

(Model.)

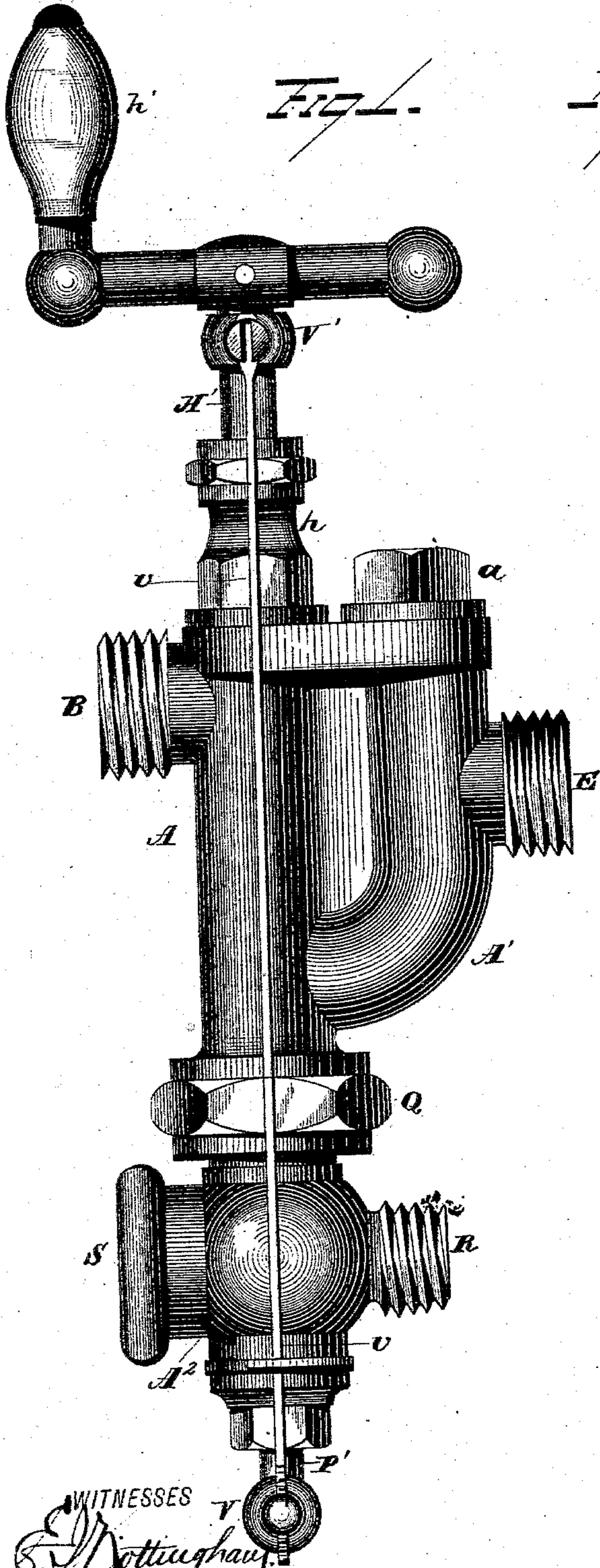
A. S. EBERMAN.

INJECTOR.

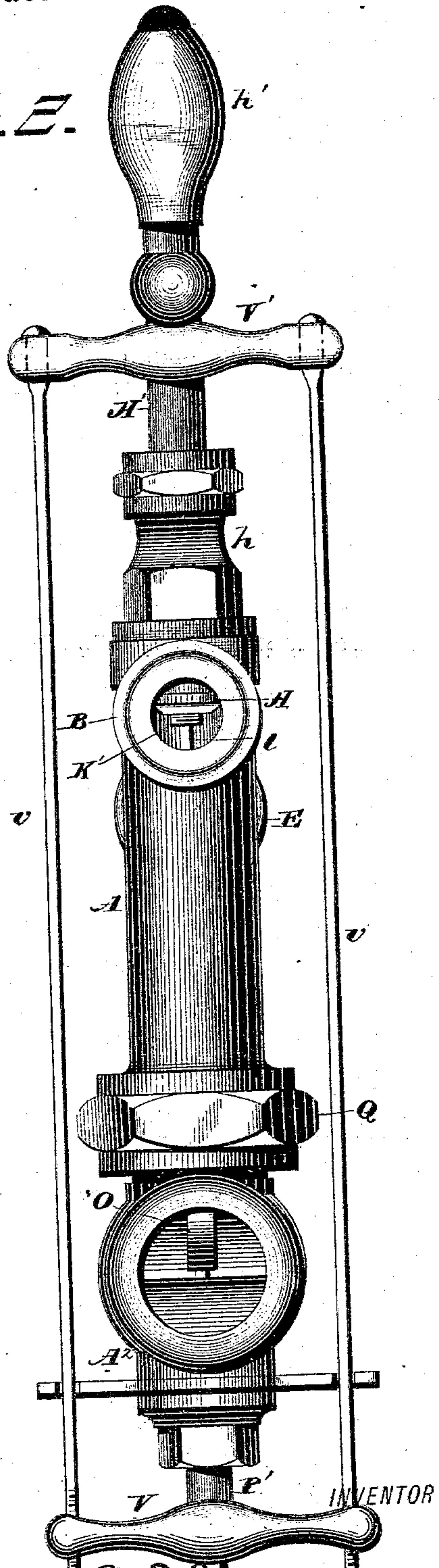
2 Sheets—Sheet 1.

