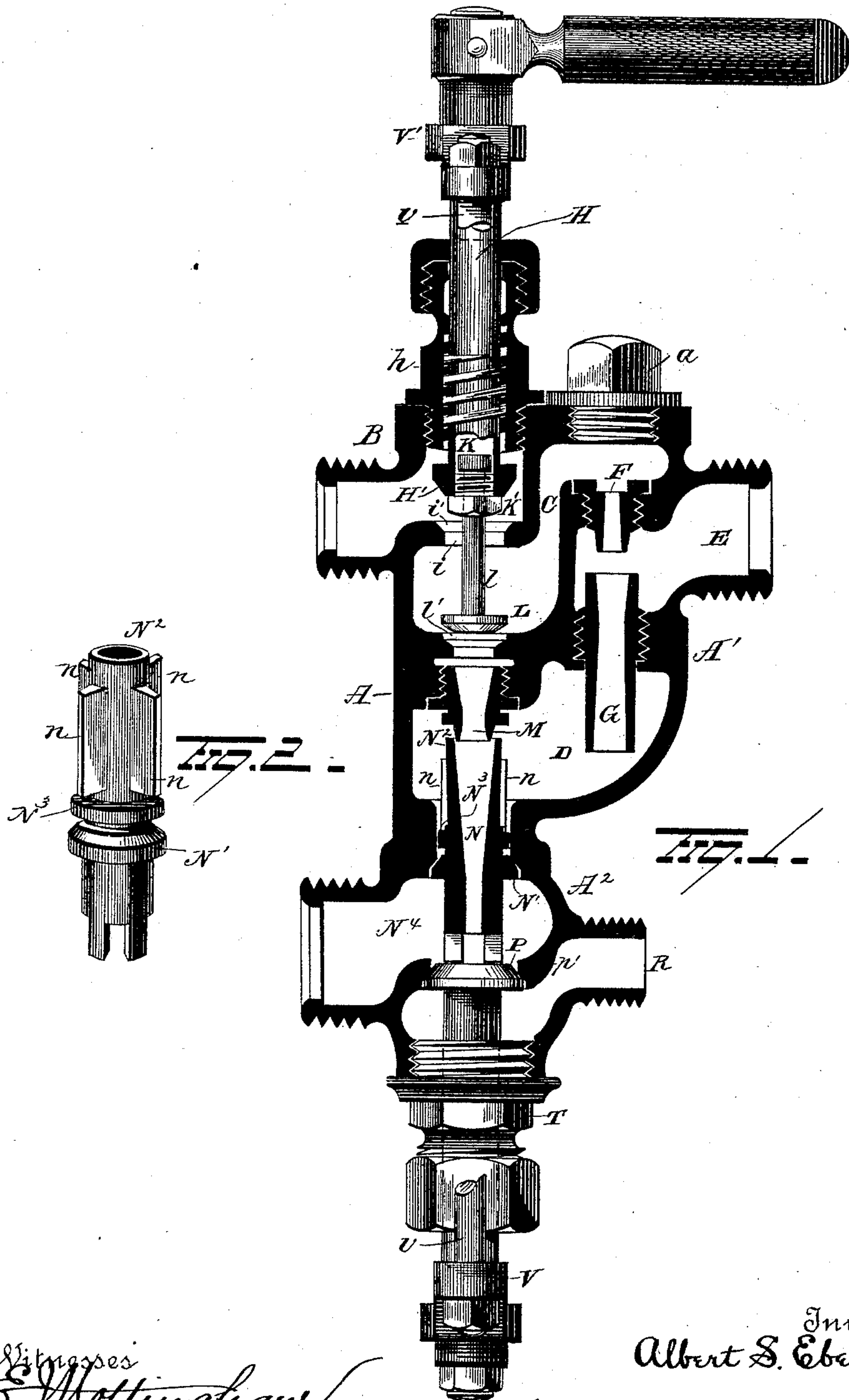


(No Model.)

A. S. EBERMAN.  
INJECTOR.

No. 440,624.

Patented Nov. 18, 1890.



Witnesses  
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# UNITED STATES PATENT OFFICE.

ALBERT S. EBERMAN, OF BALTIMORE, MARYLAND.

## INJECTOR.

SPECIFICATION forming part of Letters Patent No. 440,624, dated November 18, 1890.

Application filed April 11, 1890. Serial No. 347,497. (Model.)

*To all whom it may concern:*

Be it known that I, ALBERT S. EBERMAN, of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Injectors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in injectors, and is designed more particularly as an improvement on the construction disclosed in United States Patent No. 288,039, granted to me November 6, 1883, the object being to simplify the construction disclosed in said patent by dispensing with the spring therein and making the entire casing of a single casting.

