(Model.)

S. BORLAND.

INJECTOR.

No. 354,177. Patented Dec. 14, 1886.

Fig. 2

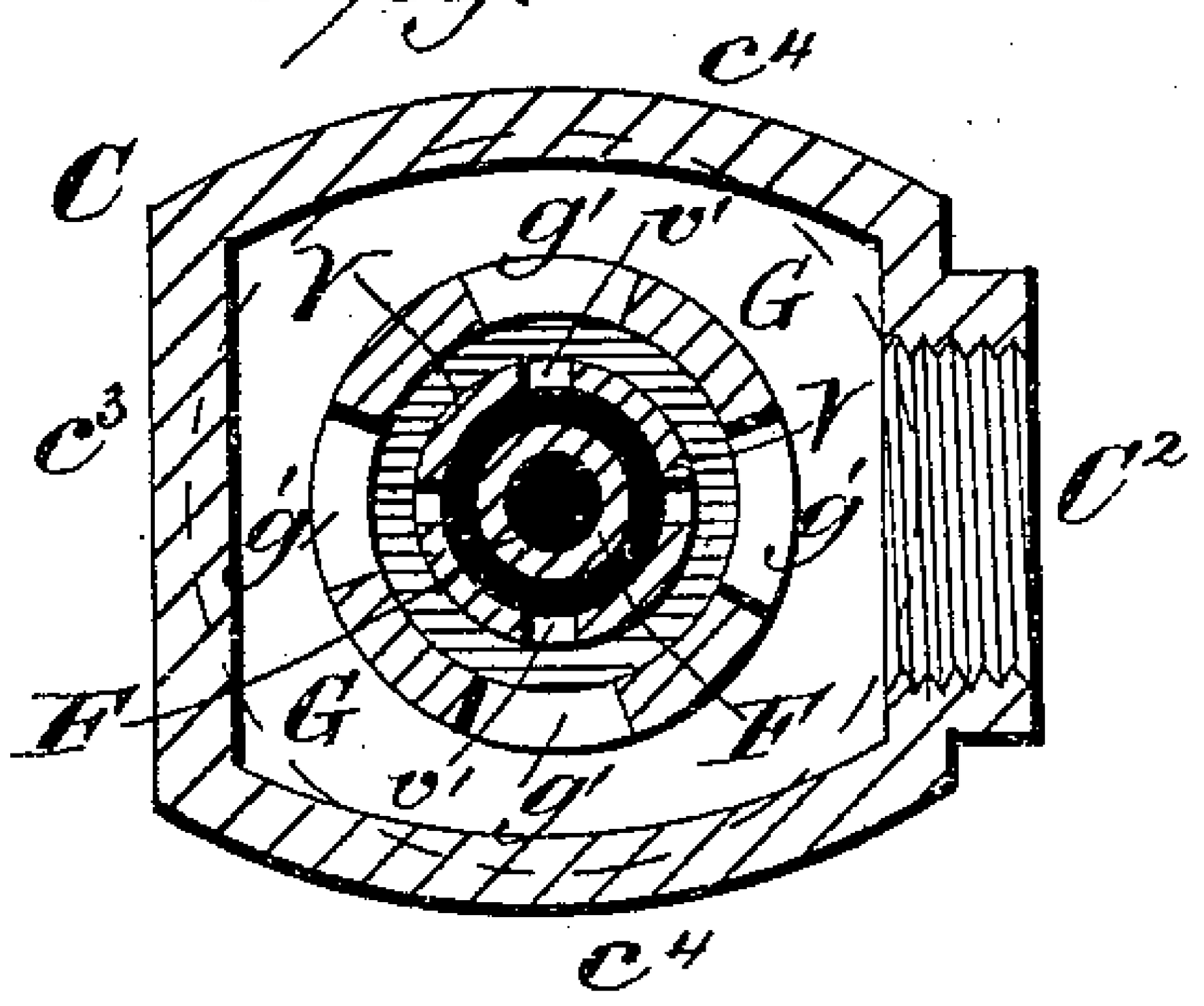


Fig. 1

