

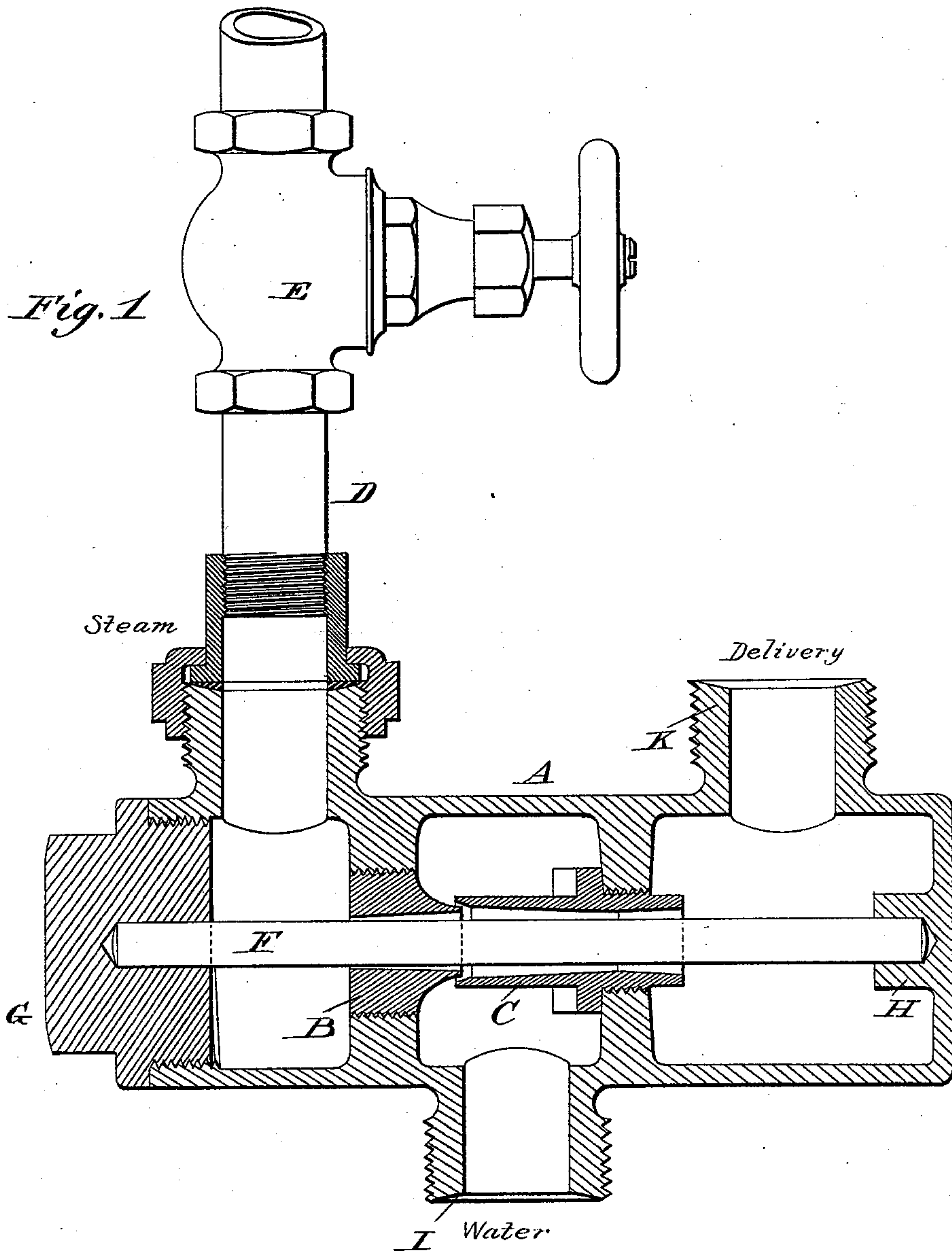
(Model.)

2 Sheets—Sheet 1.

E. J. YOUNG.  
INJECTOR.

No. 516,387.

Patented Mar. 13, 1894.



