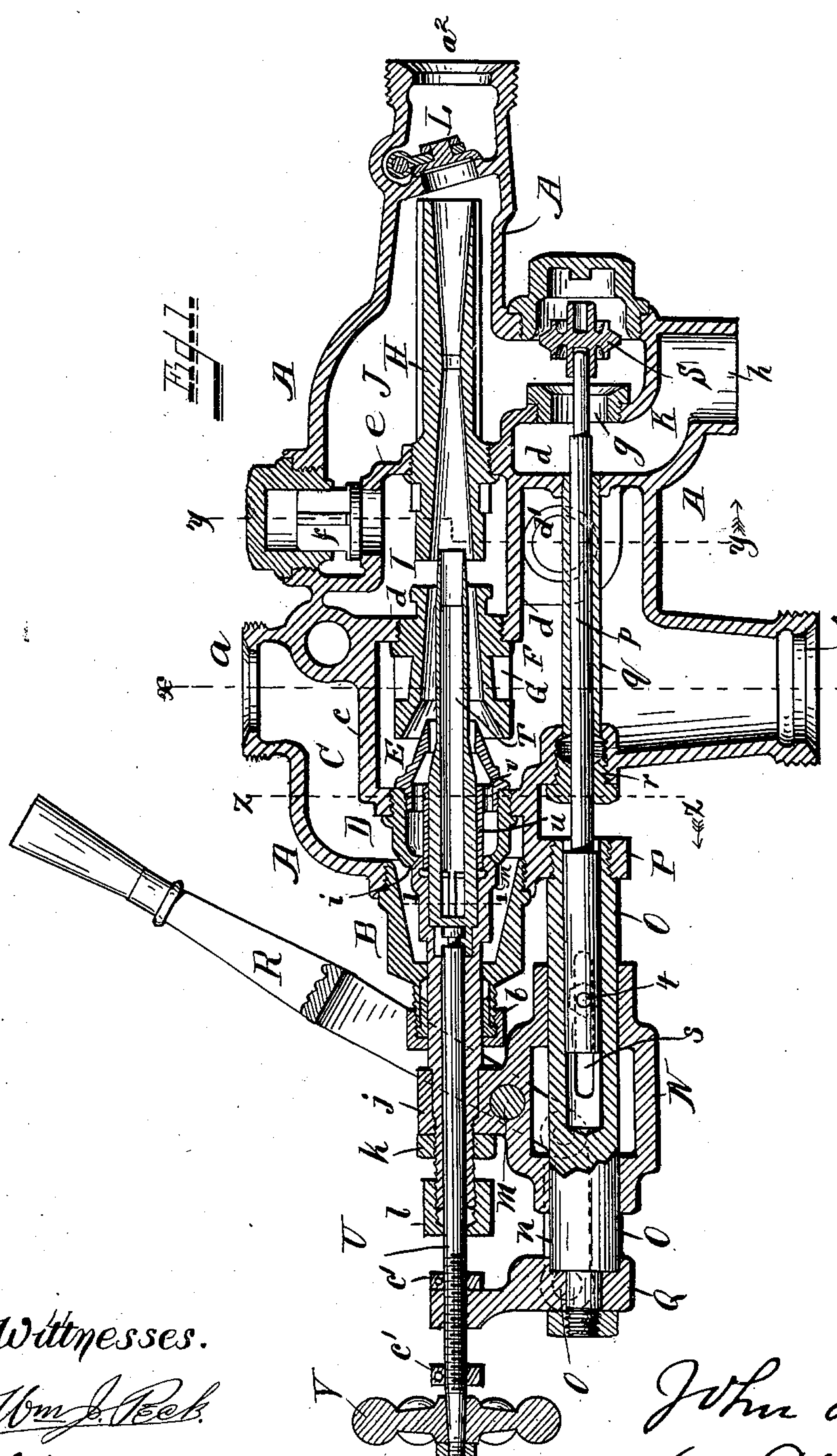
No. 636,499. Patented Nov. 7, 1899.

J. DESMOND.

INJECTOR.

(Application filed June 12, 1899.)

(Model.) 3 Sheets—Sheet 1.



Witnesses.

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Claude Prouman

Inventor.

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by Chas M. Peck

his Attorney.

No. 636,499. Patented Nov. 7, 1899.

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(Model.) 3 Sheets—Sheet 2.

Fig. 3.

