(Model.)

2 Sheets—Sheet 1.

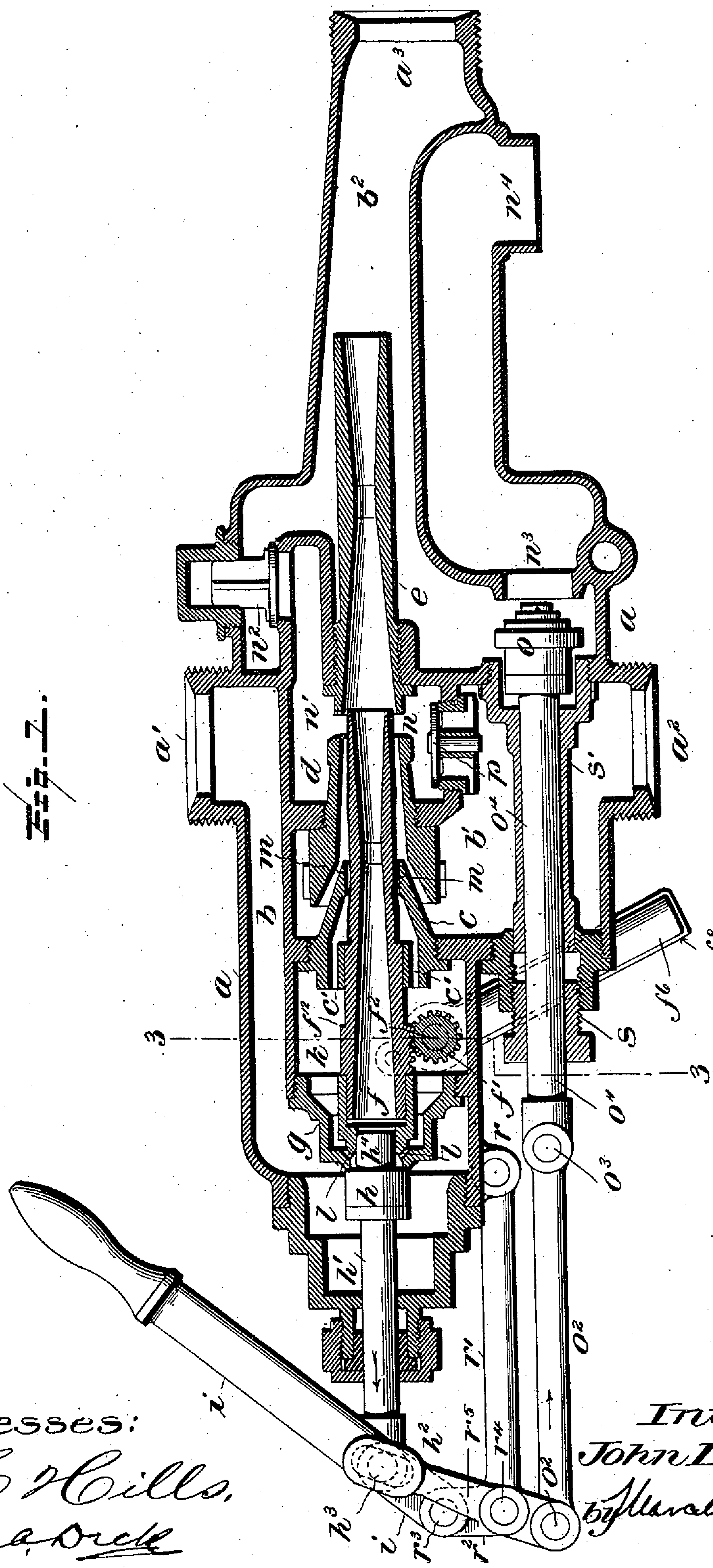
J. DESMOND.

INJECTOR.

No. 574,985.

Patented Jan. 12, 1897.

Fig. 1.



Witnesses:

L. C. Hills,

Ewell A. Dick

Inventor:

John Desmond

by Marcellus Bailey

his Atty.

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

(Model.)

2 Sheets—Sheet 2.

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Fig. 2.