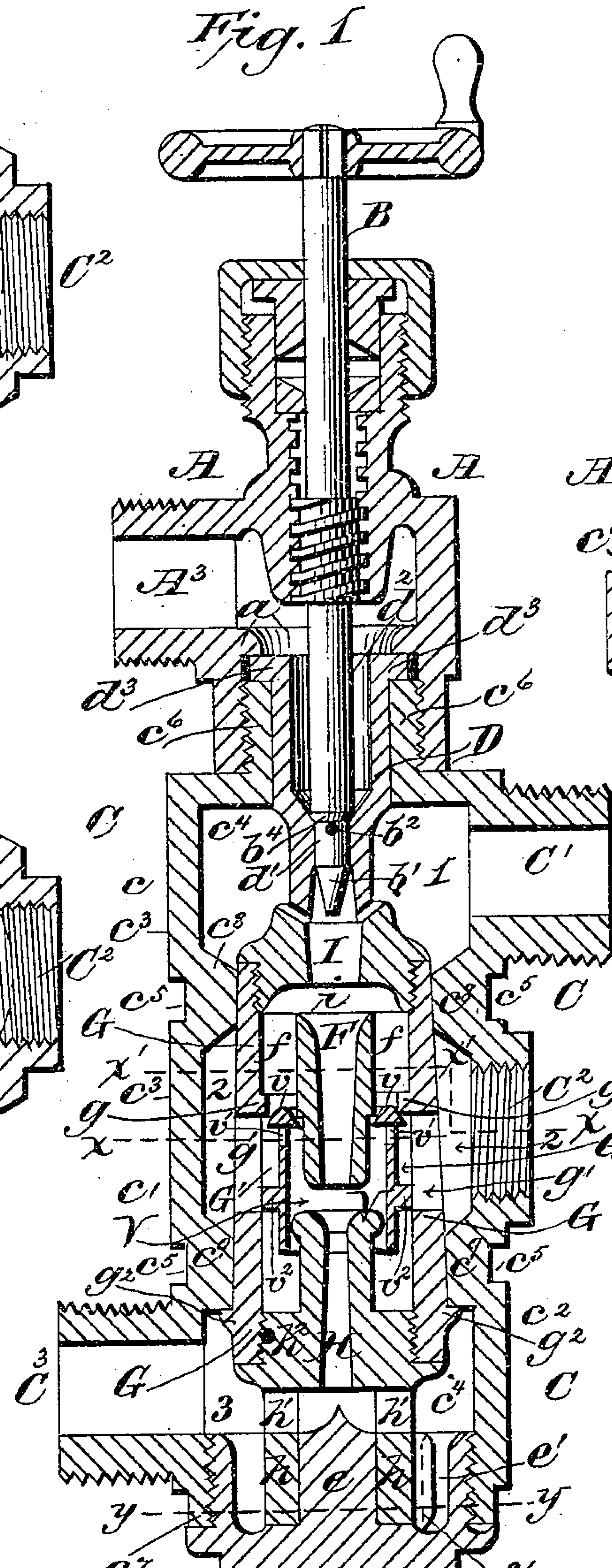


Fig. 5

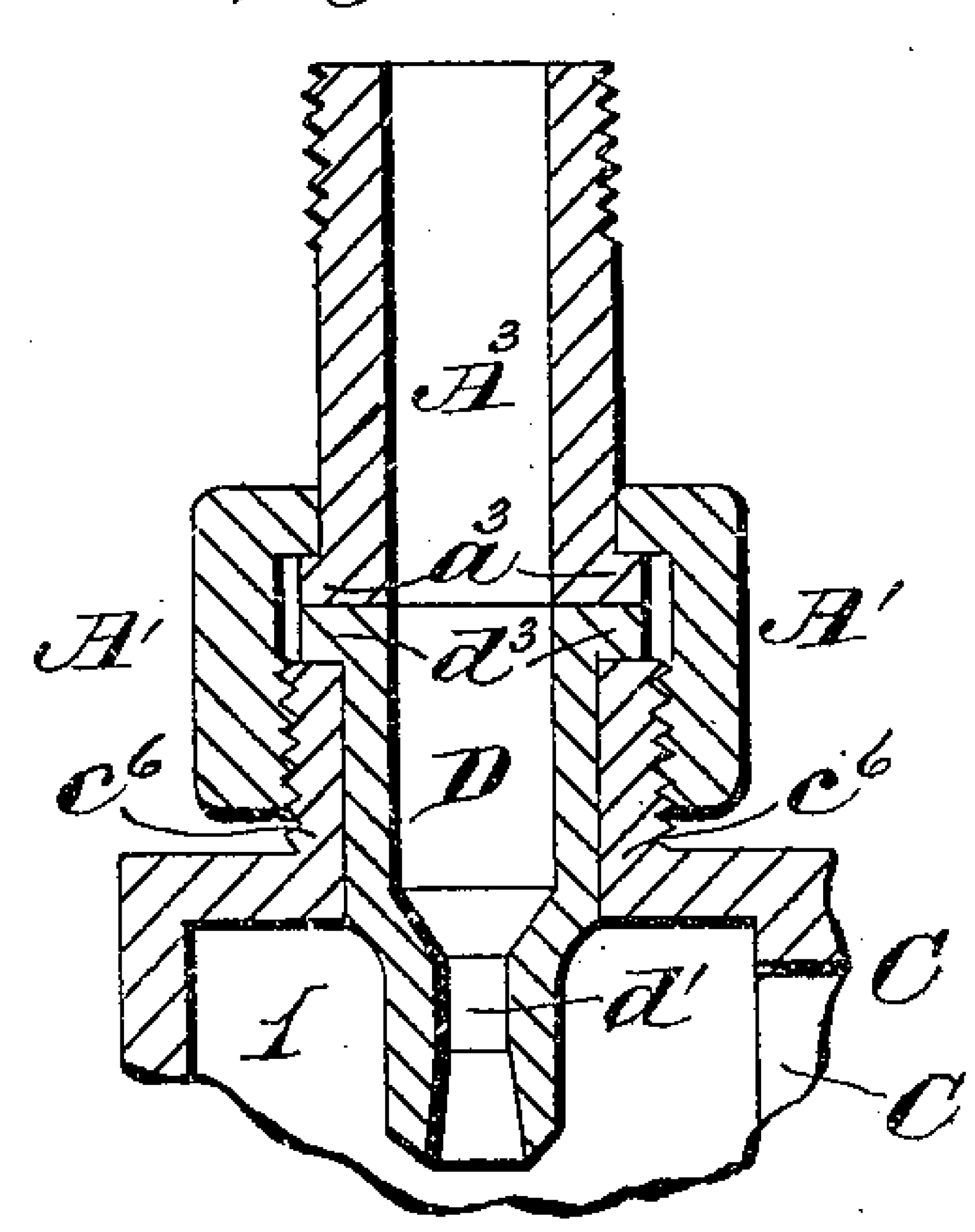