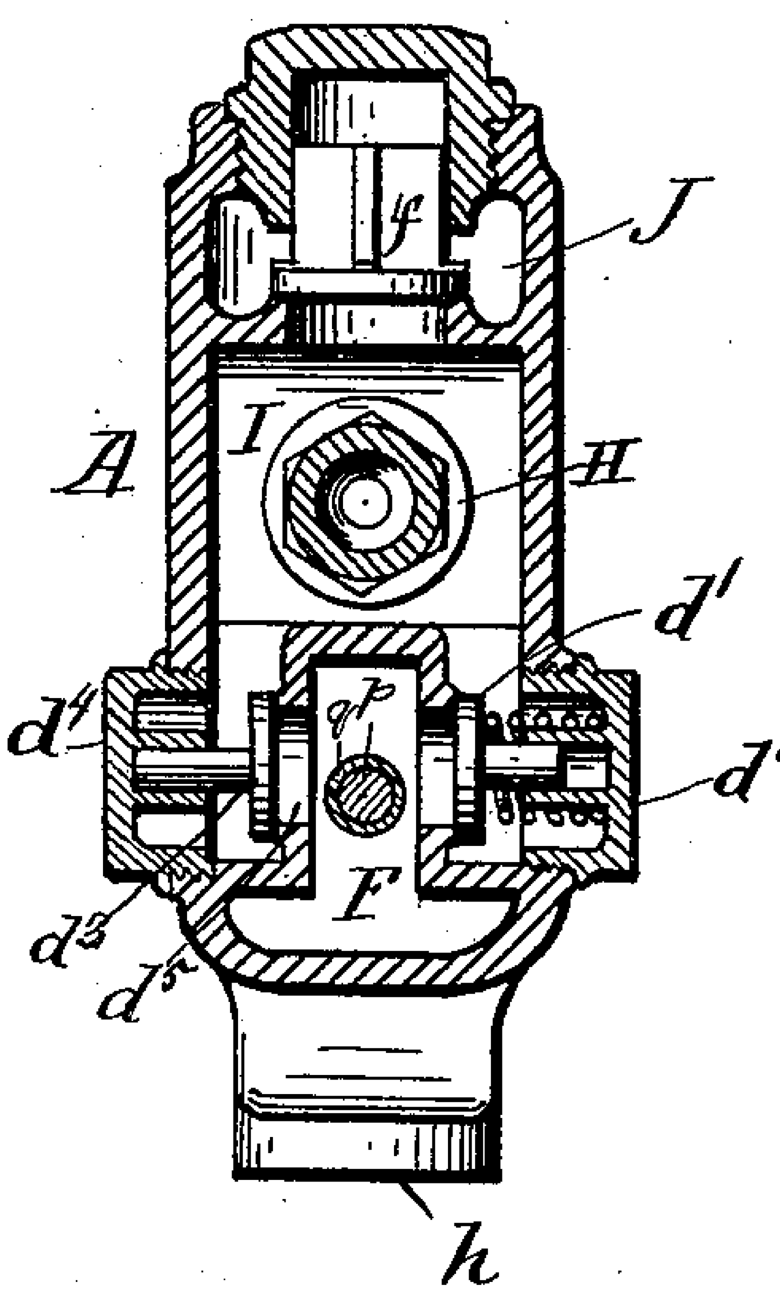


Fig. 2.

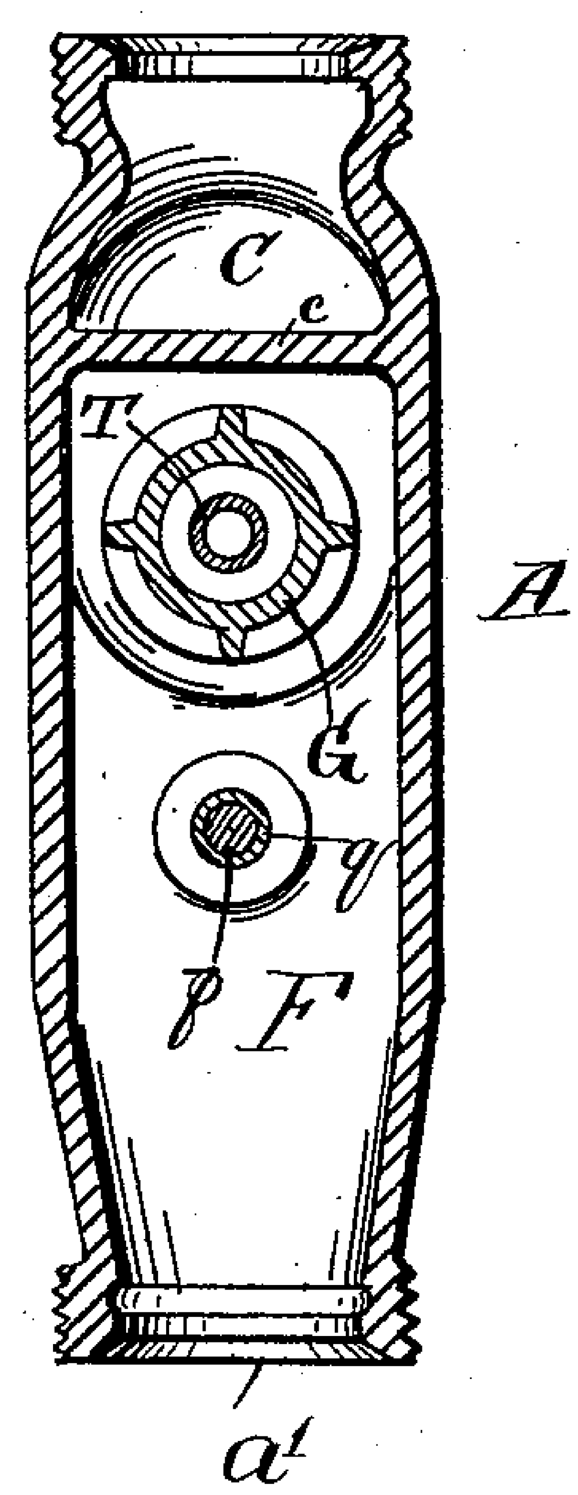


Fig. 4.