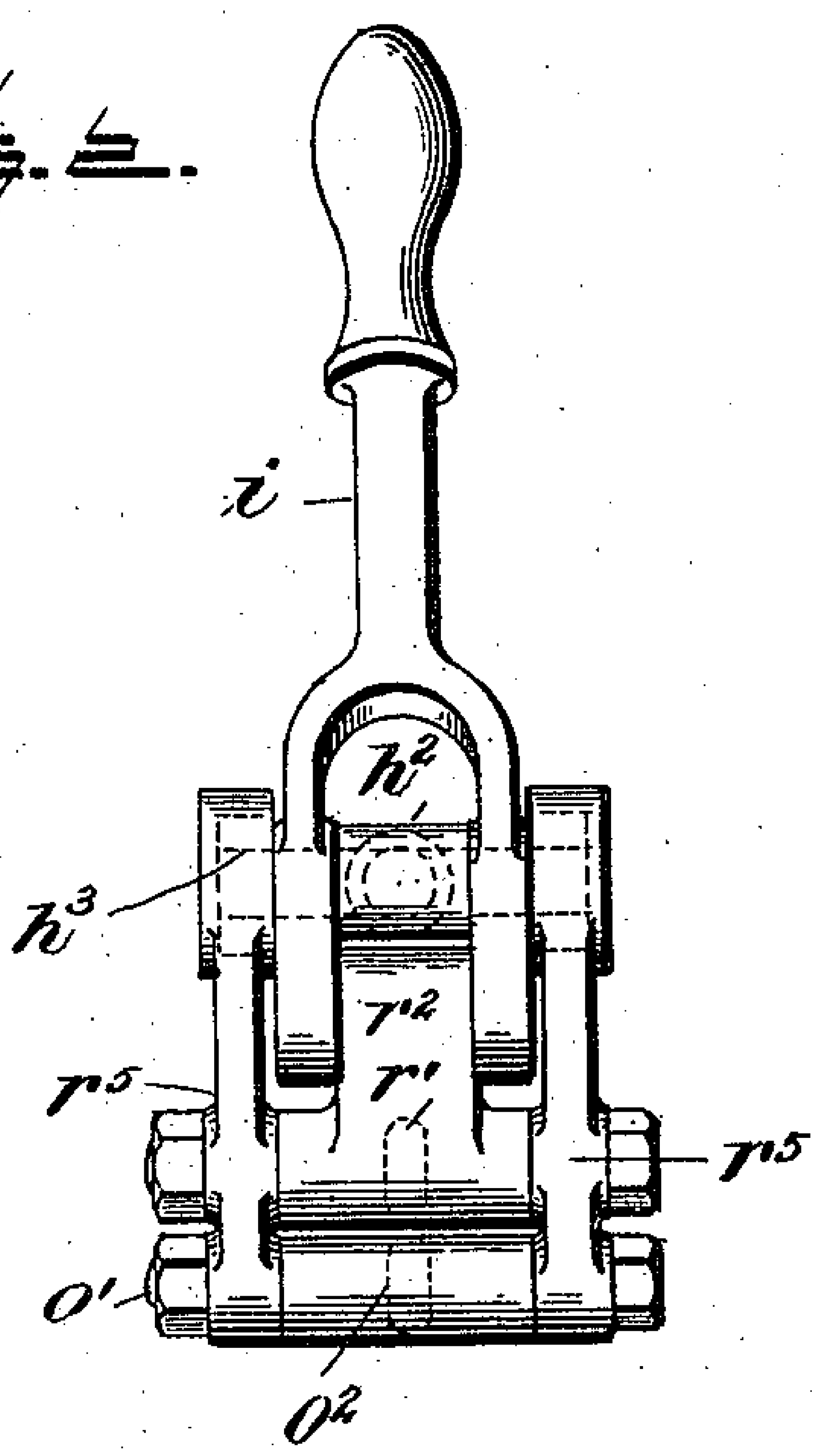


Fig. 3.