Fig. 3

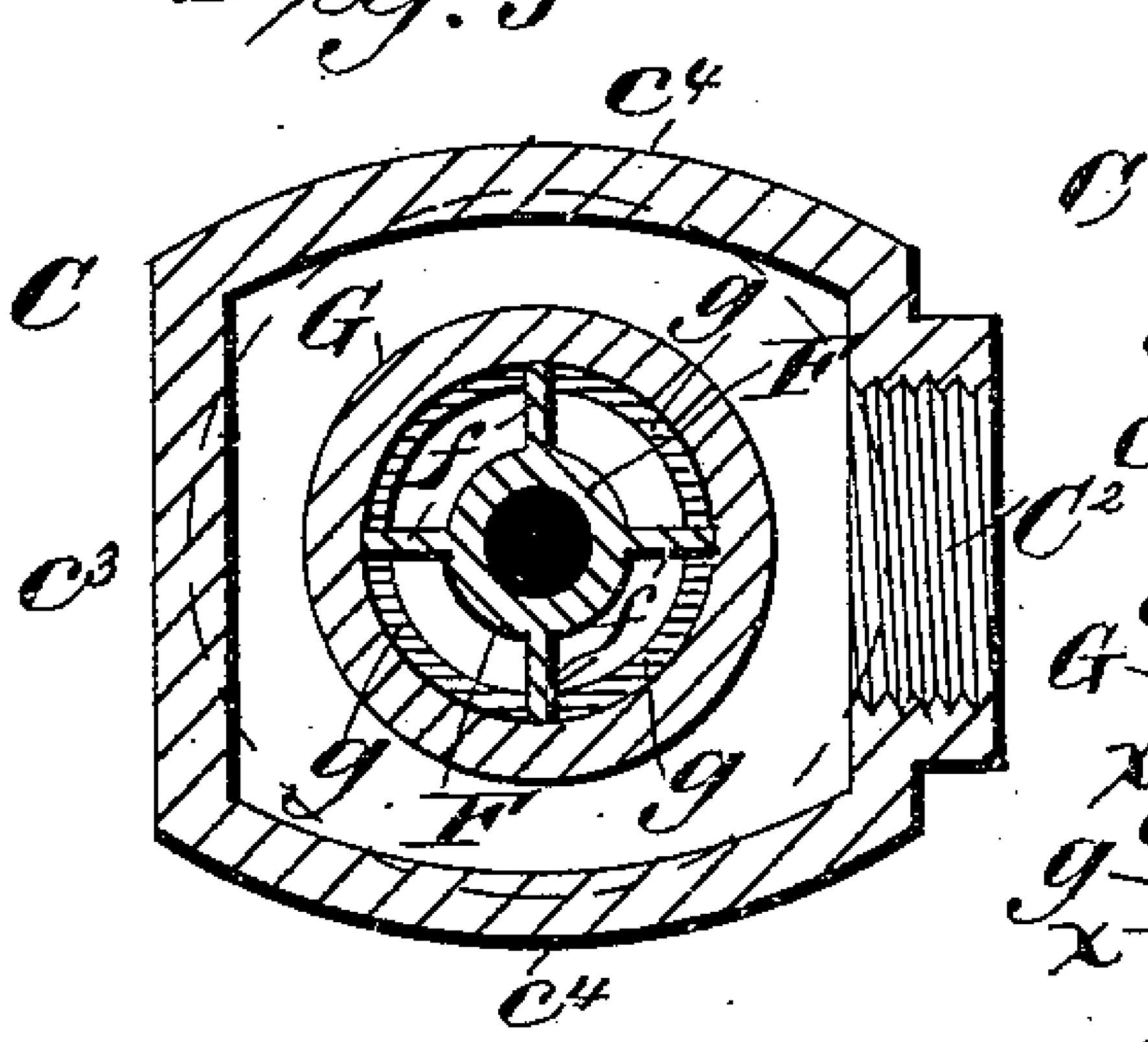


Fig 6

