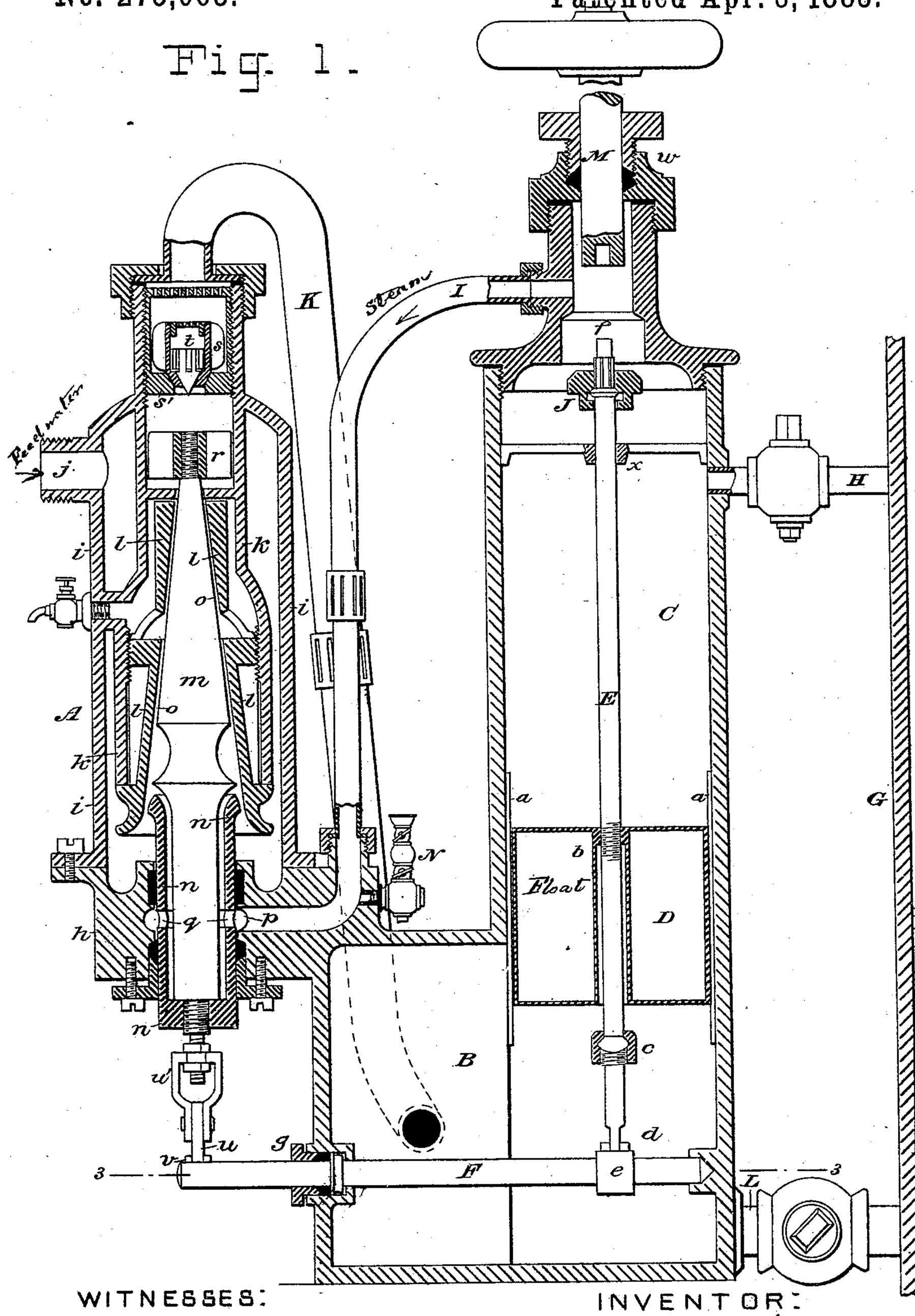
(Model.) 3 Sheets—Sheet 1.

W. McELROY.

FEED WATER INJECTOR.

No. 275,063. Patented Apr. 3, 1883.