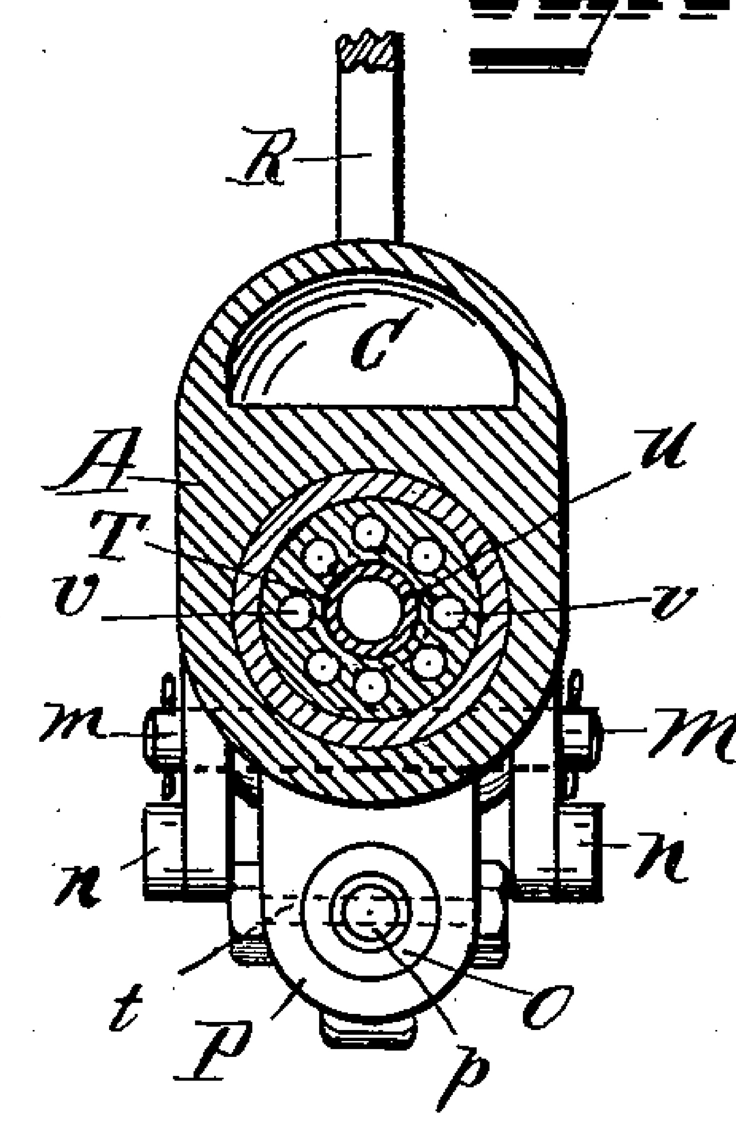


Fig. 5.

