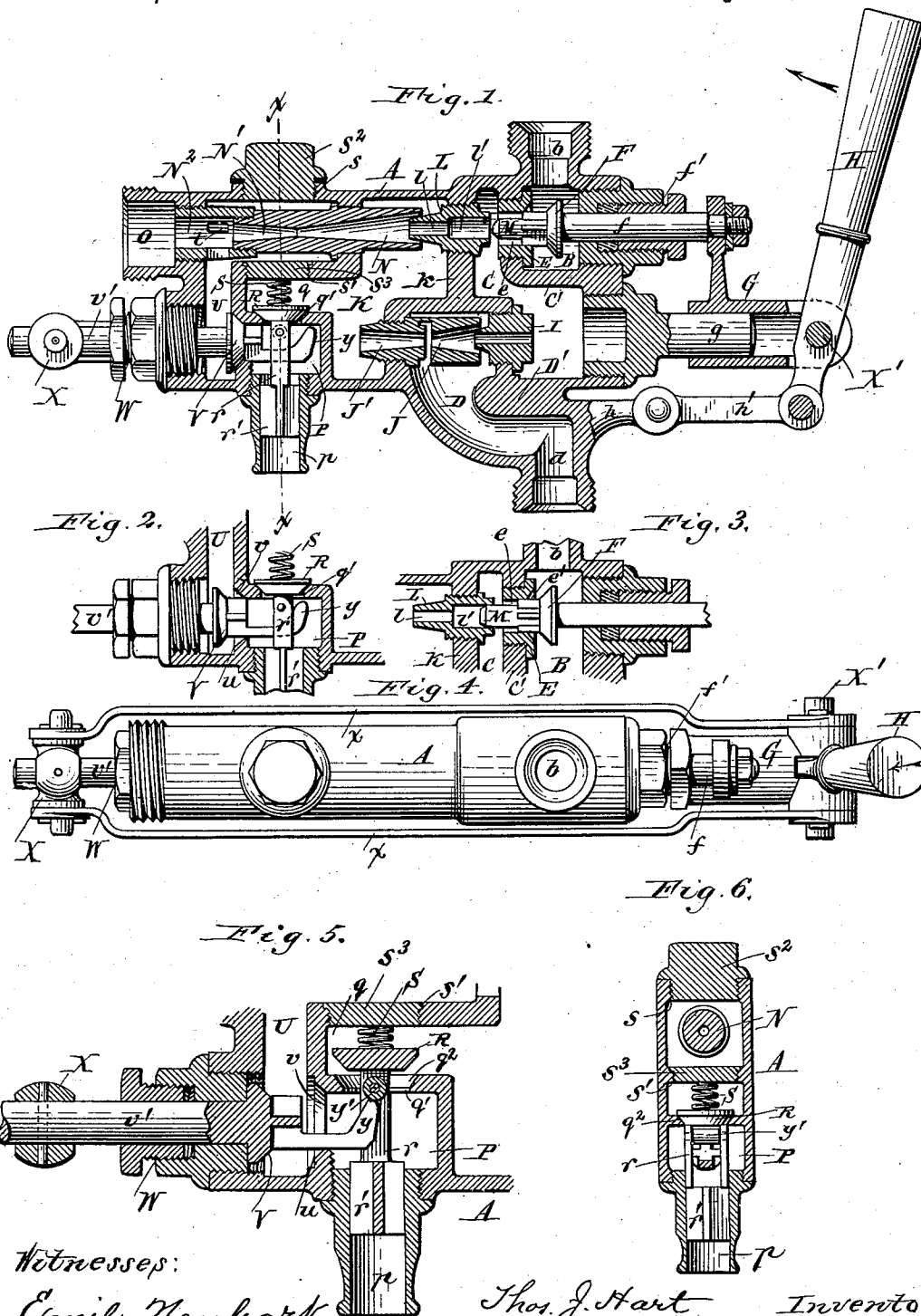


(Model.)

T. J. HART.
INJECTOR.

No. 474,991.

Patented May 17, 1892.