Fig. 1.



WITNESSES:

E. B. Bolton

Geo. Bainton

INVENTOR:

Wm McElroy

by his Attys.

Burke, Fraser & Connett.

(Model.)

3 Sheets—Sheet 2.

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Fig. 2.

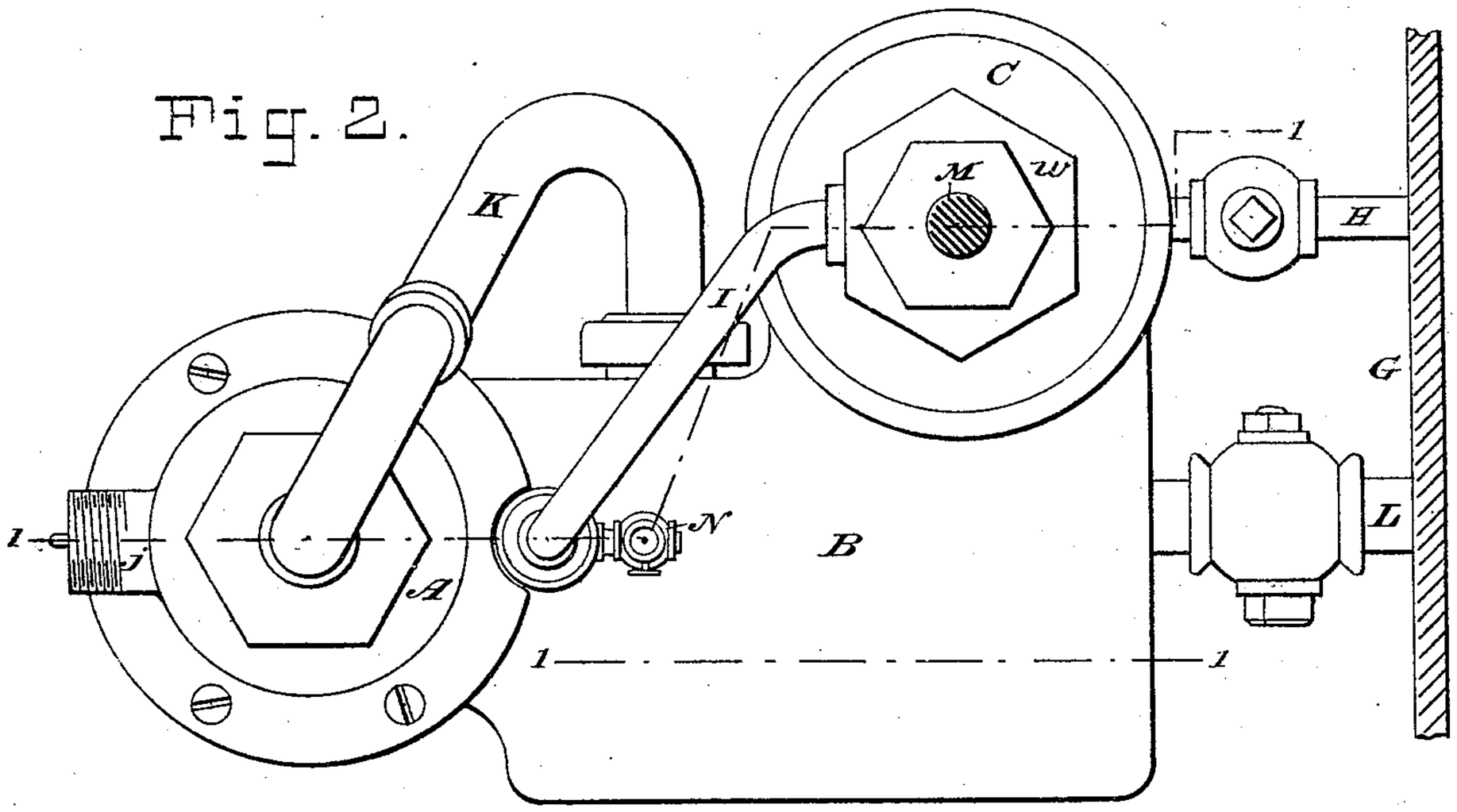

Fig. 3.