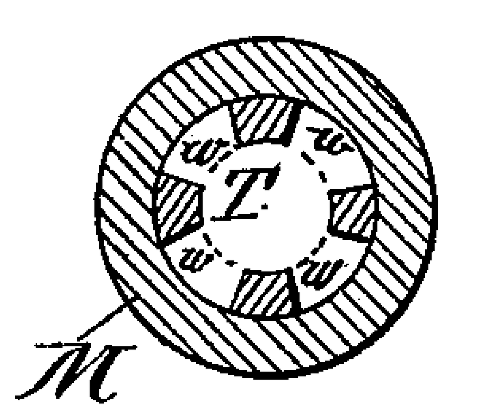
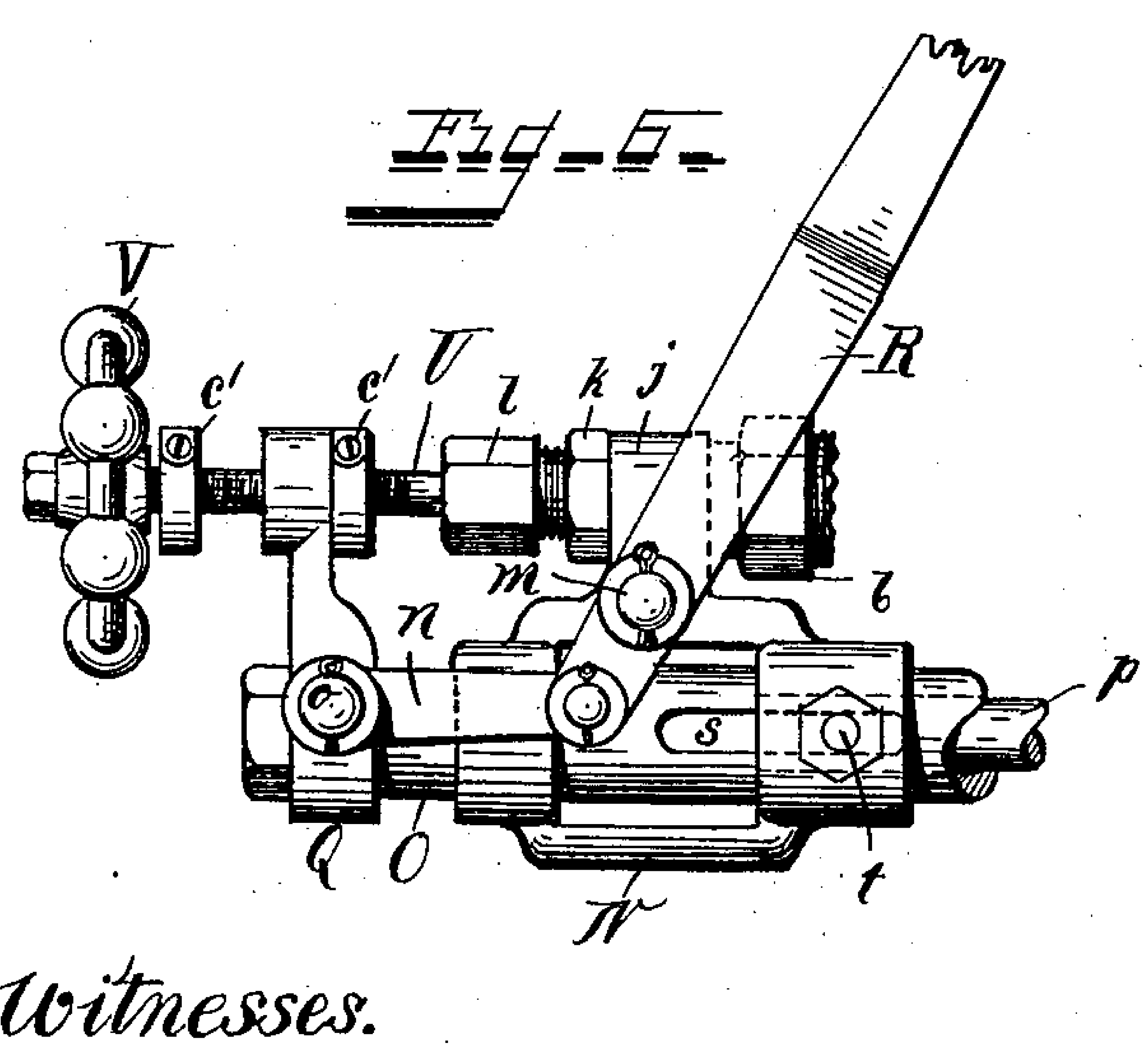


Fig. 6.



Witnesses.

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(Model.)

J. DESMOND.

INJECTOR.

(Application filed June 12, 1899.)

Patented Nov. 7, 1899.

3 Sheets—Sheet 3.

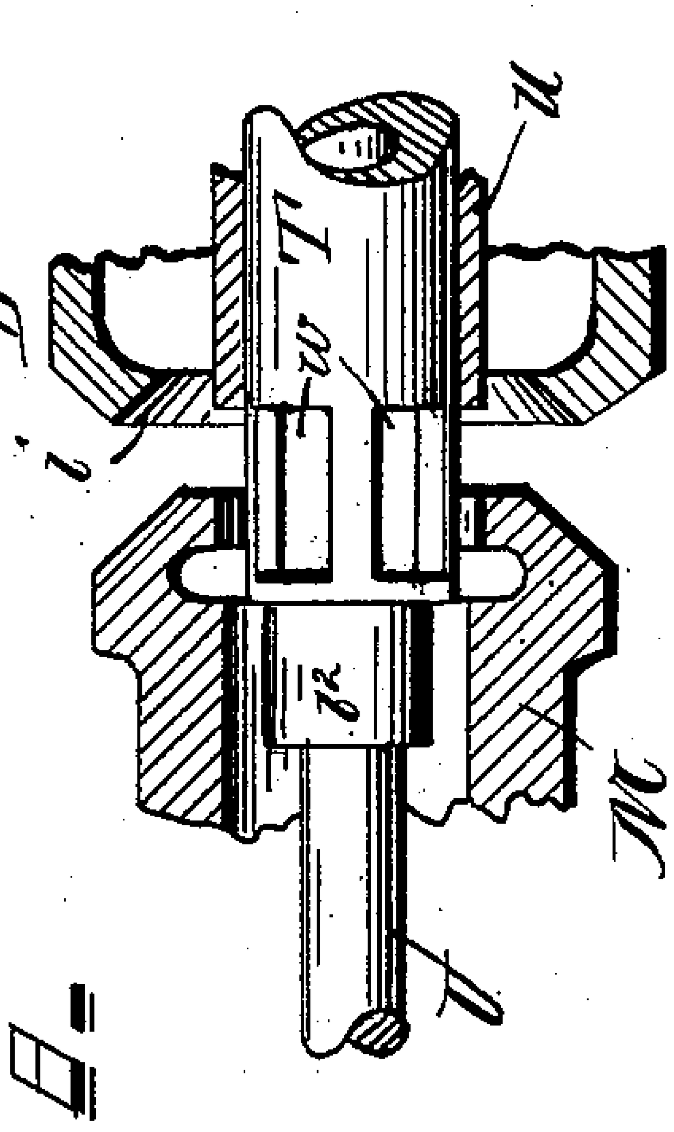

Fig. 8.