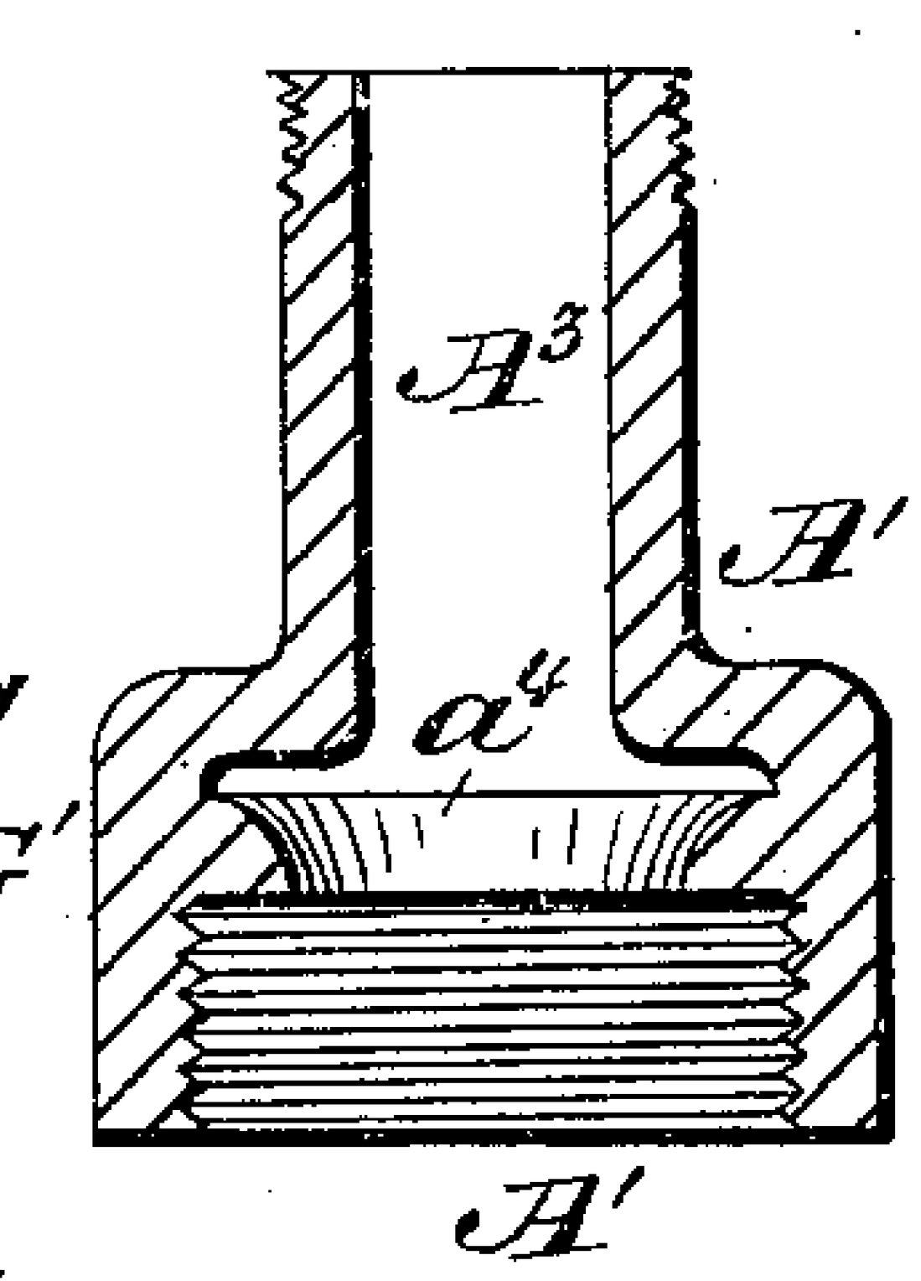
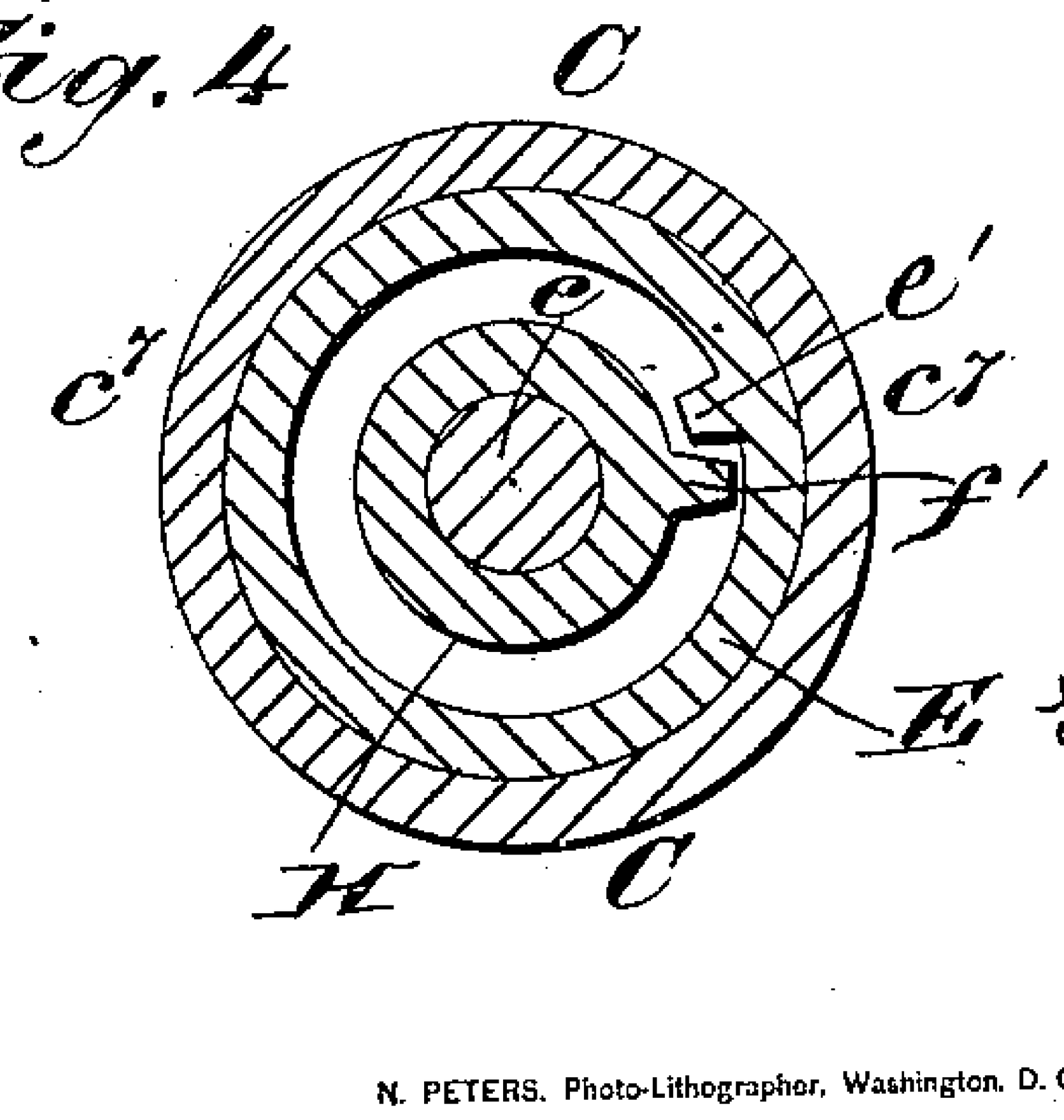