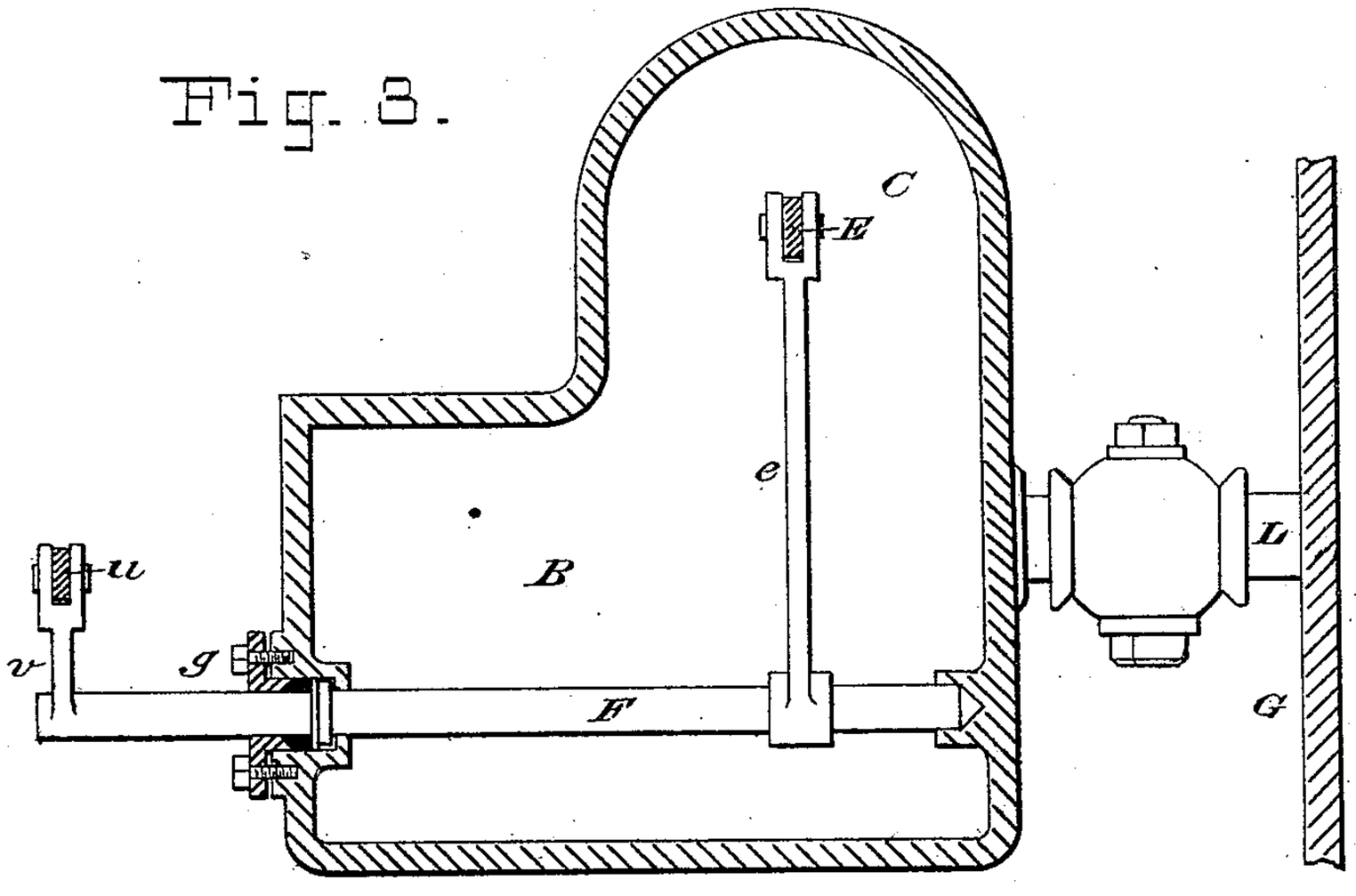

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Fig. 4.