Witnesses  
*J. F. Coleman*  
*E. J. Young*

Inventor.  
*Edwin J. Young*  
by *W. H. Funchel*,  
att'y.

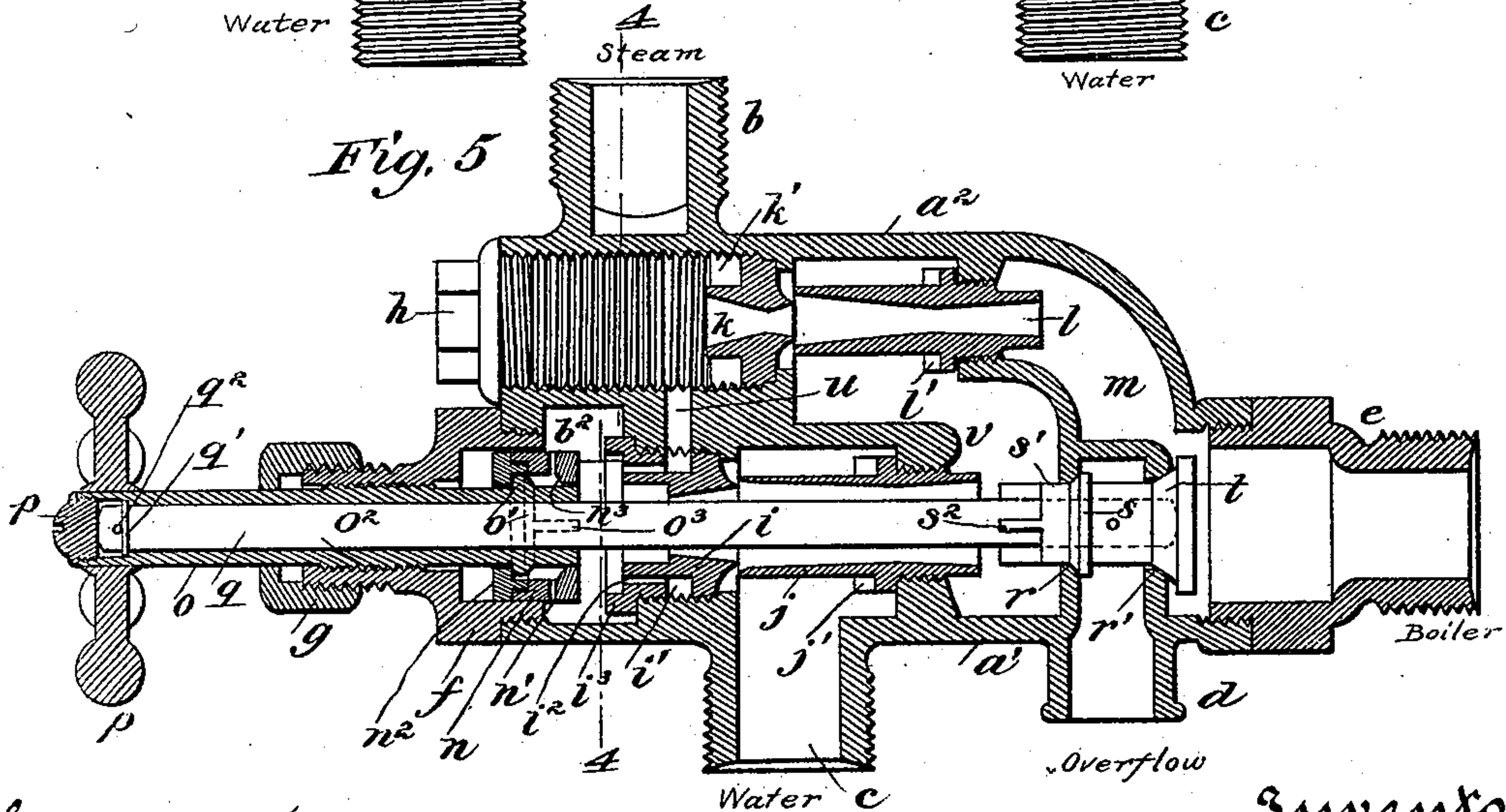
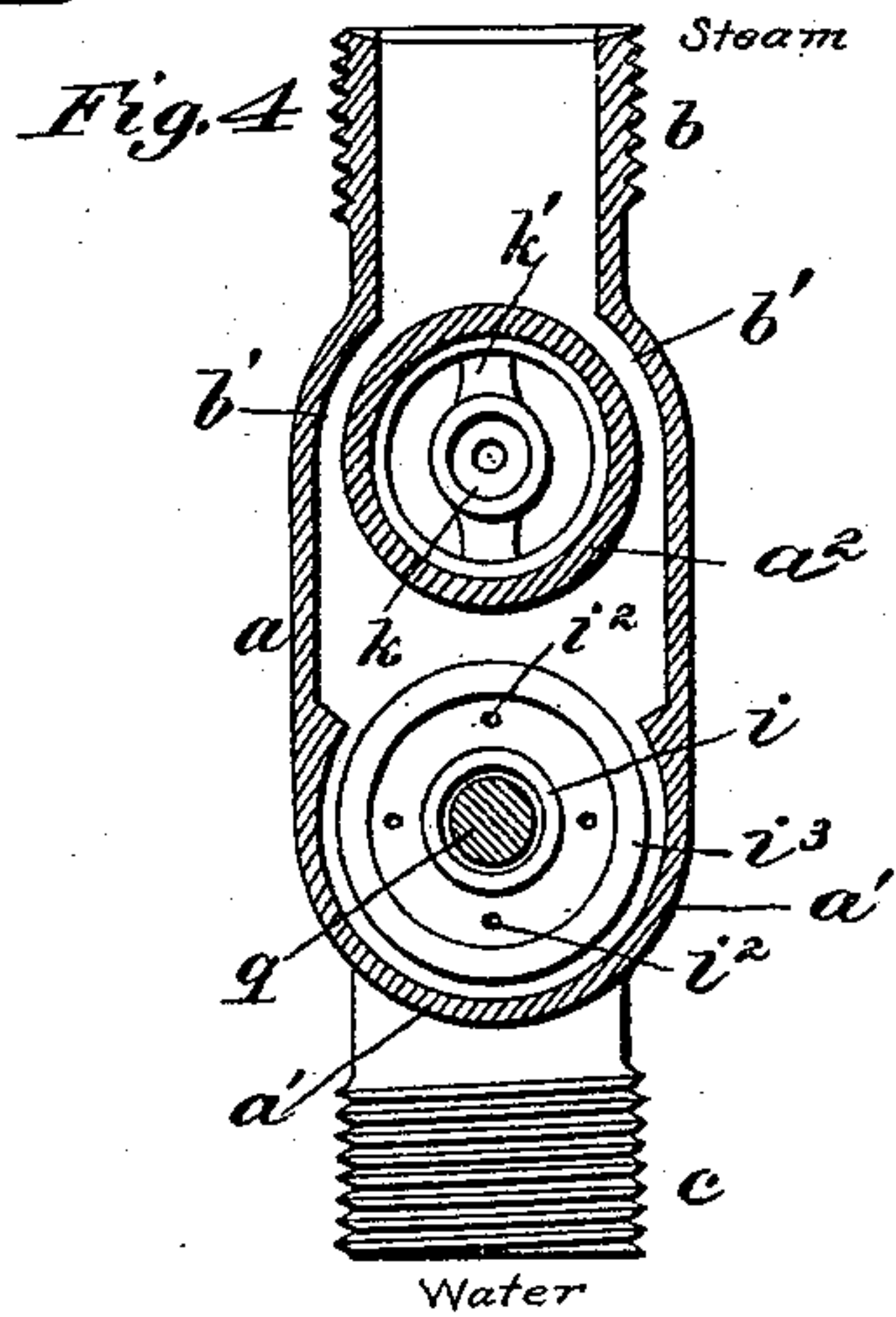