With these ends in view my invention consists in certain details in construction and combinations of parts, as will be more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view, partly in elevation and partly in longitudinal section, of my improved injector; and Fig. 2 is a detached perspective view of the combined by-pass valve and injector-nozzle or combining-tube.

A indicates the main shell or casing, having on one side, at the top, a branch B for connection with a steam-pipe and on the opposite side a projection A', in which are formed steam and water passages C and D, and from which projects a branch E for connection with a water-supply pipe, which may lead from a well, tank, or other suitable water-source. The branch E connects with the steam-passage C through a steam-jet nipple F above and with the water-passage D through a nozzle G, below said branch, this nipple and nozzle being screwed into seats formed for them in such position that their bores are at right angles to the branch. At the top of the projection A' is formed an opening through which the nipple F and nozzle G may be passed for placing them in or removing them from their proper positions, this opening being normally closed by a screw-plug a. At the top of the main portion of the casing A is an opening in which is screwed an internally-threaded sleeve h, in which is fitted a correspondingly-threaded main valve-stem H',

which carries at its lower end a valve H, arranged to control a passage i, which connects the steam-supply branch B with the interior of the casing A and with the passage C. Around this passage i is formed a seat i' for said valve. Through the center of valve H and into its stem is formed a socket or chamber K, in the lower portion of which is screwed a centrally-bored plug K', through which is loosely arranged the upper portion of a stem l, which is provided at its top with a head to keep it from falling through the plug, and carries at its lower end a valve L, arranged to fit a seat l' formed for it in the main casing at the lower side of the intersection of the passage C. Directly under the valve-seat l' is arranged a steam-nozzle M, the lower end of which projects partially across the inner opening of the passage D. Immediately below the steam-nozzle M is arranged a sliding combined injector or discharge nozzle or combining-tube N and by-pass valve N', which is a centrally-bored cylinder or stem having radial guide-wings n, the edges of which have bearings against the inner surface of the casing. At its lower end the stem is enlarged to form the by-pass valve N', which is arranged to fit a seat formed for it at the lower end of the main casing, and at its upper end the stem and its bore are expanded, as shown at N<sup>2</sup>, so that the upper end of the bore is larger in diameter than the lower end of the steam-nozzle or injector-discharge nozzle standing above the center of the water-passage D and close to the steam-nozzle.

In the patent above referred to the combined by-pass valve and injector-nozzle or combining-tube is elevated partly by the valve which closes the overflow, to be hereinafter referred to, and partly by a spring inclosing a stem secured to a depending loop. In the present device the spring, loop, and stem are dispensed with and the injector-nozzle or combining-tube elevated partly by the valve which closes the overflow-outlet and partly by the water-pressure in the chamber below the by-pass valve. This partial elevation of tube N by the water-pressure is accomplished as follows: The tube N is provided at a point above valve N' with a circular abutment or piston N<sup>2</sup>, which snugly fits with and closes the passage around the out-



side of the tube N. When the tube N is in its lowered position, the by-pass valve and circular abutment or piston  $N^2$  are in a plane below the seat on which valve  $N'$  rests when tube N is elevated, and when thus lowered the water and steam have free passage around the outside of the tube to the chamber  $N^3$ .

In the patent above referred to the by-pass valve is larger in diameter than the overflow-valve P, and consequently, in order to introduce the tube N, carrying valve  $N'$ , into position it was necessary to make section  $N^2$  of the casing independent of the casing proper and secure it thereto by a coupling. In the present device I have made valve P and its seat greater in diameter than valve  $N'$ , and consequently the tube N, with its valve  $N'$ , can be introduced into position through the lower end of the injector and through the opening in partition  $p'$ , which forms the seat for the overflow-valve P, thus enabling me to make the entire casing in a single casting.

The tube N is provided at its lower end with a series of open slots all communicating with the bore of the tube for the purpose of permitting the free egress of water and steam passing downwardly through said tube. Instead of slots, lugs for elevating the lower end of the tube can be provided. This tube when not in operation and while starting rests on the overflow-valve P, and while in operation is but slightly elevated above said valve. Hence in order to provide for the free passage of water at all times the slots or lugs are provided, either of which leaves ample orifices for the escape of the water forced downwardly through the tube.

On one side of the partition  $p'$  the section  $A^2$  of casing A is provided with an overflow-outlet R and on the other side with a branch or union nozzle S for connection with a feed-pipe. The stem of the overflow-valve P passes downward through a bushing T, which is screwed into the lower side of the section  $A^2$ , and at its lower end the said stem carries a cross-bar V, the ends of which, by means of adjustable rods  $v v$ , are connected to the ends of a similar cross-bar  $V'$ , which is loosely supported by a shoulder of the main valve-stem  $H'$  above the sleeve  $h$ .