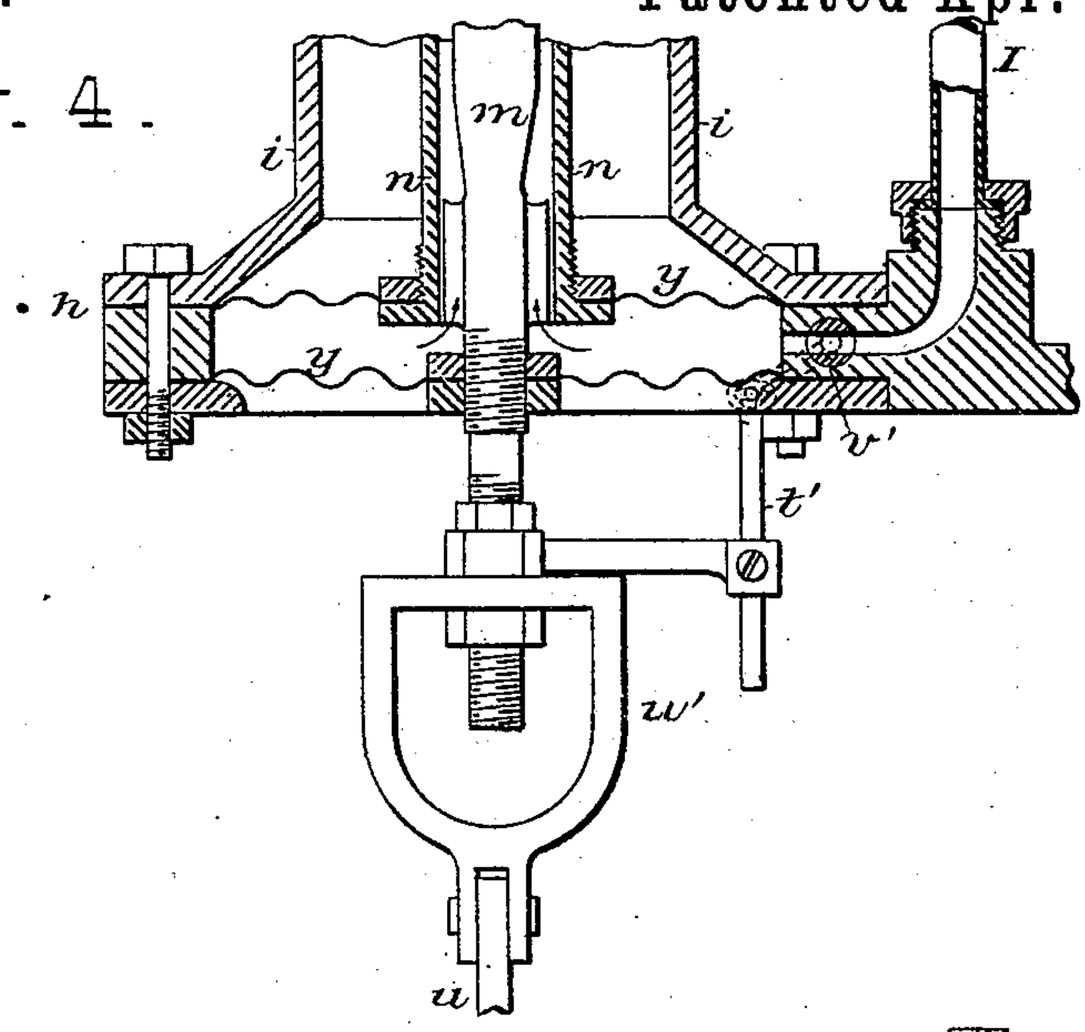


Fig. 5.