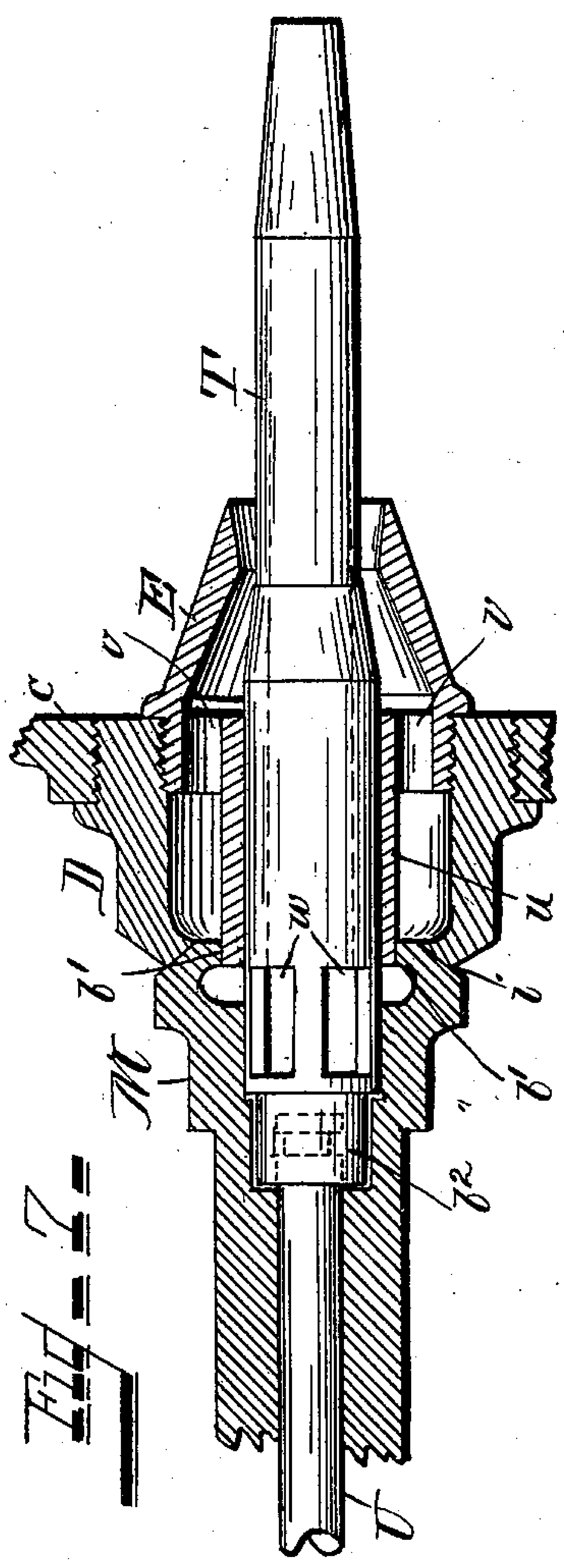

Fig. 7.

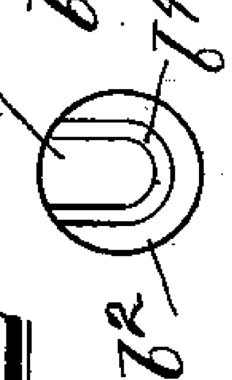

Fig. 9.

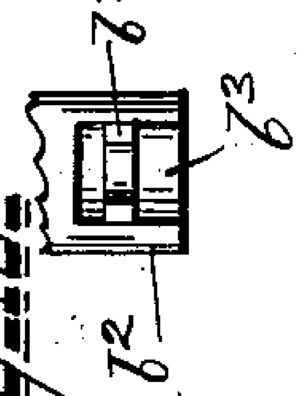

Fig. 10.

Fig. 11.

Witnesses.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN DESMOND, OF CINCINNATI, OHIO, ASSIGNOR TO THE LUNKENHEIMER COMPANY, OF SAME PLACE.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 636,499, dated November 7, 1899.

Application filed June 12, 1899. Serial No. 720,195. (Model.)

To all whom it may concern:

Be it known that I, JOHN DESMOND, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Injectors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to injectors in which successive impulses of a plurality of steam-jets force the water into the boiler and in which the final overflow is positively closed, suitable means being used for the opening and closing of the overflow simultaneously with the closing and opening of the valve which admits the operating-steam into the injector.

One object of my present invention is to construct the injector in such manner that its feeding capacity can be readily adjusted to the required duties of either stationary or locomotive engines.

Another object is to so construct the feeding mechanism that the feeding of the injector will not raise the temperature of the fed-in water to such a degree as to deposit scale within the tubes of the injector, by which its use would be impaired, and the final object is to produce an injector of a simplified and cheapened mode of construction and at the same time greatly increase its reliability and efficiency of action.