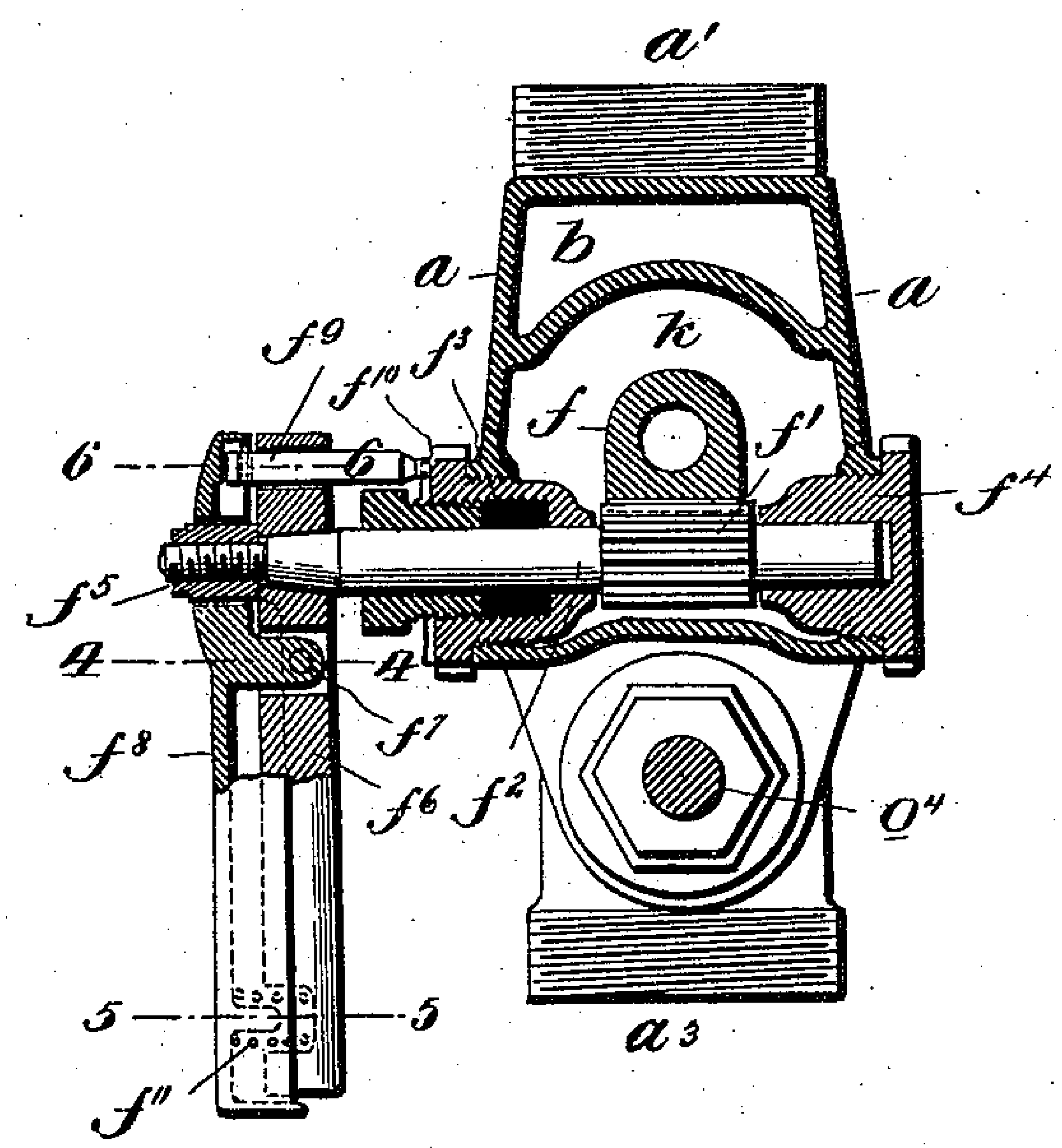


Fig. 4.