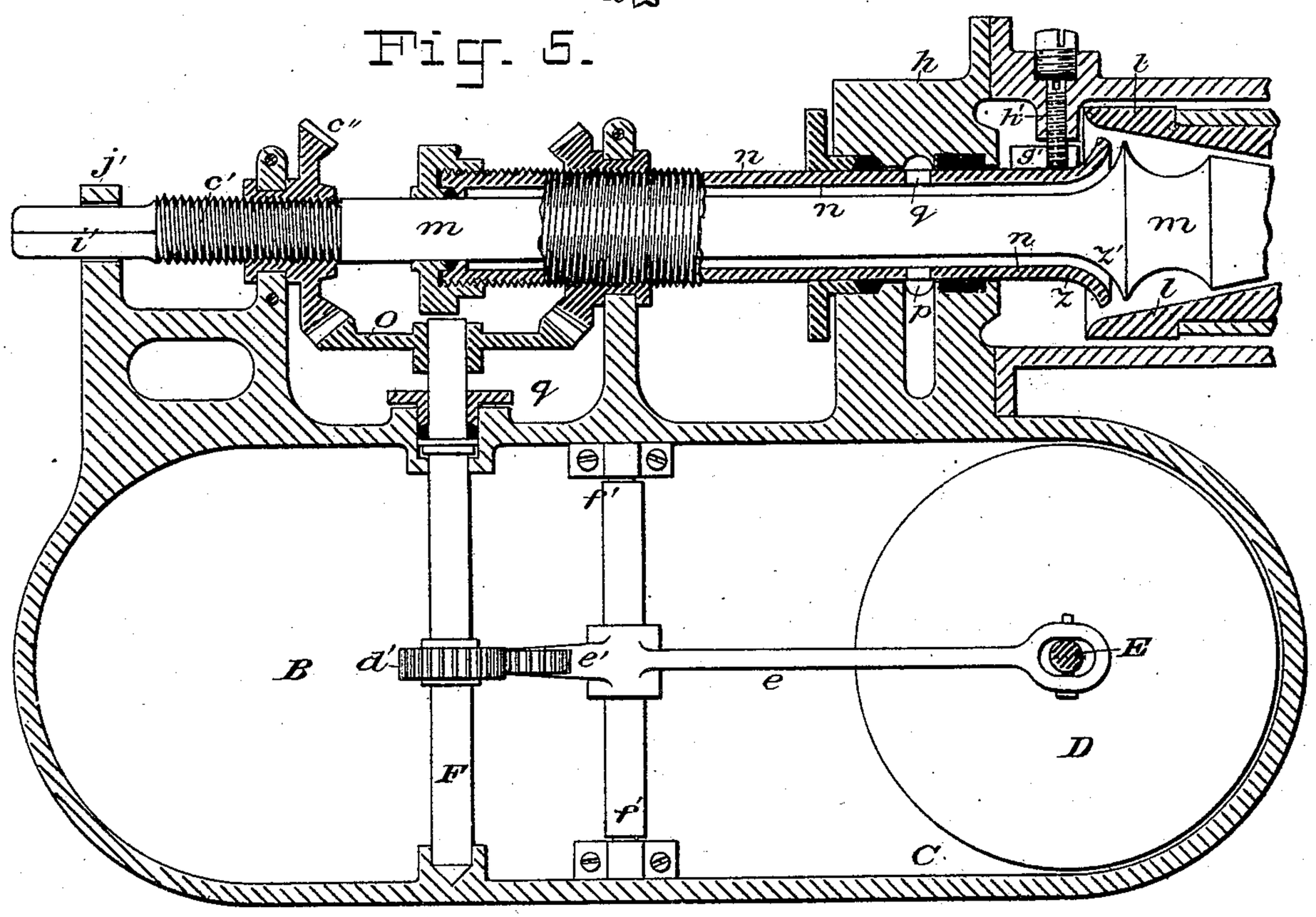
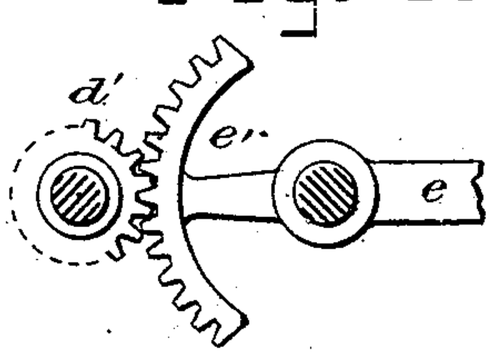


Fig. 6.