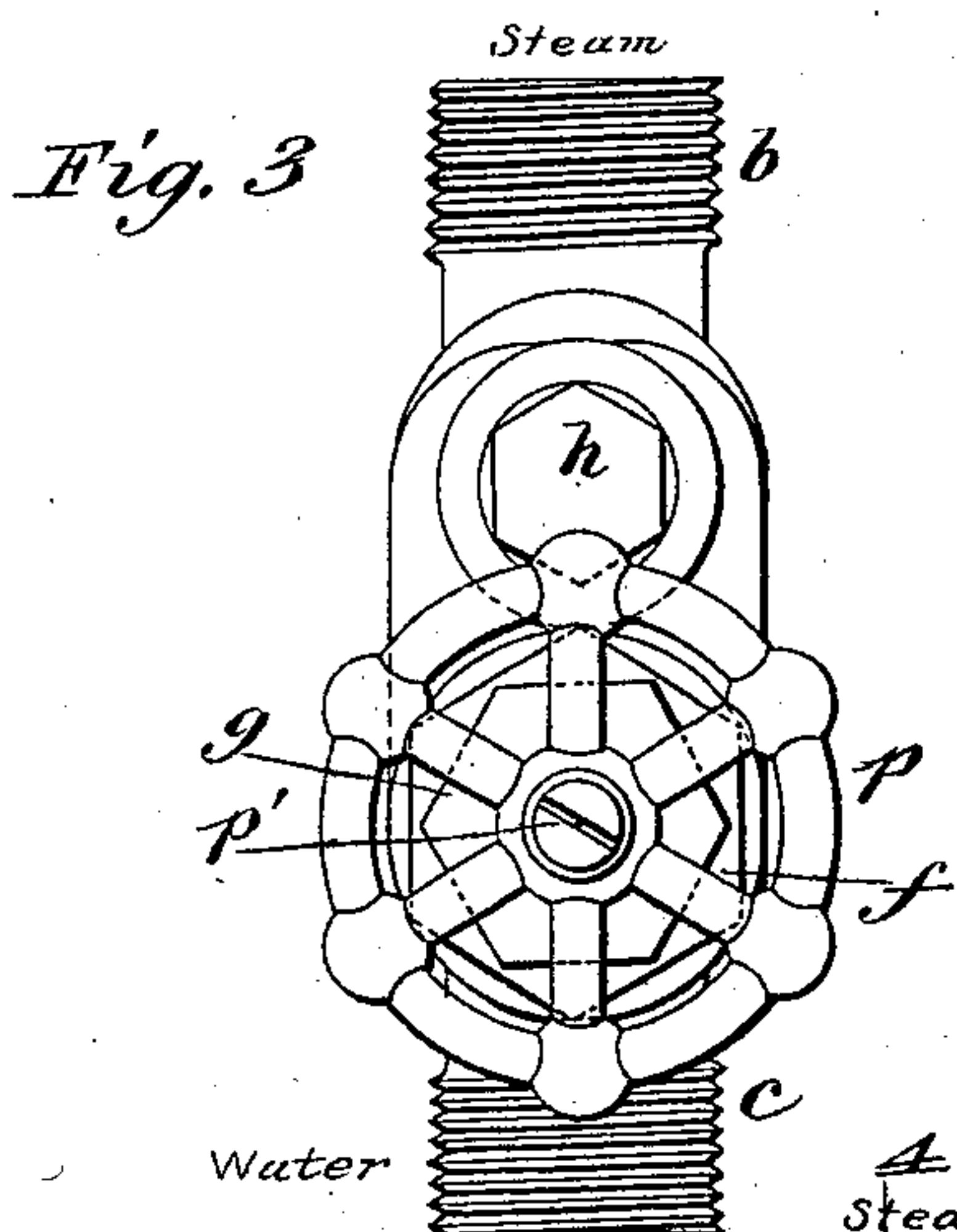
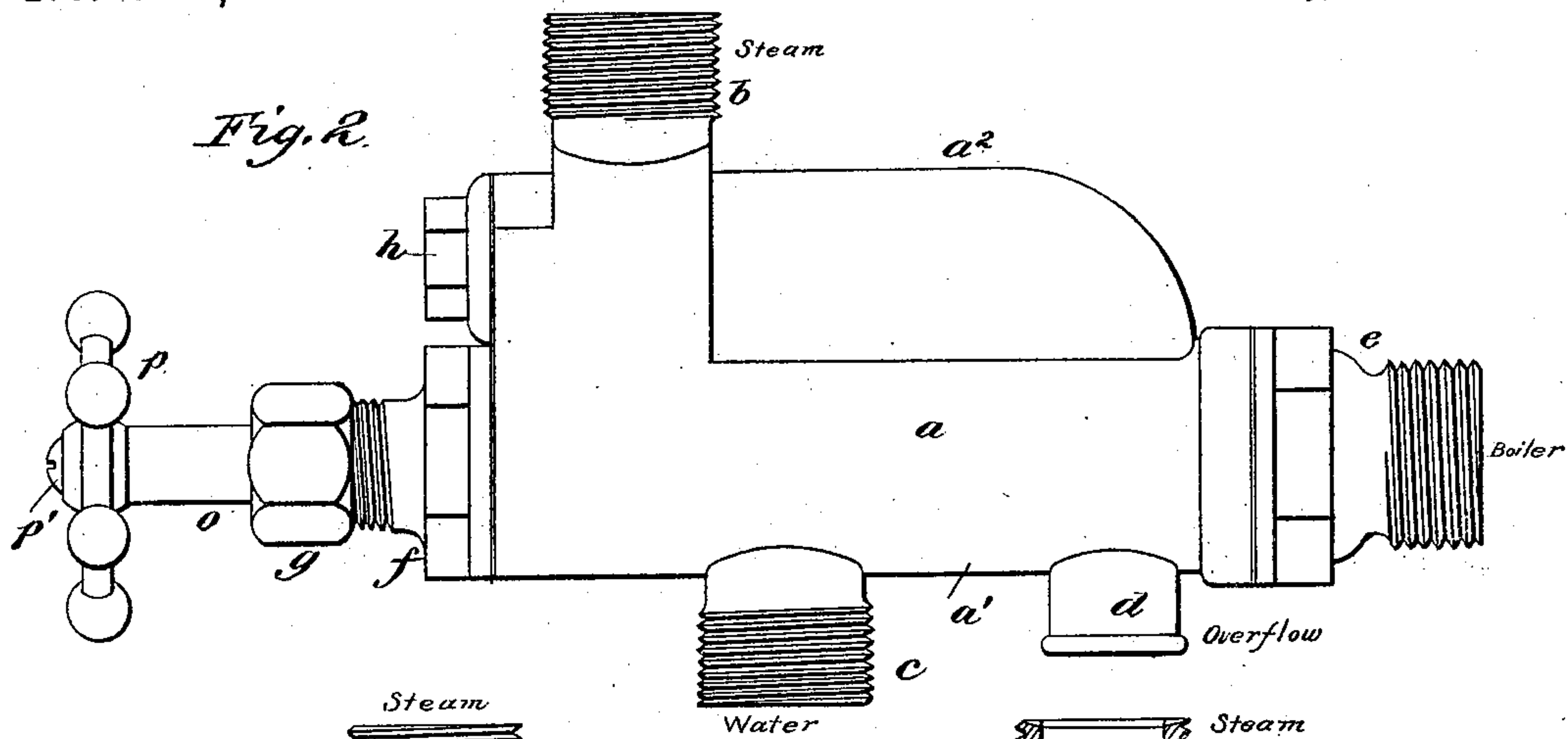
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2 Sheets—Sheet 2.