Witnesses:

Emil Neuhart.
Friedrich, Gustav, Wilhelm

Thos. J. Hart Inventor.
By Wilhelm O'Donnell.
Attorneys.

UNITED STATES PATENT OFFICE.

THOMAS J. HART, OF BUFFALO, NEW YORK, ASSIGNOR TO THE SHERWOOD MANUFACTURING COMPANY, OF SAME PLACE.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 474,991, dated May 17, 1892.

Application filed August 5, 1891. Serial No. 401,764. (Model.)

To all whom it may concern:

Be it known that I, THOMAS J. HART, a citizen of the United States, residing at the city of Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Injectors, of which the following is a specification.

This invention relates to that class of injectors commonly known as "duplex" injectors and which are provided with two sets of steam-nozzles and combining and delivery tubes, the steam-valves of which are controlled by a single hand-lever.

The objects of my invention are to utilize the pressure of the fluid for reliably closing the primary overflow-valve and to simplify the mechanism for operating the same.

In the accompanying drawings, Figure 1 is a longitudinal sectional elevation of my improved injector, showing the position of the parts after the injector is started. Fig. 2 is a fragmentary longitudinal section of the injector, showing the primary overflow-valve closed and the secondary overflow-valve open. Fig. 3 is a similar view showing the primary steam-valve open and the secondary steam-valve closed. Fig. 4 is a top plan view of the injector. Fig. 5 is a fragmentary longitudinal section of the injector, on an enlarged scale, showing the overflow-valves open. Fig. 6 is a cross-section in line *xx*, Fig. 1.

Like letters of reference refer to like parts in the several figures.

A represents the shell or inclosing casing of the injector, which is preferably cast in one piece in the ordinary manner.

b is the steam-inlet, connecting with a primary steam-chamber B, arranged in the upper front portion of the shell.

C is a secondary steam-chamber arranged below the primary steam-chamber B and separated from the latter by an angular diaphragm C'.

d is the water-inlet, connected with a primary water-chamber D, arranged in the lower portion of the shell behind the secondary steam-chamber and separated from the latter by a diaphragm D'.

E is a screw-plug secured in a threaded opening formed in the vertical portion of the angular diaphragm C' and having through

its center a steam-passage *e* and at its front end a valve-seat *e'*.

F is a primary conical steam-valve arranged in front of the valve-seat *e'* and controlling the admission of steam to the secondary steam-chamber C. This valve is secured to the inner portion of a valve-stem *f*, which passes through a stuffing-box *f'*, closing the open outer end of the primary steam-chamber B. The valve-stem *f* is secured to a sliding yoke or head G, which is guided upon a rod or stud *g*, projecting from the front end of the shell and is actuated by a hand-lever H. The latter is pivoted at its lower end to the yoke G and has its lower end pivotally connected with a projecting arm *h* of the shell by a link *h'*, so that upon shifting the hand-lever in one or the other direction the primary steam-valve is opened or closed.

I is a primary steam jet or nozzle secured in an opening formed in the front wall D' of the water-chamber and having the usual axial passage for the steam.

J is a combining-tube arranged in the water-chamber D, axially in line with the steam-jet I, and J' is a delivery-tube arranged in rear of the combining-tube in a well-known manner and opening into a secondary water chamber or passage K, arranged in rear of the secondary steam-chamber and the primary water-chamber D and which receives water from the latter. These combining and delivery tubes and the steam-jet may be of any common construction. The secondary water and steam chambers are separated by a diaphragm *k*. The primary steam-jet I with its combining and delivery tubes J J constitute the water-lifting devices of the injector.

L is a secondary steam jet or nozzle located behind the primary steam-chamber B and having a central steam-passage *l* arranged in line with the passage of the screw-plug E. The steam-jet L projects into the upper portion of the secondary water-chamber and is provided in its rear portion with an enlarged cylindrical cavity or valve-seat *l'*. M is a secondary cylindrical steam-valve adapted to enter the cylindrical valve-seat *l'* and formed on or secured to the valve-stem *f* in advance of the primary steam-valve F, so as to move simultaneously with the latter.