WITNESSES:

E. B. Bolton

Geo. Bainton

INVENTOR:

Wm McElroy

By his Attorneys,

Burke, Fraser & Connelly

UNITED STATES PATENT OFFICE.

WILLIAM McELROY, OF BROOKLYN, NEW YORK.

FEED-WATER INJECTOR.

SPECIFICATION forming part of Letters Patent No. 275,063, dated April 3, 1883.

Application filed July 13, 1882. (Model.)

To all whom it may concern:

Be it known that I, WILLIAM MCELROY, a citizen of the United States, residing at Brooklyn, Kings county, New York, have invented certain Improvements in Feed-Water Injectors, of which the following is a specification.

This invention relates to an injector for feeding water to steam-generators, arranged to be automatically controlled in its operation by a float, whereby the admission of steam to the injector is proportioned to the altitude of the water-level in the generator, and whereby the steam is entirely cut off from the injector when the water-level has risen to the predetermined altitude.

So far as I am aware, all injectors heretofore have been controlled by hand only, and it was necessary to keep up a vigilant inspection of the water-gage in order to maintain the water at the proper level. My injector entirely obviates this difficulty, being automatic in its action, and arranged to inject the feed-water only when needed.

In the drawings which serve to illustrate my invention, Figure 1 is a vertical section taken substantially on lines 1 1 in Fig. 2. Fig. 2 is a plan. Fig. 3 is a horizontal section taken on line 3 3 in Fig. 1. Figs. 4, 5, and 6 illustrate modifications which will be referred to more particularly hereinafter.

A represents the injector proper, taken as a whole; B, a water-chamber, and C a float-chamber. The float D is mounted to play up and down in the float-chamber, being guided on ribs *a a*.

E is the stem of the float, which is screwed into the latter at *b*. The stem E has a ball-coupling in it at *c*, and its lower extremity, *d*, is coupled to an arm, *e*, on a rock-shaft, F.

The steam-space in the generator G is connected with the float-chamber by a pipe, H, which may be controlled by a cock, as shown.

I is a steam-pipe leading from the float-chamber to the injector; and J is an ordinary relief-valve, mounted on the stem E, and arranged to cut off the passage of steam to the injector by the seating of said valve on its seat *f* when the water in the boiler has raised the float to its greatest altitude. This valve is a precautionary device in the main, and its functions will be explained more fully hereinafter.

The rock-shaft F is packed at *g*, where it passes out of chamber B, and it will readily be seen that when the float D plays up and down with the rise and fall of the water in C the shaft F will be rocked or oscillated through the medium of the arm *e*.

The water is fed from the injector through a pipe, K, into chamber B, and passes thence through a pipe, L, to the generator below the water-line. Thus the chambers B and C become substantially a part of the generator, and there is open communication between the two around the float.

The injector proper, A, does not differ materially from the ordinary injectors now in use in its functions and internal structure, except in respect to those parts which are modified to suit it to my purposes. Its base *h* is mounted on or fixed to the chamber B, and on this base is mounted the outer shell, *i*, in which is the feed-water inlet *j*. Cast with the shell *i* is the inner pendent casing, *k*, into which are screwed the parts *l l*, forming the exterior cone. These parts are all fixed in place, and are constructed similar to the like parts in ordinary injectors. In my injector, however, the interior spindle or cone, *m*, and its exterior tubular shell, *n*, are fixed together, but are arranged to play up and down through a packed bearing in the base *h*, whereby the faces of the interior and exterior cones may be brought more or less nearly together, and the annular space *o* between them be reduced or enlarged. The steam from pipe I enters an annular channel, *p*, in the base *h*, around the cylindrical tubular shell *n*, and passes through said shell at apertures or ports *q* when the latter coincide or register with the said channel *p;* but when the connected parts *m* and *n* are pushed upward these ports are gradually cut off and the admission of steam checked and eventually stopped entirely. The upper extremity of the spindle *m* is guided in its movements by a winged cross-head, *r*, and the water-outlet is controlled by a double check-valve. The main check-valve *s* closes down upon a seat, *s'*, and the lesser supplementary check-valve *t* seats itself inside of the valve *s*. When the supply of steam to the injector is reduced by the rising of the float the lesser check-valve only will be lifted, and this will afford egress sufficient for the limited amount of water passing.