E. J. YOUNG.  
INJECTOR.

No. 516,387.

Patented Mar. 13, 1894.



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# UNITED STATES PATENT OFFICE.

EDWIN J. YOUNG, OF WADSWORTH, OHIO, ASSIGNOR TO THE GARFIELD  
INJECTOR COMPANY, OF SAME PLACE.

## INJECTOR.

SPECIFICATION forming part of Letters Patent No. 516,387, dated March 13, 1894.

Application filed December 11, 1893. Serial No. 493,346. (Model.)

*To all whom it may concern:*

Be it known that I, EDWIN J. YOUNG, a citizen of the United States, residing at Wadsworth, in the county of Medina and State of Ohio, have invented a certain new and useful Improvement in Injectors, of which the following is a full, clear, and exact description.

As is well known, an injector is a machine for forcing water into a boiler against boiler pressure, and an ejector is a machine for raising or lifting water. The two machines oftentimes, if not commonly, are combined in one apparatus which takes the single name of "injector." It is well known also that such injectors require a valve for controlling the amount of steam for raising the water into the apparatus, and another valve for controlling the overflow and another valve for controlling the direction of the steam carrying the water into the forcing apparatus, whereby it is directed to the boiler, and another valve interposed between the boiler inlet and the overflow, and that these four valves ordinarily have been provided with independent means for operating them, although it is not uncommon to provide external means for operating two or more of them simultaneously. Ordinarily the steam used in ejectors is in the form of a solid column, the center of which exerts little if any force in raising the water, and, because of its contained heat, it is a positive detriment in cases where the water raised is desired in a cool state for condensing and other purposes.

In my invention as applied to ejectors, pure and simple, I employ a metallic cylinder or rod extending through the steam jet and lifting tube, whereby the steam is spread out in the form of a hollow cylindrical column so as to increase its working area with a smaller quantity of steam for a given work and to reduce its heating capacity.

My invention consists also in arranging all of the four valves before mentioned as common to injectors upon a single operating stem or spindle, which stem is arranged within and not outside of the apparatus.

The invention also consists in certain details of parts and combinations of parts as hereinafter more particularly set forth and claimed.

Having thus stated the principle of my invention, I will proceed now to describe the best mode in which I have contemplated applying that principle, and then will particularly point out and distinctly claim the part or improvement which I claim as my invention.

In the accompanying drawings illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a longitudinal section of an ejector embodying my invention. Fig. 2 is a side elevation of my combined ejector and injector or double injector. Fig. 3 is an end elevation thereof. Fig. 4 is a cross-section taken in the plane of line 4—4, Fig. 5; and Fig. 5 is a substantially central longitudinal sectional elevation of the double injector.

The simplest form of my invention is its application to ejectors or devices for raising or lifting water without regard to the use to which such water is to be applied. An illustration of this use is shown in Fig. 1, wherein—

A is a shell of suitable construction, and containing a steam jet or tube B and a lifting tube C, such, for example, as are commonly employed in the lifting portion of an injector but somewhat larger in order to receive the rod or cylinder presently described. D is a steam pipe suitably connected to the shell A to admit steam to the jet B, and E is a valve in said steam pipe for controlling the admission of steam to the shell.

F is a round rod or true cylinder of metal, arranged within and passing through the steam jet B and lifting tube C and supported stationarily within the shell and centrally within the tubes B and C by means of any suitable supports G and H.

I is the nipple for connection with the water supply and K is a delivery nipple. If, now, the water connection be made and steam be admitted to the shell, the steam will pass through the tubes B and C and be spread out by and around the rod F in the form of a hollow column, and driving the air before it, will exhaust the shell and its tubes of air and so lift the water. Since the rod or cylinder passes through both the steam jet and the lifting tube, the steam is preserved in the form of a hollow column until its work is ac-



complished. By thus spreading out the steam through these tubes in the form of a hollow column, less steam is required to effect the raising of the water, and moreover, the water is freed from the heat that it would derive from the solid column of steam were that used, and hence the water is delivered cool and in a fit state to use for condensing purposes. Not only does the use of a hollow column of steam effect a saving in steam but it also quickens the action of raising the water, since its expulsive force is distributed over a larger area.

Another useful form of my invention is shown in Figs. 2 to 5, wherein a combined ejector and injector is shown. In these figures, the casing *a* may be made as one casting with the lifting or ejector portion *a'* and the forcing or injector portion *a''*; the steam inlet nipple *b*, the water inlet nipple *c*, and the overflow *d*. The boiler connection *e* may be made as a separate piece tapped into the end of the lifting portion *a'*; and the other end of the lifting portion is provided with a hub or bonnet *f*, which may be supplied with the gland or stuffing box *g*; and one end of the forcing portion *a''* is screwthreaded internally and closed by means of the removable screw plug *h*. The steam inlet *b* surrounds the forcing portion and is cored out at *b'*, *b''*, around such forcing portion, and this cored-out portion is open at *b''* into the lifting portion of the apparatus.