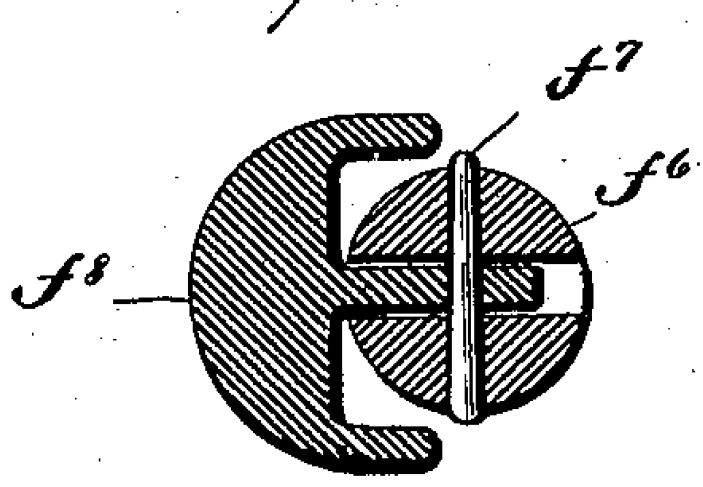


Fig. 5.

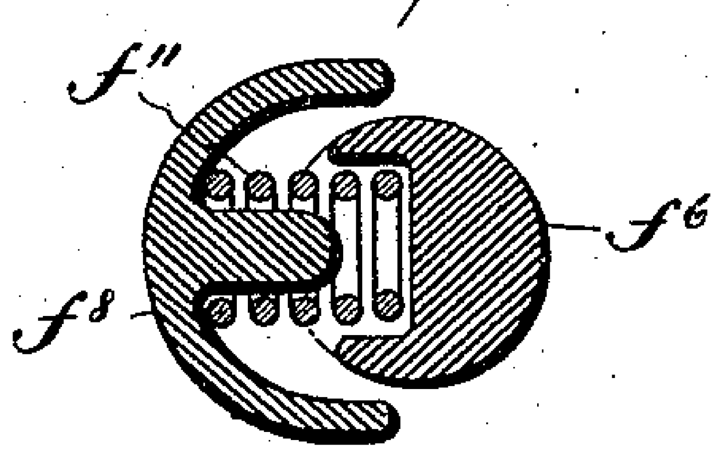
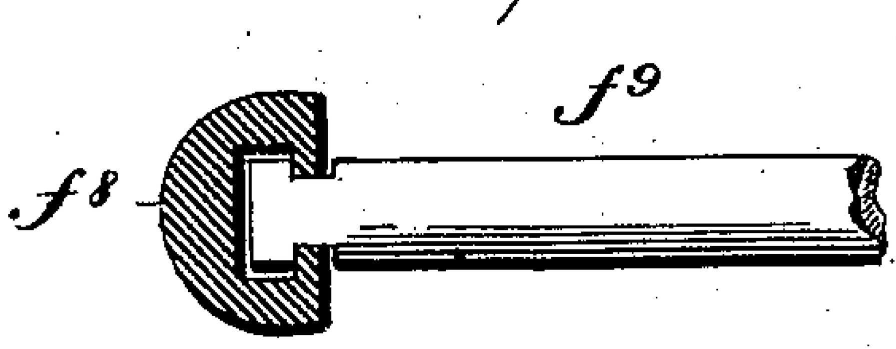


Fig. 6.



Witnesses:
L. C. Hills
Ewell A. Dick

Inventor:
John Desmond,
by [signature] his Atty.

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

UNITED STATES PATENT OFFICE.

JOHN DESMOND, OF NEW YORK, N. Y., ASSIGNOR TO THE NATHAN MANUFACTURING COMPANY, OF SAME PLACE.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 574,985, dated January 12, 1897.

Application filed September 3, 1896. Serial No. 604,707. (Model.)

To all whom it may concern:

Be it known that I, JOHN DESMOND, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Injectors, of which the following is a specification.

My invention relates to injectors in which the water by successive impulses of two or more steam-jets is forced into the boiler and in which the final overflow is forcibly closed, requiring efficient means 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.