The moving parts *m* and *n* of the injector

proper are coupled by a link, *u*, with a short arm, *v*, on the exterior extremity of shaft F, an adjustable coupling, *w'*, being employed to effect the proper adjustment of the said parts *m* and *n*, with respect to the float. The latter may also be adjusted by the following-described means.

On the top of the float-chamber is a stuffing-box, *w*, through which passes a key, M, provided with a hand wheel or crank. In the lower end of this key is a socket, which, when the key is pressed down, takes over a square on the upper end of the float-stem E. By turning the key the stem is turned and the float D run up or down, as required. The ball-coupling at *c* permits rod E to turn freely without affecting the joint to the arm *e*.

So far as described the operation is as follows: The float is set in such a position as to cut off the steam to the injector when the water has risen in the generator to the desired level or altitude. When the water stands at this level the ports *q* of the injector will be raised above the steam-inlet *p* and the injector will cease to operate. When the water falls in the generator the float will also fall, and, operating through the arm *e*, rock-shaft F, and arm *v*, will draw down the parts *m* and *n* and bring the ports *q* opposite the steam-inlet *p*. This will set the injector in operation to supply the deficiency of water in the generator, and the float will again be raised to cut off the steam. It will be observed, also, that, as the ports *q* are gradually closed and the amount of steam entering thereat is gradually diminished, the rising of the spindle *m* gradually diminishes the width of the annular space *o* around said spindle, thus proportioning the passages of the injector to suit the amount of steam supplied to it. This is a very important feature, as it is well known that with a given area of channel for the passage of the steam and water in an injector a proportionate area of steam-inlet is required for effective work. If the steam-inlet be reduced, the other passages must be proportionately reduced. Should the cut-off at the ports *q* fail for any reason, and the injector continue to work, the float will continue to rise until the valve J is seated, when the steam will be cut off at that point.

The stem E is shown as provided with a guide, *x*; but in lieu of this the valve J might be provided with wings and be arranged to move up and down in a bore in the cap of chamber C.

The size and weight of the float D and the comparative length of the arms *e* and *v* are matters of proportion that may be left to the skill and judgment of the constructer. It is only necessary to say that the power of the float must be sufficient to overcome the friction at the packed joints.

N is an oil-cup to supply oil to the moving tube or cylinder *n* where it passes through the base *h*.

Fig. 4 illustrates a modification of the above-described device, being a fragmentary sectional view of the base of the injector. In this case the packed joints in the base *h* around the tubular part *n* are dispensed with and the steam is admitted between flexible diaphragms *y y*, to which the parts *m* and *n* are secured. In this case the flexibility of the diaphragms is relied on to permit the spindle *m* to play endwise. The steam is gradually cut off as the spindle rises by means of a rod, *t'*, secured adjustably to the prolonged shank of the spindle *m*. The upper end of this rod is coupled to an arm on a cock-plug, *v'*, arranged to control the steam-inlet. The arm is shown in dotted lines in Fig. 4. Other known means may also be employed for this purpose.

In Figs. 5 and 6 I have illustrated another modification of my invention. Fig. 5 is a horizontal section taken in the axis of the injector, which in this case is arranged horizontally and not vertically, as in Fig. 1. The distinctive difference between the construction shown in this modification and that shown in Fig. 1 lies in the movement of the spindle *m* independently of the tubular shell *n*. In Fig. 1 these parts are shown as connected and moving together, while in Fig. 5 they move independently, the shell *n* moving the fastest in order that the flared upper end, *z*, of the shell may be brought gradually nearer to the flare *z'* on the spindle *m*, so as to lessen the width of the annular steam-passage between them proportionally to the reduction of the steam-ports *q*. To accomplish this I prolong the tubular shell *n* and cut on it a double screw-thread, *a'*, and prolong the shank of the spindle *m* to pass through a stuffing-box, *b'*, on *n*, and cut a single thread, *c'*, on said shank. Two collared nuts, *a''* and *c''*, are mounted rotatively in fixed bearings, as shown, and engage the screws *a'* and *c'*, respectively. These nuts have bevel-teeth on their peripheries, and are substantially miter wheels or pinions with tubular threaded axes. O is a bevel spur-wheel mounted on the rock-shaft F and arranged to mesh with both of the nut-wheels *a''* and *c''*. On the shaft F, inside of the water-chamber B, is mounted a pinion, *d'*, which meshes with a segment, *e'*. This segment forms the short end of the lever or arm *e*, which is fulcrumed at *f' f'* and coupled to the float-stem. Fig. 6 shows this segment-rack and pinion in side elevation.