All of these objects are attained by the mechanism illustrated in the accompanying drawings and hereinafter to be more fully described, and the novelty of my invention will be specifically pointed out in the claims.

In the accompanying drawings, Figure 1, Sheet 1, is a longitudinal axial section, in side elevation, of an injector embodying my invention. Fig. 2, Sheet 2, is a transverse section on the dotted line $x\,x$ of Fig. 1, looking in the direction of the arrow. Fig. 3, Sheet 2, is a transverse section on the dotted line $y\,y$ of Fig. 1, looking in the direction of the arrow. Fig. 4, Sheet 2, is a transverse section on the dotted line $z\,z$ of Fig. 1, looking in the direction of the arrow. Fig. 5, Sheet 2, is a transverse sectional detail on the dotted line 1 1 of Fig. 1, the figure being enlarged. Fig. 6, Sheet 2, is a detail side elevation of the end of the injector containing the lever and valve operating mechanisms. Fig. 7, Sheet 3, is an enlarged detail view, in side elevation and partly in section, of the steam-admitting valve, the lifting-nozzle, the forcing-tube, and their associated parts with the steam-admitting valve closed. Fig. 8, Sheet 3, is a corresponding view with some of the parts broken away and with the steam-admitting valve open. Fig. 9, Sheet 3, is an end elevation of the coupling-seat for the forcing-tube. Fig. 10, Sheet 3, is a plan view of Fig. 9. Fig. 11, Sheet 3, is a central sectional side elevation of Fig. 9.

The same letters of reference are used to indicate identical parts in all the figures.

A is the shell or casing of the injector, which at a, a', and a^2 is provided with the usual threaded necks for the steam, inlet-water, and boiler delivery connections.

At the end of the shell A opposite the delivery end a^2 is an interiorly-threaded opening concentric with the opening a^2, into which is screwed a cap or bonnet B, provided with a stuffing-box b.

The steam-inlet a opens into a chamber C, formed by the outer shell A and an inner diaphragm c, and the latter has a threaded aperture, into which is screwed a cap or bonnet D, projecting toward the bonnet B, and into the opposite end of which is screwed a nozzle E, projecting into the water-chamber F, that communicates with the water-inlet a', and by the passage of the steam through which the initial lifting of the water is effected in starting the injector. There is a second diaphragm d within the shell A, into a central bore of which is screwed the lifting-tube G, into the end of which the nozzle E of the tube projects. There is a third diaphragm e within the shell A, into which is screwed the combining and delivery tube H.

The tubes H G and the nozzle E are in axial alinement and in this instance in alinement with the axes of the outlet a^2 and stuffing-box b.

Between the diaphragms d and e is the overflow-chamber I, and in the diaphragm e is seated a check-valve f, opening into the delivery-chamber J, from whence the overflow passes through a valve-controlled opening g and passage K to an outlet h, leading to the atmosphere.

L is the usual check-valve, interposed between the discharge end of the delivery-tube H and the outlet a^2, to be closed at proper times by the back pressure of the boiler.

The cap or bonnet D has its apertured end within the steam-chamber C formed into a valve-seat i, (see Figs. 7 and 8,) against which closes a tubular valve M, extending rearwardly through the stuffing-box b, thence through a head or collar j on a sleeve N, having its bearing and sliding upon a tubular support O, supported by bracket P and carrying at its outer end a bracket Q. The stem of the valve M is threaded at its outer end and is locked to the lug j by a shoulder on one side thereof and by a nut k on the opposite side, and it has upon its extreme rear end a stuffing-box l. A hand-lever R has a fork straddling the collar N and pivoted thereto on both sides, as at m. The lower ends of the fork of the lever on each side of the collar N are provided with pivoted links n, whose ends are pivoted, as at o, to the bracket Q in such manner that the vibration of the lever R will cause the longitudinal movement of the valve M to open and close the same, as will be readily understood. In addition to this function of opening and closing the valve M the lever R also closes and opens the valve S, which controls the opening g in the overflow-chamber K, said valve S being secured on a stem p, passing through a tubular bearing q in the chamber F, thence through a stuffing-box r into the bore of the tubular support O. Said tubular support O has slots s through it on opposite sides, through which and the collar N a pin t is passed, and said slots are sufficiently elongated to permit the fullest movement of the lever R in both directions.

Extending axially through the nozzle E and the tube G is the forcing-tube T, the discharge end of which, slightly tapered exteriorly, partially enters the inlet end of the tube H. Said tube is again beveled and enlarged exteriorly just in rear of the discharge-nozzle of the tube and has its bearing in a tubular extension u of said nozzle. Between said tubular extension and the threaded end of the nozzle E are a series of perforations v, Figs. 1 and 4, surrounding the tube u. The rear end of the forcing-tube T is closed, but is provided with a series of longitudinal slots w, Figs. 7 and 8, which when the valve M is closed extend rearwardly from laps b' on the valve M, which engage the rear end of the tube u. These slots w open into the tube T, as clearly shown in Figs. 1, 5, 7, and 8.