It is one object of my invention to so construct an injector that its capacity, that is, the amount of water fed by the injector into a steam-boiler, can be readily adjusted to the varying duty of a stationary or locomotive engine in connection with which the injector may be used. Ordinarily for the purpose of regulating the quantity of water delivered double-jet injectors have been provided with a water-valve arranged in the water-chamber or suction-pipe of the injector and operated independently of the steam-inlet mechanism. Under this arrangement the water-valve is kept wide open when the maximum amount of water is to be delivered, and in order to feed smaller quantities the supply of feed-water is reduced by partially closing the water-valve. On the other hand, the volume of steam issuing from the different steam-nozzles remains constant, resulting necessarily in a considerable increase in the temperature of the water and consequently in an interruption of the water-jet before the desired reduction in the amount of feed-water could be reached. This is an occurrence well known to those skilled in the art. The greatest range of delivery can be obtained by varying the sectional area of the lifting steam-nozzle and of the combined nozzle of an injector of the character proposed by means of an endwise-movable and properly-formed forcing steam-nozzle. Heretofore this has usually been done by means of steam-valve-operating mechanism and nozzle-operating mechanism interdependent in their action, thereby rendering the mechanism too complicated for practical purposes and making it impossible to obtain a fixed position of the forcing steam-nozzle for maximum delivery, which is of course most desirable for the purpose of attaining the highest possible range of delivery. By means of my improved construction this desirable end is attained in an effective, practical, and simple manner.

A second object of my invention is to so construct the lever mechanism of the injector that the strain upon its component parts should be reduced to a minimum, thereby increasing the durability and efficiency of the device.

These, together with other features of my invention and their resultant advantages, will be pointed out in the detailed description of the apparatus in connection with the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a longitudinal axial section of the injector. Fig. 2 is an end view of the lever arrangement. Fig. 3 is a vertical cross-section on line 3 3, Fig. 1. Fig. 4 is a horizontal cross-section on line 4 4, Fig. 3. Fig. 5 is a horizontal cross-section on line 5 5, Fig. 3; Fig. 6, a like section on line 6 6, Fig. 3.

a is the casing or barrel of the injector, which at a', a^2, and a^3 is provided with the usual threaded necks for the steam, water, and delivery connections.

b is the steam-chamber, b' the water-chamber, and b^2 the delivery-chamber, of the injector, which latter is provided with the usual backflow-valve. (Not shown in the drawings.)

Into suitable partitions of the casing are screwed the lifting steam-nozzle *c*, the intermediate nozzle *d*, the combined condensing and delivery nozzle *e*, and the cap *g*.

The forcing steam-nozzle *f* is longitudinally movable and is supported and guided partly in the lifting steam-nozzle *c* and partly in the cap *g*. Cap *g* forms the seat of the steam-valve *h*, operated by the lever *i*, which valve, provided with a cylindrical extension h^4, controls the admission of steam to the forcing steam-nozzle *f*, as well as to the intermediate steam-chamber *k*, which is formed by and included between the cap *g* and the lifting steam-nozzle *c*. This intermediate steam-chamber, when valve *h* is partly or fully opened, is supplied with steam from the main chamber b through channels l in cap g. From the intermediate steam-chamber the steam enters the lifting-nozzle through channels c' in said nozzle. It will be noticed that the lifting steam-jet proper is formed as an annular opening by the inside bore m of nozzle c and the outside of the forcing steam-nozzle f. Back of the bore m the forcing-nozzle is slightly tapered, so that by moving this nozzle forward increasing diameters will enter the bore m, thereby reducing the annular opening at m and with this the delivery capacity of the injector. The forward end of nozzle f is also tapered, so as to reduce the area of the annular water-passages in nozzles d and e gradually when nozzle f is moved forward, thereby still further decreasing the delivery capacity when so desired.

n is the overflow-space for the lifting steam-jet, n' the overflow-chamber, and n^2 the usual overflow-valve. In starting, the lifting steam-jet passes through the space n, valve n^2, and final overflow-outlets n^3 and n^4 into the atmosphere. The final overflow-opening n^3 is controlled by valve o, which is operated by the same lever which controls the steam admission.

p is a check-valve interposed between water-chamber b and overflow-chamber n'. This valve admits an additional supply of water in addition to that at the receiving end of nozzle d whenever the pressure in chamber n' is lower than that in chamber b'.