N is a secondary combining-tube arranged in rear of the secondary steam-jet L, axially in line therewith and communicating at its rear end with the secondary water-chamber.

5 N' is a delivery-tube arranged in rear of the combining-tube in the ordinary manner and preferably provided at its front end with a tubular extension N², which opens into the outlet branch O, from which the water is conducted to the boiler. The secondary steam-jet L with its combining and delivery tubes N N' constitute the forcing devices of the injector.

10 P indicates an overflow-chamber arranged in the rear portion of the injector behind the secondary water-chamber K, and p is the exit through which the excess of water escapes from said chamber in starting the injector.

q is a rearward extension of the secondary water-chamber K, and q' is an aperture or passage formed in the upper wall of the overflow-chamber P and connecting the latter with the secondary water-chamber.

20 q² is a valve-seat formed at the upper end of the passage q', and R is a primary overflow valve arranged within the chamber extension q opposite the valve-seat q² and controlling the admission of water into the overflow-chamber. This valve is provided with a stem r, having wings r' at its outer end, whereby it is guided in the tubular exit p of the overflow-chamber. The primary overflow-valve and its seat are preferably conical, as shown. The valve is forced against its seat by the pressure of the fluid in the secondary water-chamber bearing against the flat back of the valve. A seating-spring S is preferably employed in addition to the fluid-pressure for pressing the valve against its seat when the injector is inverted or placed in any other position in which the valve would be liable to open by gravity. The primary overflow-valve R is inserted and removed through openings s s', formed, respectively, in the upper wall of the chamber extension q and the shell of the injector, in line with each other, and closed by screw-plugs s² s³, the extension N² and the secondary combining and delivery tubes N N' being first removed to afford access to the inner screw-plug s³ and the primary overflow-valve.

t are openings formed in the extension of the secondary combining-tube N' near the rear end thereof.

35 u is an opening formed in the rear wall of the overflow-chamber P, and U is a passage leading from the openings of the secondary combining-tube to the opening in the rear wall of the overflow-chamber.

60 v is a valve-seat, preferably conical, formed at the inner end of the opening u, and V is a secondary overflow-valve of corresponding form, adapted to close against said seat for shutting off the flow of water from the passage U to the overflow-chamber P. This valve is attached to a stem v', which passes through a stuffing-box W, secured in an opening in

the rear end of the injector or shell. The secondary valve is connected with the hand-lever by links or connecting-rods x x, attached at their rear ends to a cross-head X, secured to the projecting portion of the valve-stem v' and at their opposite ends to the cross pin or head X', whereby the hand-lever is pivoted to the yoke. By this connection the secondary overflow-valve is moved toward its seat at the same time that both steam-valves are moved away from their seats, and vice versa.

70 y is a cam or finger connected with the secondary overflow-valve V for opening the primary overflow-valve and holding the same in an open position. The stem of the primary overflow-valve is bifurcated and provided with an anti-friction roller y', against which the incline of the cam y bears in opening the valve. The carrying-arm of the cam passes between the jaws of the bifurcated valve-stem, and the cam stands in front of the anti-friction roller and clears the latter when the secondary overflow-valve is closed. Upon shifting the hand-lever inwardly in the direction of the arrow the secondary overflow-valve recedes from its seat and carries the cam y with it. Thereafterward movement of the cam causes the anti-friction roller of the primary overflow-valve to ride up the incline of the cam, the rearward movement of the cam being arrested when its nose reaches the under side of the roller, so as to support and hold the primary overflow-valve in an open position. Upon shifting the hand-lever in the opposite direction the cam is caused to move forwardly, allowing the anti-friction roller to ride down the incline of the cam and permitting the valve to be closed against its seat by its spring and the pressure of the fluid in the secondary water-chamber. The movements of the primary and secondary overflow-valves are so timed relatively to the steam-valves that in shifting the hand-lever to start the injector the primary overflow-valve is closed a short interval in advance of the secondary steam-valve and the secondary overflow-valve is closed a short interval after the secondary steam-valve is opened. Before admitting steam to the injector the hand-lever is moved inwardly to the limit of its movement. This movement closes both steam-valves F and M, opens the secondary overflow-valve V, and causes the cam of the latter to open the primary overflow-valve R, as represented in Figs. 2 and 5.