Upon the rear end of tube T, within a recess in the valve M, is an extension b^2, having a slot b^3 cut down into it, with an intermediate bead b^4, (see Figs. 9, 10, and 11,) into which slot is slipped the T-headed end of a rod or stem U, which passes through a bore in the stem of the valve M and has its rear end threaded and engaging with an aperture in the bracket Q. Nuts c' on the stem U on both sides of the bracket Q serve to limit the longitudinal movement of the stem U in both directions, and a hand-wheel V, fast on the rear end of the stem, serves to turn the same to cause the longitudinal movement of the tube T.

In addition to the check-valve f I provide a spring-closed check-valve d', closing and opening from the chamber F into the chamber I and covered by a cap d^2, screwed into the wall of the injector, for the purpose of introducing and removing said valve when desired, and directly opposite the valve-opening for the valve d' I provide a similar opening d^5, which is covered by a blind valve d^3, held constantly closed by a removable cap d^4, screwed into the opposite side of the injector-shell. The purpose of this construction is to enable me to shift the valve d' to either side of the injector-shell to enable the injector to be used as a right or left hand injector and at the same time to give free access to the valve d'.

The operation of the injector is as follows: Assuming the parts to be in the position shown in Fig. 1, the lever R is drawn rearward, and thereby first uncovers or opens the valve M, admitting steam into the cap or bonnet D, which passes through the orifices v and escapes from the nozzle E around the tube T into the lifting-tube G, thereby creating a vacuum in the chamber F, which will cause the water from the source of supply to enter said chamber through opening a'. The water so raised will pass through the tube G and be driven into the chamber I and partly through the tube H into the chamber J until the pressure in chamber I is sufficient to raise the valve f, whereupon the water in chamber I, joining that in chamber J, will pass through the opening g and escape through chamber K into the atmosphere. The further movement of the lever R in opening the valve M will gradually bring the valve S toward a closing position until such time as that the laps b' have passed beyond the end of the tube u, thereby uncovering the ports w in the forcing-tube T, whereupon steam will enter through said ports into the tube T and will impart a second impulse to the water passing through the tube H sufficient to form an equilibrium between chambers I and J, which will cause valve f to drop to its seat, thereby closing communication between the two chambers. Valve S being still open, all the water is passed through tube H to the atmosphere through opening g. As the back movement of lever R still gives more steam through ports w the velocity of the water through jet H is increased sufficiently to resist boiler-pressure. At about that time, or a little later, valve S begins to close, gradually bringing pressure in chamber J up to boiler-pressure, and at that point valve L immediately lifts, allowing free access to the boiler for all the water, and just at this moment the valve S will be closed upon the opening *g*, the overflow will be stopped, and the increasing velocity of the water through the tube H by the further uncovering of the ports *w* will be sufficient to overcome the boiler-pressure and open the valve L to permit the water to pass from the injector into the boiler. As soon as the pressure in chamber J rises above that in the chamber I the check-valve *f* is closed, and all of the water that passes through the tube G has to pass through the tube H. Should a vacuum be formed in the chamber I, the valve *d'* will at once be opened to admit water from the chamber F into the chamber I, and thereby restore the equilibrium. As soon as the injector is thus started the tube T through the medium of hand-wheel V can be moved forward longitudinally to regulate the amount of steam passing from nozzle E around the tube T, and by cutting off this supply of steam or throttling the nozzle E the steam is made to pass almost entirely through the tube T, and the entering water through the tube G will not be heated to an extent sufficient to deposit scale in the tubes of the injector. This latter result is accomplished not merely by the throttling of the ports *w* consequent upon the advancement of the tube T through the tubular support *u*. In other words, I not only throttle the steam passing through the nozzle E around the tube T, but I also throttle the steam entering and passing through the tube T, and also by the same movement of tube T throttle the water at the outer end of the tube T. All three of these results are accomplished by the same movement of tube T, and these results are accomplished by the same movement of the tube T longitudinally. These results, accomplished by the longitudinal movement of the tube T, are such that, so far as I am aware, are entirely new and have never before been discovered or applied to injectors, and by means of them I am enabled to use only the amount of steam that is required to keep the injector up to its required work, even to the maximum amount of delivery, without heating the water so delivered to a degree sufficient to cause it to deposit scale in the tubes, and I do not therefore wish my invention to be limited to the size, configuration, or location of the aperture *w*, which admits steam into the tube T, provided the same are throttled by the same movement which throttles the passage of steam around the tube T into the lifting-tube.

Another important feature of my invention to which I here wish to call special attention is the mode of operation of the valve S, which, as seen by reference to Fig. 1, is not fast upon the stem *p*, but merely has frictional engagement therewith in a socket formed in the valve. This construction permits the valve S to be carried toward its seat in the opening *g* by the movement of the stem *p*, when the lever R is vibrated until the pressure behind it automatically closes it and holds it closed. The stem *p* then, being drawn practically away from it, allows the valve to conform to its seat independent of any guide, and then, in adjusting the valve M backward or forward to admit the required amount of steam, the valve S will not be again opened until the valve M is traveling toward its closed position.