Nozzle f is adjusted and moved in the following manner: The nozzle is provided at its bottom with a rack which engages with a pinion f' on spindle f^2, this latter being packed and guided by the stuffing-box f^3 and cap f^4, respectively. By means of the lock-nut f^5 the handle f^6 is made fast on the conical end of spindle f^2. To this handle is pivoted by pin f^7 a second handle f^8, to which is attached by means of a dovetail arrangement, such as shown in Fig. 6, a lock-pin f^9, which passes loosely through the upper part of handle f^6 and engages with notches milled into the outer surface of stuffing-box plate f^{10}. A spring f^{11}, placed into a recess of handle f^6 and pressing against the inner surface of handle f^8, tends to force the pin 4 into whatever notch it is opposite, thereby fixing the position of handle f^6 and with it that of nozzle f. By compressing the spring in grasping the lower ends of handles f^6 and f^8 the pin f^9 will be pulled out of the notches in plate f^{10}, when the spindle f^2 and with it the pinion f' can be oscillated and the nozzle f moved to and fro at will.

It will be noticed that as the movement of nozzle f is entirely independent of the steam-valve mechanism the position of said nozzle for maximum, as well as minimum, delivery or for intermediate delivery capacities can be fixed independently of the steam-valve.

The construction of the lever mechanism is as follows: The spindle h' of valve h passes through an ordinary stuffing-box, and by means of cross-piece h^2 and pin h^3 is attached to lever i. To suitable lugs on the casing of the injector is pivoted at r the fulcrum-bar r', which is provided with an upward extension r^2, through which are passed two pins r^3 and r^4. The upper pin r^3 forms the fulcrum for the lever i. The lower pin r^4 forms the fulcrum for two hangers r^5, hung on pin h^3 and engaging by means of pin o' the rod o^2, to which is pivoted at o^3 the spindle o^4 of overflow-valve o. It is evident that by moving the lever i in the direction of the arrow the steam-spindle h' and overflow-spindle o^4 will move in the direction of the arrows on their center lines, producing a perfectly-parallel motion for these two spindles. At the same time the power exercised at lever i applied to valve o will be multiplied through the intermediate-lever system, making it possible to easily overcome the pressure against valve o in stopping the apparatus.

Spindle o^4 is guided in stuffing-box s and guide-box s', which latter also closes the communication between delivery-chamber b^2 and water-chamber b'.

The operation of the injector is as follows: The lever is moved slightly in the direction of the arrow, lifting valve h off its seat. Steam through passages l, chamber k, and passages c' will enter the lifting-nozzle and, passing through overflow-openings n, n^2, n^3, and n^4 into the atmosphere, will exhaust the air from the water-chamber and suction-pipe and cause the atmospheric pressure to drive the water from a well or tank into the injector in the manner usual in injectors. The water so raised will pass through the receiving end of nozzle d and by the lifting steam-jet will be driven partly through valve n^2, partly through nozzle e into delivery-chamber b^2, and from there through overflow n^3 into the atmosphere. By moving the lever gradually backward the cylindrical extension h^4 of valve h will be removed from its guide in cap g, and steam will gradually enter also the forcing-nozzle f. The water will receive a second impulse from the steam passing through nozzle f and will be driven with increasing velocity through nozzle e. The pressure in chamber b^2 will soon rise above that in chamber b', and the valve n^2 will be closed down by the increasing pressure in chamber b^2. When this takes place, all the water will be compelled to pass through nozzle e into chamber b^2 and through the overflow-opening n^3, the area of which is continually decreased by the gradual closing of valve o. The pressure in chamber b^2 will now rise rapidly, and when the valve h is fully opened and valve o fully closed the velocity of the jet in e and the pressure in chamber b^2 will have increased sufficiently to overcome the resistance of the boiler-pressure, and then the water will enter the boiler.

In Fig. 1 nozzle f and handle f^6 are shown in their position for maximum delivery. To obtain the minimum delivery, nozzle f has to be moved forward until a shoulder f^{12} on it brings up against the base of nozzle c. Intermediate positions of nozzle f will give capacities intermediate between the maximum and minimum delivery.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a double-tube injector of the character described, the combination with the movable forcing steam-nozzle, lifting, intermediate and delivery nozzles of the intermediate steam-chamber k, formed by the valve-seat cap g and the lifting steam-nozzle c, as and for the purpose specified.