Fig. 4



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UNITED STATES PATENT OFFICE.

SEVERIN BORLAND, OF MANCHESTER, COUNTY OF LANCASTER, ENGLAND.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 354,177, dated December 14, 1886.

Application filed November 21, 1885. Serial No. 183,555. (Model.) Patented in England November 8, 1884, No. 14,729.

To all whom it may concern:

Be it known that I, SEVERIN BORLAND, a citizen of Great Britain, residing at Manchester, in the county of Lancaster and Kingdom of Great Britain, 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to that class of injectors known as "restarting" injectors—that is to say, to those injectors which start automatically when their function is interrupted temporarily through a temporary stoppage of the water or steam supply.

The invention has for its object to so construct the injector as to adapt it for use as a "lifting" or a "non-lifting" restarting injector, and adapted to be started whether the steam or the water is first turned on; further, to increase the efficiency of this class of injectors and reduce their size or dimensions to a minimum and reduce the labor in their construction; finally, to facilitate the assemblage of the parts which constitute the injector, or to disconnect such parts from one another, or to remove the internal parts of the injector from the casing.

In the accompanying drawings, Figure 1 is a longitudinal section of my improved restarting injector when used as a lifting-injector. Figs. 2, 3, and 4 are transverse sections taken, respectively, on lines $x'\,x'$, $x\,x$, and $y\,y$ of Fig. 1. Fig. 5 is a section of the upper part of the injector, showing the interchangeable cap or casing applied when the injector is used as a non-lifting injector, and Fig. 6 is a modification of this cap.

In the above-described drawings, C is the casing divided exteriorly into three sections, $c\,c'\,c^2$, by annular or cylindrical grooves c^5, each section having opposite plain or convex or curvilinear outer faces, $c^3\,c^4$, respectively, as more plainly shown in Figs. 2 and 3. The interior of the casing C is divided by partitions $c^8\,c^9$, tapering inwardly, into three chambers, 1 2 3, respectively communicating with the water-branch C′, the overflow C^2, and the discharge-branch C^3, said partitions having conical axial openings or passages that serve as seats for the lifting, combining, and discharging cones. The water-branch C′, overflow C^2, and combined steam and water or discharge branch C^3 are formed on or in one of the plane faces c^3 of the sections $c\,c'\,c^2$, respectively, and communicate with the corresponding interior chambers of the casing. The opposite ends $c^6\,c^7$ of the casing C are cylindrical, and the outer end, c^6, is screw-threaded exteriorly, and upon said end is seated the steam-cone D, that has an annular flange, d^3, around the enlarged portion d^2 of the cone, which also has a cylindrical portion, d', forming a seat for a steam spindle or valve.