Having thus fully described my invention, I claim—

1. In an injector of the character described, the combination with the delivery and lifting tubes, of a forcing-tube provided with a steam-inlet from the steam-space to its interior, an exterior annular steam-discharge around the forcing-tube into the lifting-tube, a single valve controlling said steam-inlet and annular steam-discharge and means for moving said forcing-tube longitudinally to diminish the exterior annular discharge and at the same time diminish the steam-inlet to the interior of the forcing-tube, substantially as described.

2. In an injector of the character described, the combination with the delivery and lifting tubes, of a forcing-tube provided with steam-ports from the steam-space to its interior an exterior annular steam-discharge around the forcing-tube into the lifting-tube, a single valve controlling said steam-inlet and annular steam-discharge and means for moving said forcing-tube longitudinally to diminish the exterior annular discharge and at the same time diminish the steam-inlet to the interior of the forcing-tube, substantially as described.

3. In an injector of the character described, the combination with the delivery and lifting tubes, of a forcing-tube provided with a steam-inlet from the steam-space to its interior, an exterior annular steam-discharge around the forcing-tube into the lifting-tube, a valve common to said steam-inlet and annular steam-discharge, and means for moving said forcing-tube longitudinally to diminish the exterior annular discharge and at the same time diminish the steam-inlet to the interior of the forcing-tube, substantially as described.

4. In an injector of the character described, the combination with the delivery and lifting tubes, of a forcing-tube provided with steam-ports from the steam-space to its interior, an exterior annular steam-discharge around the forcing-tube into the lifting-tube, a valve common to said ports and annular discharge and means for moving said forcing-tube longitudinally to diminish the exterior annular discharge and at the same time diminish the steam-inlet to the interior of the forcing-tube, substantially as described.

5. In an injector of the character described, the combination with the delivery and lifting tubes, of a longitudinally-movable forcing-tube provided with a steam-inlet from the steam-space to its interior, and exterior annular steam-discharge around the forcing-

tube into the lifting-tube, a valve common to the interior of the forcing-tube and the annular steam-discharge around the same constructed to first open the latter passage and then the former passage, and means for moving said forcing-tube longitudinally to diminish the exterior annular discharge and at the same time diminish the steam-inlet to the interior of the forcing-tube, substantially as described.

6. In an injector of the character described, the combination with the delivery and lifting tubes of a forcing-tube provided with a steam-inlet from the steam-space to its interior an exterior annular steam-discharge around the forcing-tube into the lifting-tube, a valve common to said steam-inlet and annular discharge, a valve for the overflow loosely mounted on its operating-stem, so as to act automatically when brought near to closing position, and lever mechanism common to both valves, whereby the opening of the first-mentioned valve will cause the closing of the overflow-valve and the closing of the first-mentioned valve will cause the opening of the overflow-valve, substantially as described.

7. In an injector of the character described, the combination of the lifting-chamber F, and overflow-chamber I provided with check-valve *f* opening from chamber I and the spring-actuated check-valve d' opening from the chamber F into the chamber I, substantially as described.

8. In an injector of the character described, the combination and arrangement between the chambers F and I of the spring-actuated check-valve d' on one side of the injector, and the blind valve d^3 on the opposite side of the injector, each being provided with removable and interchangeable caps, whereby the check-valve d' may be transferred from one side of the injector to the other, and likewise the blind valve d^3, substantially as described.

9. In an injector of the character described, the combination of the lifting-tube G, lifting-nozzle E provided with apertures *v* and tubular extension *u*, the cap D surrounding the tubular extension *u* and provided with a valve-seat *i*, the valve M engaging both said valve-seat and the end of the tubular extension *u*, the forcing-tube T having bearing in the tubular extension *u*, and provided with a steam-inlet to its interior, and means for operating the valve M to admit steam, first to the lifting-nozzle E, and then to the interior of the tube T, substantially as described.

10. In an injector of the character described, the combination of the lifting-tube G, lifting-nozzle E provided with apertures *v* and tubular extension *u*, the cap D surrounding the tubular extension *u* and provided with a valve-seat *i*, the valve M engaging both said valve-seat and the end of the tubular extension *u*, the forcing-tube T having bearing in the tubular extension *u*, and provided with a steam-inlet to its interior, means for operating the valve M to admit steam, first to the lifting-nozzle E, and then to the interior of the tube T, and means for moving the tube T longitudinally to throttle both the lifting-nozzle and the inlet to the interior of tube T, substantially as described.

11. In an injector of the character described, the combination of the valve M for the lifting-nozzle and forcing-tube provided with a stem projecting from the injector-case, the valve S for the overflow-opening *g*, the stem *p* loosely connected to the valve S and supporting the same, the slotted tubular support O for the stem *p*, the sleeve N having a sliding bearing on the support O, and made fast to the stem of the valve M, the pin *t* connecting the sleeve N to the stem *p*, and the pivoted hand-lever R, united to the sleeve N and to a fixed part of the injector-frame, whereby simultaneous movement is imparted to the valve M and valve-stem *p* by the vibration of said lever, substantially as and for the purpose specified.

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Witnesses:
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