The operation of the injector as described is as follows: When the injector is not in use, the stem  $H'$  is screwed down by means of its handle  $h'$ , so that the valve H is seated upon the seat  $i$ , and thus communication from the steam branch B is cut off from the interior of the main casing and from the steam-passage C. At the same time the valve L is lowered and rests upon the seat  $l'$ , the head or shoulder at the upper end of the stem  $l$  standing clear of the same plug  $K'$  and at the upper end of the socket K. The valve P is lowered from its seat, and as this valve supports the combined injector-nozzle the valve  $N'$  and abutment  $N^2$  will also be lowered below the seat for valve  $N'$  and there will be a free communication from the branch D to cham-

ber  $N^3$  around the injector-nozzle N and between its wings  $n$ . It will be understood that the rods  $v v$  are so adjusted as to force the valve-stem  $P'$  down and carry the valve P off its seat, at the same time allowing tube N to drop. Now, when it is desired to start the injector to work, the stem  $H'$  is turned partially, so as to raise the valve H from its seat and raise valve P toward its seat, but not sufficiently to cause the valve L to be raised, as it will be remembered that the plug  $K'$  has a short upward play on said stem without striking its head nor sufficiently to raise abutment  $N^2$  up to the seat for valve  $N'$ . The valve H being thus raised, steam will flow from the branch B through the passage  $i$  and thence through the passage C, nipple F, and nozzle G, escaping through chamber D and around and through tube N, creating a lifting-exhaust in the water-supply pipe, which is connected to branch E, so that water will be raised through such pipe and flow through the nozzle G, passage D, around the injector-nozzle and valve  $N'$  to the chamber  $N^3$ , and thence through the port in partition  $P'$  and off through the overflow-outlet R. As soon as the water appears in sufficient volume at the overflow-outlet the main stem  $H'$  is screwed up high enough to lift the valve L from its seat and cause the rods  $v v$  to lift the valve P up to its rest. The lifting of the valve P to its seat raises tube N sufficiently high to carry piston or abutment  $N^2$  above the seat for valve  $N'$ . This abutment, which, as before stated, neatly fits the bore of casing in which the tube N rests and moves, now closes off practically the flow of water around the tube and causes all the water and steam to pass downwardly through the tube, and, as the pressure of the water in chamber  $N^3$ , bearing against the under side of the tube N, the under side of valve  $N'$ , and the under side of the piston or abutment  $N^2$  is greater than the pressure of water or steam on top of abutment  $N^2$ , the tube is elevated by such pressure until the valve is firmly seated, where it is held while the injector is in operation. As the valve P has been also seated, the steam and water entering the chamber  $N^3$  have no passage to the overflow, and therefore pass through the branch S to the feed-pipe connected thereto and reach the boiler after passing the usual check-valve with which the feed-pipe is supplied. It will now be seen that the entire adjustment of the valves and regulation of the feed is accomplished by the manipulation of a single handle which is attached to the main valve-stem.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an injector, the combination, with a casing having an overflow valve and outlet, of an injector-nozzle or combining-tube having a valve thereon for shutting off the passage of water around the tube and an abutment or piston above the valve, the said abut-



ment or piston adapted to practically cut off the passage of water around the tube before the valve on the tube has been seated, substantially as set forth.

5 2. The combination, with a casing and lifting and forcing injectors therein, of a movable injector-nozzle or combining-tube carrying a valve and an abutment or piston located above the valve, the said abutment or piston adapted to practically cut off the passage of water around the tube before the valve on the tube has been seated, substantially as set forth.

15 3. The combination of a casing made in a single casting and inclosing lifting and forcing injectors and a movable injector-nozzle or combining-tube, the said nozzle or tube having a valve and an abutment or piston thereon, the latter being located above the valve and adapted to practically cut off the passage of water around the tube before the valve on the tube has been seated, substantially as set forth.

25 4. In an injector, the combination, with a casing, a steam-inlet valve, an overflow-valve, and devices for moving said valves simultaneously, of the independently movable or sliding injector-nozzle or combining-tube located between the steam-inlet valve and the overflow-valve and provided with a valve

and an abutment or piston, the abutment or piston being located above the valve on the tube and adapted to practically cut off the flow of water around the tube before the valve on the tube has been seated, substantially as set forth. 35

5. In an injector, the combination, with the main steam-valve, a valve loosely attached thereto, an overflow-valve, and means for actuating them simultaneously, of an injector-nozzle or combining-tube having a valve and an abutment or piston thereon, the said tube adapted to be elevated partly by the elevation of the overflow-valve and partly by pressure of water against the valve and abutment or piston, substantially as set forth. 45

6. In an injector, the combination, with a casing, of an injector-nozzle or combining-tube located within said casing, a water-passage around said tube, and a valve and abutment or piston on said tube, substantially as and for the purpose described. 50

In testimony whereof I have signed this specification in the presence of two subscribing witnesses

ALBERT S. EBERMAN.

Witnesses:

C. S. DRURY,  
R. S. FERGUSON.