No. 288,039.

Patented Nov. 6, 1883.



WITNESSES  
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(Model.)

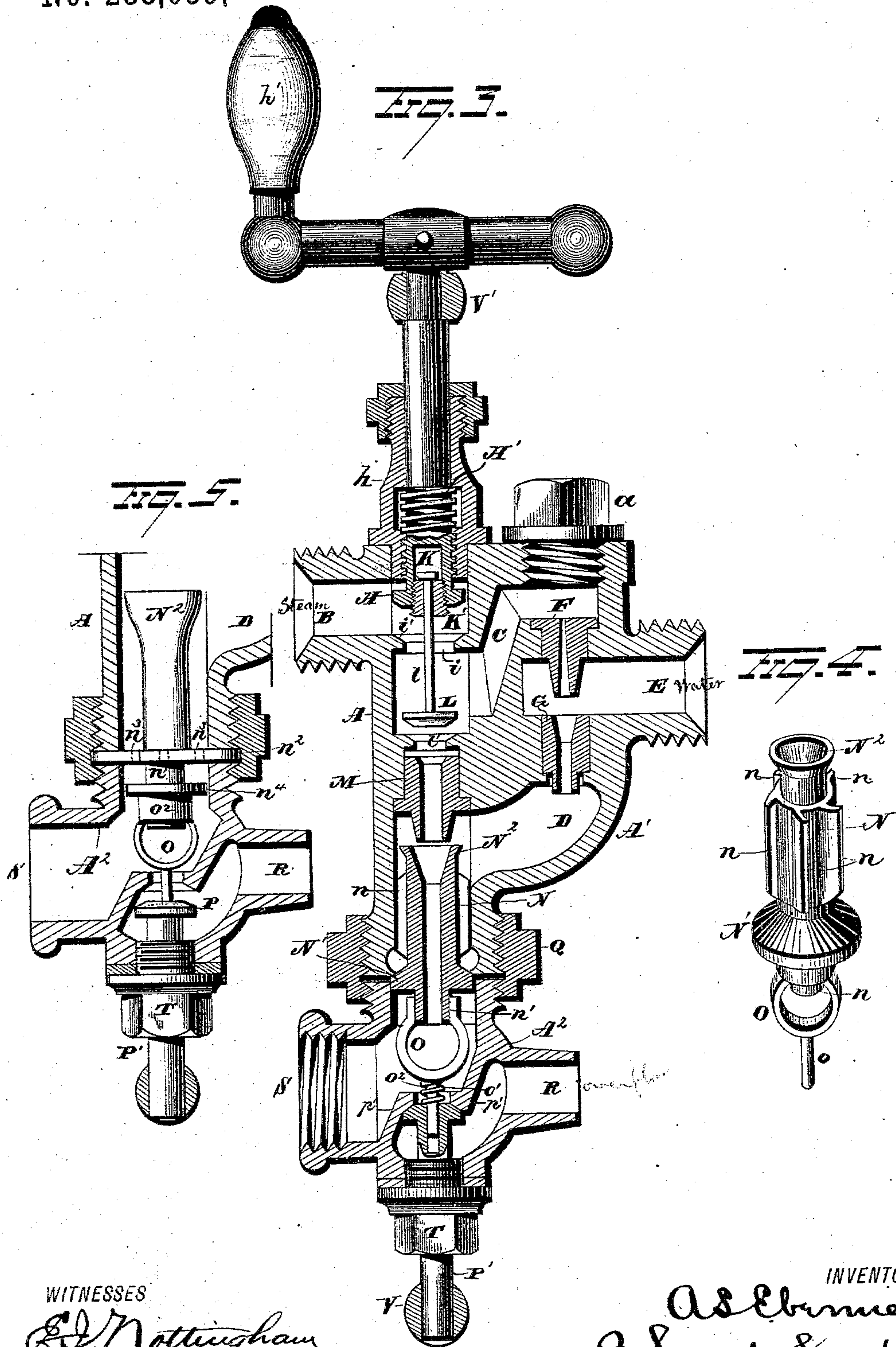
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# UNITED STATES PATENT OFFICE.

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## INJECTOR.

SPECIFICATION forming part of Letters Patent No. 288,039, dated November 6, 1883.

Application filed August 2, 1883. (Model.)

*To all whom it may concern:*

Be it known that I, ALBERT S. EBERMAN, of Sandy Lake, in the county of Mercer and State of Pennsylvania, 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 injectors for supplying feed-water to steam-boilers, its object being to simplify the construction of this class of devices, to give a positive action to the several valves, to enable all the valves to be operated simultaneously and properly by manipulation of the main-valve stem, thus obviating the necessity of separately adjusting different valves, and to generally promote efficiency and economy of construction in this class of devices for supplying feed-water.