2. In a double-tube injector of the character described, the combination with the annular lifting steam-nozzle, central forcing steam-nozzle, intermediate and delivery nozzles, of the intermediate steam-chamber k, formed by the valve-seat cap g and lifting steam-nozzle c and supplied with steam from the main steam-chamber b through passages l in cap g, as and for the purpose specified.

3. In a double-tube injector in which both sets of nozzles are located in a common barrel on the same axis, the combination with the annular lifting steam-nozzle, central forcing steam-nozzle, intermediate and delivery nozzles of the intermediate steam-chamber k, formed by the valve-seat cap g and lifting steam-nozzle c, supplied with steam from the main chamber b through passages l in cap g and supplying steam to nozzle c through passages c' in the latter, substantially as described.

4. In a double-tube injector of the character described, the combination with the movable forcing steam-nozzle, annular lifting steam-nozzle, intermediate and delivery nozzles of the intermediate steam-chamber k, formed by the valve-seat cap g and lifting steam-nozzle c, said cap and nozzle serving also as supports and guides for the movable forcing steam-nozzle f, substantially as described.

5. In a double-tube injector of the character described, the combination with the movable forcing steam-nozzle, annular lifting steam-nozzle, intermediate and delivery nozzles, of the cap g, provided with a seat for valve h, with side passages l and a central passage, the former communicating with the chamber inclosed between the cap and the lifting steam-nozzle, the latter with the nozzle f, steam admission into passages l, being controlled by valve h and into the central passage by extension h^4 of said valve, substantially as and for the purpose specified.

6. In a double-tube injector with forcibly-closed final overflow, the combination with the usual steam-valve h and its spindle, overflow-valve o and its spindle, and the lever i, of the fulcrum-bar r' r^2, and the hangers r^5 connected to the overflow-valve spindle and operated by the lever i, substantially as hereinbefore set forth.

7. In an injector with forcibly-closed overflow, the combination with the steam-valve h and its spindle, overflow-valve o and its spindle, lever i, fulcrum-bar r', r^2 and hangers r^5, of the link o^2 connecting spindle o^4 with hangers r^5, as and for the purpose specified.

8. In a double-tube injector with forcibly-closed overflow, a compound-lever arrangement for the simultaneous operation of the steam-valve and overflow-valve in parallel but opposite directions, consisting of the lever i, double fulcrum-bar r', r^2, hangers r^5, link o^2, spindles h' and o^4, valves h and o, the hangers being oscillatingly attached to pin h^3, which connects spindle h' to lever i, the lever imparting an oscillating motion to hangers r^5, which transmit this motion through link o^2 to spindle o^4 and valve o, substantially as described and specified.

9. In an injector with forcibly-closed overflow the combination with the casing of the injector, overflow-valve o, spindle o^4 and stuffing-box s of the guide-box s', separating the delivery-chamber from the water-chamber b' and serving as guide to the spindle o^4, substantially as described.

10. In an injector with forcibly-closed overflow, the combination with the casing of the injector, overflow-valve o, spindle o^4 and stuffing-box s, of the cylindrical guide-box s', passing longitudinally through the water-chamber b', separating this latter from the delivery-chamber b^2 and serving as guide and support for spindle o^4, substantially as specified.

11. In an injector with forcibly-closed overflow, the combination with the casing, overflow-valve o, spindle o^4 and stuffing-box s, of the cylindrical guide-box s', screwed at one end into the partition which separates the water and delivery chambers, and at the other end fitted piston-like into the stuffing-box s and tightly packed therein, permitting the overflow-spindle to pass through the water-chamber, but preventing any fluid from passing from the delivery-chamber b^2 into water-chamber b^5, substantially as described.

12. In a double-tube injector of the character described, the combination with the movable forcing steam-nozzle, pinion f' and spindle f^2 of the double handle f^6 f^8, notched plate f^{10} and pin f^9, all arranged, constructed and operated substantially as described.

13. In a double-tube injector of the character described, the combination with the steam-valve-operating mechanism, of the movable forcing steam-nozzle, an operating mechanism for said nozzle independent of and separate from the steam-valve-operating mechanism and means for locking said nozzle-operating mechanism in its adjusted position, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 26th day of August, 1896.

JOHN DESMOND.

Witnesses:
MORRIS STETTHEIMER,
ADOLPH BARGEBUHR.