When the injector is used as a lifting-injector, it is provided with such a spindle or valve, as shown in Fig. 1, in which A is a cap or casing screw-threaded interiorly for the reception and working of the screw-threaded stem of a spindle, B, the reduced end b' of which is partly cylindrical and partly tapering, and has a conical shoulder or bearing, b^4, that fits into a corresponding seat, d', formed in the steam-cone D.

The end of the spindle B is hollow, and has a port or ports, b^2, through which and the tapering portion steam is admitted to the cone D, when the spindle is screwed out sufficiently to clear the ports from the cylindrical part of the cone, the steam being cut off when the spindle is screwed to its seat—a construction that is usual in injectors.

The cap or casing A has a steam-branch, A^3, and is screw-threaded interiorly and provided with an internal annular flange, a, that bears upon the flange d^3 of the cone D when the cap is screwed on, as plainly shown in Fig. 1.

When the injector is to be used as a non-lifting injector, the cap or casing A is removed, and the cap or casing A′, Fig. 5, or that shown in Fig. 6, substituted.

The cap, Fig. 5, is simply a screw cap or coupling provided with an axial passage for the steam-branch A^3, said branch having a flange, a^3, that is seated upon the flange d^3 of the steam-cone D when the cap A′ is screwed to end c^6, which cap or coupling thus holds the

cone and steam-branch securely in the required position. The steam-branch, if desired, may, however, be formed on the cap A′, as shown in Fig. 6, in which case an internal flange, a^4, is provided that holds the cone D in position. The inner end, c^7, of the casing C is also made cylindrical, and is screw-threaded interiorly, to which end is secured a screw-cap, E, that has an axial conical pin or plug, *e*, which projects into the inner open end of the discharging cone. This inner end of the discharging-cone is also provided with a radial lip or lug, *f′*, that engages with a similar lip or lug, *e′*, on the screw-cap E.

I have found that in injectors in which the internal parts are seated in the casing for ready removal these parts, when the injector has been in use for some time, bind or stick or become fast in their seat or seats, and it is very difficult to remove the same without some tool which is apt to more or less injure the parts. This is entirely obviated by the described construction of screw-cap and lug on the discharging-cone F, by means of which the cap can be first loosened, as it can make a complete revolution, or nearly so, when unscrewed before it engages the lug on the end of the cone F, and by further unscrewing the said cap the cone or the cone and parts connected therewith are rotated in their seats and loosened, and can be readily removed. This construction also facilitates the assemblage of the parts, which must necessarily fit closely to their seats to form tight joints, and are not readily pushed into place. When, however, the screw-cap E is screwed into the casing, the cone or the cone and parts connected therewith are rotated, and thus more readily forced into their seats.

So far as I have described the construction of the casing and its connection with the steam-branch or with a steam-branch and a spindle, B, and the mode of securing the discharging-cone, or said cone and parts connected therewith, to the casing C, or removing the same therefrom, said construction is substantially the same as that described in an application for patent of even date with this in reference to an injector convertible from a lifting to a non-lifting injector, or vice versa; and I wish to have it understood that I do not desire herein to claim these features of construction *per se*, or broadly, but only in their combination and co-operating with parts of this injector not described or claimed in the application referred to. The inner faces of the axial openings or passages in the partition-walls c^8 c^9 of the casing C are also made conical or tapering outwardly, as above referred to, and serve as seats for a conical or tapering tube, G, in the periphery of which are formed overflow-ports *g′*, that communicate with the overflow-chamber 2 of the casing C. The conical or tapering tube is also provided with an annular seat or flange, g^2, that abuts against the square face of the partition c^9, and serves to limit the movement of said tube toward the steam-cone D when the parts are in position for operation.