With these objects in view the invention consists in certain novel constructions and arrangements of valves and steam and water passages, and in a novel construction of valve-casing, all of which will be fully understood from the following particular description, in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of my improved injector. Fig. 2 is a front view of the same. Fig. 3 is a vertical section on line *x x* of Fig. 2. Fig. 4 is a detached perspective view of the combined by-pass valve and injector-nozzle or combining-tube. Fig. 5 is a vertical view of the lower portion of the apparatus, illustrating a modified construction of the injector-nozzle and by-pass valve.

Referring to Figs. 1, 2, and 3, the letter 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, which is 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 split 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, which is 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 a 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 M, this expanded portion of the hollow stem or injector discharge-nozzle standing above the center of the water-passage D, and close to the steam-nozzle.



From the under side of the valve N' projects a central nipple,  $n'$ , which forms a continuation of the injector discharge-nozzle, and to which is secured a pendent loop, O, from the lower side of which projects a stem,  $o'$ , which enters loosely into a socket formed through a valve, P, and into its stem P'. This valve P is arranged to be seated upwardly against a seat,  $p$ , formed for it around a port in an oblique partition,  $p'$ , in a globular casing,  $A^2$ , which, by an adjustable right-and-left screw-coupling, Q, is secured to the lower end of the main casing A, and between the valve and the loop O is a short spiral spring,  $o^2$ , which surrounds the stem  $o$ .

On one side of the partition  $p'$  the casing  $A^2$  is provided with an overflow-outlet, and on the other side with a branch or union nozzle, S, for connection with a feed-pipe. The stem P' of the valve P passes downward through a bushing, T, which is screwed into the lower side of the globe  $A^2$ , 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 and by-pass valve N the valve N' will also be lowered from its seat, and there will be a free communication from the branch D to the casing  $A^2$ , 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 valves P and N' off their seats when the main valve H is on its seat. 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, 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. 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, 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 casing  $A^2$ , and thence through the port in partition  $p'$  and off through the overflow-outlet R. As soon as the water appears in sufficient vol-

ume 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 valves P and N', the valve N' being adjusted to first reach its seat, so that the overflow will not be closed until the passage around the injector-nozzle is closed and the steam-supply to said nozzle is established. Then the main volume of steam will rush through the steam-nozzle M and the injector-nozzle, forcing the water also through the injector-nozzle, as the water around said nozzle has been cut off by the seating of valve N'. As the valve P has been also seated, the steam and water entering the globe-casing  $A^2$  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 supported.

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.

In Fig. 5 the injector-nozzle N<sup>2</sup> is held rigidly in position by means of a flange,  $n^2$ , which is held between the lower edge of the main casing and the upper edge of the globe-casing  $A^2$ . In this flange are a series of perforations, as shown at  $n^3$ , and around the nipple  $n'$  is a flat ring or valve,  $n^4$ , which is arranged to close the perforations in the flange. This ring rests upon a collar,  $o^2$ , formed on the loop O, and arranged to play loosely on the nipple  $n'$ , so that when the valve P is raised to its seat the loop will rise and force the ring  $n^4$  against the under side of the flange  $n^2$  and close the perforations in the same, so as to cut off the water-flow around the injector-nozzle. When this modified form of injector-nozzle and by-pass valve is used, the other parts will be the same as already described.

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 the main valve controlling the steam-supply passage, of a loosely-attached valve controlling the passage of steam to the injector or combining-tube, a by-pass valve controlling the passage of water around the injector discharge-nozzle, an overflow-valve, and suitable intermediate connections, whereby all of said valves may be operated by the manipulation of the main valve, substantially as described.

2. The combination, with the main valve, the lifting-jet devices, and the valve loosely attached to the main valve for controlling the flow of steam to the injector discharge-nozzle, of a by-pass valve arranged to control the flow of water around said injector discharge-nozzle, and suitable connection between the main valve and by-pass valve, by means of which the latter may be operated by the movement of the main valve, substantially as described.

3. The combination, with the main valve



and the loosely-attached valve for controlling the flow of steam to the injector discharge-nozzle, of an overflow-valve connected with the main valve for operation thereby, substantially as described.

4. In an injector, the combination, with the water and steam supply passages and injector discharge-nozzle, of a by-pass valve arranged to control the flow of water around the injector-nozzle and an overflow-valve connected with said by-pass valve and arranged to operate the same, substantially as set forth.

5. In an injector, the combination, with the main casing and main water-passage, of the injector discharge-nozzle having a water-passage around it, and carrying a valve for closing said passage, substantially as described.

6. The combination, with the main valve for

controlling the passage of steam to the interior of the main casing, the injector discharge-nozzle or combining-tube, and a valve for controlling the flow of steam to the said injector discharge-nozzle or combining-tube, of a by-pass valve for controlling the flow of water around the same, and means connecting said main valve and by-pass valve, whereby the latter will be operated by the former, substantially as described.

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

ALBERT S. EBERMAN.

Witnesses:

G. D. SEYMOUR,

S. G. NOTTINGHAM.