*i* is the steam jet, and *j* the lifting tube in the ejector, which may be of usual construction, excepting as hereinafter described and correspond with parts B and C in Fig. 1.

*k* is the steam jet in the ejector, and *l* the forcing tube therein; and this forcing tube opens into a passage *m*, which leads to the boiler through the boiler coupling *e*, past the overflow. The steam jet *i* is provided with an annular recess or groove *i'*, which forms a steam passage, access to which steam passage *i'* is had through longitudinal holes *i''*, and opposite the said holes *i''* the said steam jet forms a valve seat for the duplex steam valve presently described. The steam jet *i* is provided with wings or lugs *i'''*, and the lifting tube *j* is provided with wings *j'*, and the steam jet *k* is also provided with wings *k'*, and the tube *l* is also provided with wings *l'*, whereby, by means of a hollow wrench, the said jets and tubes may be screwed into place and removed at pleasure. The duplex steam valve is composed of an annular tube *n* having transverse ports *n'* opening into its hollow interior. This valve floats upon a hollow valve stem *o*, which is provided with a valve *o'*, and the said valve *n* is secured to the hollow valve stem *o* by means of an annular nut *n''*. The valve *o'* is provided with wings or ribs *o'''* which project into the opening of the valve *n* to sustain the said valve *n* in the various movements of the valves *n* and *o'* with relation to one another. The valve stem *o* is screwthreaded at *o''* to engage a corresponding screwthread in the bon-

net *f*, and to the end of this valve stem *o* is applied, in any suitable manner, the operating hand-wheel *p*, which is closed steam-tight by a screw plug *p'*. Within the hollow stem *o* is arranged the valve spindle, stem, or rod *q*, and this rod passes through the steam jet and lifting tube and ports *r*, *r'* in the overflow, and there its inner end is supplied in any suitable manner with the valves *s* and *t*. The valve *s* is supplied with a cylindrical projection *s'* and the wings *s''*. The valve *s* and its cylindrical projection control the overflow port *r* and the wings *s''* fitting in the port *r* guide the stem *q* in the further movement of the same, while the valve *t* controls the overflow port *r'*. A port *u* communicates between the forcing tube and the steam groove or chamber *i'* in the steam jet *i*, and port *v* opens communication between the lifting portion or ejector and the forcing portion or injector for the passage of water from the ejector to the said injector.

The rod *q* and the stem *o* are connected so as to move together by means of a washer *q'* and the cross-pin *q''*, or they may be connected in any other suitable manner.

The operation is as follows: When the injector is not in operation, the wheel *p* will be turned so as to move the valve *n* down upon its seat on the steam jet *i*, thereby closing the ports *i''* as well as closing the steam jet, and the valve *o'* will be seated upon its seat *n''* in the valve *n*, thereby closing the ports *n'*, and, at the same time, the valves *s* and *t* will be moved to uncover the ports *r* and *r'* in the overflow. In this position of parts, steam fills the chamber, covering the valves *n* and *o'*, and hence no valve is required in the steam pipe to operate the injector. If now the wheel *p* be turned and raises the valve *o'* from its seat, steam will enter the hollow valve *n* and hold the latter to its seat while the steam passes through the said hollow valve and out of said hollow valve around the valve stem *q*, and thence through the steam jet and the lifting tube in the form of a hollow column in the manner and with the effect described with relation to the construction shown in Fig. 1. The steam exhausts at valve *s'* until the water is raised and then the wheel is turned far enough to draw the portion *s'* of said valve *s* into the port *r*, and thus divert the water through the passage *v* into the forcer; and, at the same time, or immediately thereafter, the valve *n* is lifted from its seat and steam is admitted through the holes *i''* into the steam way *i'*, and thence into the forcer through the port *u*, whereby the injector is put into full operation, excepting that the valve *t* still allows the forced water to escape at the overflow until the velocity is fully established, and when that occurs, then the wheel *p* is turned until the valves *s* and *t* are fully seated in their ports *r* and *r'* and the overflow thus completely closed, when the water goes directly through the forcer to the boiler. It will be observed that by means of