The operation is as follows: When the float D rises the segment *e'* rotates the pinion in the direction of the arrow. This rotates the nut-wheels *a''* and *c''* in opposite directions through the intermediate wheel, O, whereby the tubular shell *n* and spindle *m* are moved endwise (to the right in the figure) at different speeds. When the float falls the operation is of course reversed.

To prevent the tubular shell *n* from turning with the nut *a''*, I provide it with a slotted guide, *g'*, and arrange a pin or screw, *h'*, in the shell of the injector to engage said guide, as shown in Fig. 5. Other equivalent means may, however, be employed. The cone *m* is

prevented from turning with nut c'' by squaring or flattening its extremity i' and arranging it to play in a guide, j'.

Having thus described my invention, I wish it understood that I do not limit myself to the precise construction and arrangement of parts herein shown, as they may be varied somewhat without materially departing from my invention.

I claim—

1. An automatic feed-water injector wherein the steam-inlet and the steam and water passages are decreased or increased in area by means of a float, said float being actuated by the rise and fall of the water in the generator fed by the injector, substantially as set forth.

2. An automatic injector for supplying steam-generators, provided with a movable interior spindle, m, arranged to play longitudinally, a float, D, arranged to rise and fall with the water in the generator being fed, and suitable mechanism to connect said float with said spindle, whereby the latter is actuated by the former, substantially as set forth.

3. The combination, in an automatic injector, of the shell i, internal shell, k, external cone, l, internal movable spindle, m, tubular movable shell n, provided with steam-ports q, base h, steam-pipe I, water-pipe K, chambers B and C, float D, and mechanism, substantially as shown, to connect the float with the spindle m, all arranged substantially as set forth.

4. The combination, with the guided float D and its chamber, of the screw-threaded rod E, provided with a square at its upper end, and the socketed key M, substantially as and for the purposes set forth.

5. The combination, in an automatic feed-water injector, of the movable ported tubular shell n, arranged to play in the base h, and to control by its movement the ingress of steam to the injector proper, the steam-pipe I, the float-chamber with valve seat f, the relief-valve J, mounted on the float-stem, the float and its stem, and mechanism between the float and the shell n, whereby the movement of the float up and down imparts a reciprocating movement to said shell, substantially as set forth.

6. The combination, with the base h of an injector provided with a steam-inlet, the steam and water chambers B and C, and the float, of the ported tubular shell n, arranged to play through a packed opening in base h, the exterior and interior shells of the injector proper, its exterior cone and check-valve, the interior cone or spindle, m, fixed to and arranged to move with the shell n, the float-stem E, relief-valve J, shaft F, arms e and v, link u, and coupling u', all constructed and arranged to operate substantially as set forth.

7. A feed-water injector provided with an interior cone capable of being moved to or from the exterior cone, whereby the annular steam and water passage between the cones may be varied in area, and provided with a tubular shell fixed to the stem of the interior cone and arranged to encircle the same, said shell having ports arranged to coincide with the steam-inlet to the injector, whereby when the interior cone is caused to approach the exterior cone the steam-inlet will be proportionately reduced in area, substantially as set forth.

8. An injector having a movable inner cone and means for reducing the area of the steam-inlet in proportion as the annular space between the the exterior and interior cones is reduced, and provided with a check-valve, s, having a lesser supplementary check-valve t, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM McELROY.

Witnesses:

HENRY CONNETT,

ARTHUR C. FRASER.