Into the lower or inner end of the tube G is screwed the discharging-cone H, that terminates in a tubular extension, *h*, provided with ports *h′*, that communicate with the discharge-chamber 3 of the casing C, and into which end the cone pin or plug *e* of the screw-cap E projects when the parts are assembled for use.

To prevent the discharging-tube from being unscrewed when unscrewing the cap E to remove the internal parts of the injector, I employ a lock pin or key, h^2, that holds said cone against rotation, as is well known.

In the outer smaller end of tube G is screwed the lifting-cone I, that is recessed on its under side to form an overflow-passage, *i;* and F is the combining-cone that is provided with radial ribs *f*, and is seated on an annular flange, *g*, formed in the interior of the tube G, and is held against displacement on said seat-flange by the lifting-cone I, that bears against the upper face of cone F when screwed into position in the outer end of tube G.

Within the annular chamber G′, formed in tube G, below its seat-flange *g*, is located a tubular valve, V, of less diameter than the tube G, and adapted to slide freely therein. This valve has a conical or nearly V-shaped annular valve-face, *v*, adapted to close the annular opening in the seat-flange *g*, as shown in Fig. 1. The valve has overflow-ports *v′*, to allow the fluid or any excess of fluid to pass into the annular space formed between said valve V and the tube G, and thence through the overflow-ports *g′* into overflow-chamber 2 of valve-casing C, and out of the latter through overflow-branch C′. The valve V has also an annular guide-flange, v^2, that serves to guide it properly in its movements toward and from its seat in the annular opening or passage formed by the flange *g*. When from any cause the jet of steam or water supplied for working the injector is interrupted, the valve will move away from its seat, allowing the water or steam to flow through passage *i*, around the combining-cone F, and thence out through ports *g* in tube G to overflow-chamber 2. As soon, however, as the jet is again established, a partial vacuum will be produced at *i*, and the valve V drawn into its seat, thus automatically restarting the injector.

Having described my invention, what I claim is—

1. In an injector of the class described, a fixed lifting, combining, and discharging cone, an overflow or fluid-escape passage between the lifting and combining cones, and a like passage between the lifting and discharging cones, in combination with an annular valve operating to automatically open the overflow or escape passage between the lifting and combining cones on the interruption of the jet of steam or water supplied to the injector, and

automatically close said passage when the jet is re-established to restart the injector, as described.

2. The combination, with the injector-casing having an interiorly screw-threaded end, c^7, and the lifting, combining, and discharging cones rigidly connected together, but detachably connected with the casing, said discharging-cone having a tubular open end provided with a radial lug on its outer periphery, of the screw-cap E, having an axial pin or plug, *e*, and a radial lug on its inner periphery, substantially as described, for the purpose specified.

3. The combination, substantially as described, with the casing C, having partitions c^8 c^9, provided with axial tapering passages, of a tapering tube seated in said axial passage, provided with an internal seat-flange, *g*, and peripheral passages or ports *g'*, a combining-cone loosely seated in said internal flange constructed to form overflow-passages between it and the tube, and a lifting-cone rigidly connected with the tube and operating to confine the combining-cone and hold it against movement on its seat, for the purpose specified.

4. The combination, substantially as described, with the casing C, having partitions provided with axial tapering passages, of a tapering tube, G, seated in said axial passage, provided with an external seat-flange, an internal seat-flange, g^3, and ports *g'*, a discharging-cone detachably connected to one end of the tube, a combining-cone loosely seated on flange *g* of the tube G, constructed to form overflow-passages between it and the said tube, and a lifting-cone, I, recessed at *i*, detachably connected with the other end of the tube, and operating to confine the combining-cone and hold it against movement on its seat, for the purpose specified.

5. The combination, substantially as described, with the injector-casing screw-threaded exteriorly at c^6, and the steam-cone D, having an external flange seated on the outer face of said screw-threaded end, of the interiorly screw-threaded casing A, having an internal flange adapted to bear on the flange of the steam-cone when screwed onto the end c^6 of casing C, substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

SEVERIN BORLAND.

Witnesses:
PETER J. LIVSEY,
JAMES WOOD.