the one valve rod *q*, the four valves necessary to operate this form of injector are given their respective movements at the proper times for raising the water, diverting it from the ejector into the forcer or injector, and thence forcing it into the boiler. The rod which effects this movement of the valves is wholly inclosed within the apparatus and thus is out of danger of being broken or distorted, as so frequently occurs with those injectors where the valve-operating devices are exposed on the outside of the apparatus. Instead of operating the valve rod *q* by means of a hand-wheel and screw, it might be operated by means of a lever in the ordinary manner, but I prefer the screw and hand-wheel.

Obviously, my invention of applying to valves a single operating device concealed within the apparatus is applicable to other forms of injectors than that herein specifically described and illustrated, whether the valve rod, stem or spindle is passed through the lifting tubes or not, with but slight obvious mechanical changes in the construction of such apparatus; and I mean to include as within my invention the application of this valve-operating mechanism to any and all forms of double injectors and other equivalent injectors.

By the construction of injector described, the apparatus is rendered very simple in operation and is easily controlled, is very quick to raise the water and to establish flow to the boiler, and may be very economically produced; its parts are all readily accessible without breaking the boiler connection, and hence repairs may be quickly made and defects or injuries remedied.

What I claim is—

1. In a steam water raising or lifting apparatus, a steam jet or tube, a lifting tube and a round rod or cylinder arranged within and passing through both to spread out the steam in the form of a hollow cylindrical column thereby giving a large working area with a small quantity of steam and reducing its heating capacity, substantially as described.

2. The combination with an injector or forcer, of an ejector mechanism, comprising a steam jet, a lifting tube, and a round rod or cylinder arranged within and passing through both to spread out the steam in the form of a hollow cylindrical column thereby giving a large working area with a small quantity of steam and reducing its heating capacity, substantially as described.

3. An injector or forcer, in combination with an ejector mechanism comprising a steam jet, a lifting tube, and a cylinder or rod passed through the said steam jet and lifting tube to spread out the steam in the form of a hollow cylindrical column thereby giving a large

working area with a small quantity of steam and reducing its heating capacity, and the steam and water controlling valves applied to and operated by said rod, substantially as described.

4. In an injector, the combination of a lifting steam jet, a lifting tube, an overflow, and a forcing apparatus, of four valves for controlling the course of the steam and the course of the water, and a single spindle, rod or stem, upon which said valves are arranged, the said spindle, rod or stem being arranged within the apparatus and extending through the lifting steam jet and the lifting tube, and operated from outside, substantially as shown and described.

5. In an injector, a duplex steam valve composed of a floating hollow valve, a positively-movable valve arranged within the same and having its seat within said floating valve and adapted by further movement to seat the said hollow valve, and the steam-jet having a seat for said hollow valve provided with ports leading into a steam passage which opens into the forcing apparatus for forcing the water to the boiler, substantially as described.

6. In an injector, the combination with the lifting apparatus and the forcing apparatus, of a duplex steam valve, an overflow having ports on the lifting side and on the forcing side of said apparatus, valves arranged in said ports, and a spindle, rod or stem common to the said overflow valves and duplex steam valve, for controlling the admission of steam both to the lifting and to the forcing mechanisms, and whereby the movements of said valves are controlled, substantially as described.

7. The combination in a single shell or case, of a water lifting mechanism and a water forcing mechanism, a duplex steam valve for controlling the initial admission of the steam to the lifting mechanism and thereafter to admit the steam to the forcing mechanism, a water-way between the lifting mechanism and the forcing mechanism, and an overflow interposed between the two mechanisms and provided with ports opening into the said overflow from the lifting side and the forcing side, valves arranged in the said overflow ports, and a valve stem, rod or spindle common to the duplex steam valve and the two overflow valves, and arranged within the apparatus, substantially as described.

In testimony whereof I have hereunto set my hand this 8th day of December, A. D. 1893.

EDWIN J. YOUNG.

Witnesses:

WM. H. FINCKEL,  
HARRY Y. DAVIS.