120 In starting the injector the hand-lever is shifted to the outward extremity of its stroke. The first part of this outward movement opens the primary steam-valve F, but leaves the secondary steam-valve M closed, as represented in Fig. 3, thus admitting steam to the secondary steam-chamber and the primary steam-jet I and causing the latter to lift the water into the primary water-chamber D and force it through the primary combining and delivery tubes J J' into the secondary water or connecting chamber K and from the latter

through the passage *q* into the overflow-chamber *P*, from which it is finally discharged through the exit *p*. As soon as the water overflows by passing the primary overflow-valve the latter is released from the cam and closed by the water-pressure in the secondary water-chamber, as represented in Fig. 2, thereby preventing the further escape of the water from said chamber. The continued outward movement of the hand-lever next opens the secondary steam-valve, as represented in Fig. 1, and admits a portion of the incoming steam to the secondary steam-jet *L*, thereby raising the water in the secondary water-chamber, forcing it through the secondary combining and delivery tubes *N N'*, and causing it to overflow through the aperture *t*, passages *U* and *u*, overflow-chamber *P*, and exit *p*. Immediately after the second overflow of water occurs the secondary overflow-valve is closed by the final portion of the outward movement of the hand-lever, as shown in Fig. 1, thus cutting off the further escape of the water through the overflow-chamber *P* and causing the water to be directed through the outlet *O* and into the boiler. The cam carried by the secondary overflow-valve has sufficient dead or lost movement to hold the primary valve open the required length of time before releasing it. By so arranging the primary overflow-valve that it is kept closed by the fluid-pressure in the secondary water-chamber the latter chamber is instantly and reliably cut off from the overflow-chamber as soon as the first spurt or overflow of water takes place in starting the injector, thereby reducing to a minimum the interval during which the overflow-passage is open and obviating unnecessary leakage of water. The seating-spring *S*, in addition to its function of closing the primary overflow-valve *R* in all positions of the injector, also serves to hasten the closing action of said valve.

45 The mechanism for holding the primary valve in an open position and suddenly releasing and closing it is very simple and not liable to get out of order.

I claim as my invention—

50 1. In an injector, the combination, with a

steam-inlet and water lifting and forcing devices, of a water-inlet and a water-chamber, an overflow passage or chamber connected with the water-chamber, an overflow-valve applied to said overflow-passage and closed by the fluid-pressure in the water-chamber, and a cam or lifting-finger whereby the overflow-valve is opened, substantially as set forth.

2. In an injector, the combination, with a steam-inlet, a steam-jet, and a water-delivery device, of a steam-valve controlling the supply of steam to the steam-jet, a hand-lever for operating said valve, a water-inlet and a water-chamber, an overflow passage or chamber connected with the water-chamber, a valve applied to said overflow-passage and closed by the fluid-pressure in the water-chamber, and a cam holding the valve in an open position and operated from the hand-lever of the steam-valve, substantially as set forth.

3. In an injector, the combination, with the primary and secondary steam-chambers and a passage connecting the same, of a water-inlet and a primary water-chamber having a primary steam-jet and a delivery device, a secondary water-chamber having a secondary steam-jet and a delivery device, connected primary and secondary steam-valves applied, respectively, to the secondary steam-jet and the connecting-passage of the steam-chambers, a hand-lever for operating said valves, an overflow-chamber having passages whereby it communicates with the secondary water-chamber and the delivery device of said chamber, a primary overflow-valve applied to one of said passages and closed by the fluid-pressure in the secondary water-chamber, a secondary overflow-valve applied to the other passage and operated from the hand-lever of the steam-valves, and a cam or finger connected with said secondary overflow-valve and closing the primary overflow-valve, substantially as set forth.

Witness my hand this 1st day of August, 1891.

THOS. J. HART.

Witnesses:

THEO. L. POPP,
CARL F. GEYER.