(Model.) 2 Sheets—Sheet 1.

S. BORLAND.

INJECTOR FOR STEAM ENGINES.

No. 255,920. Patented Apr. 4, 1882.

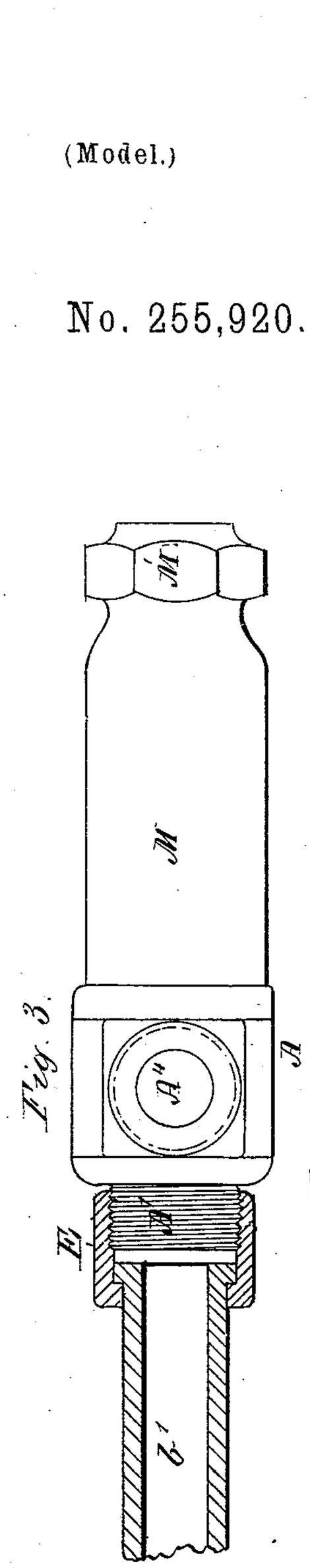

Fig. 3.

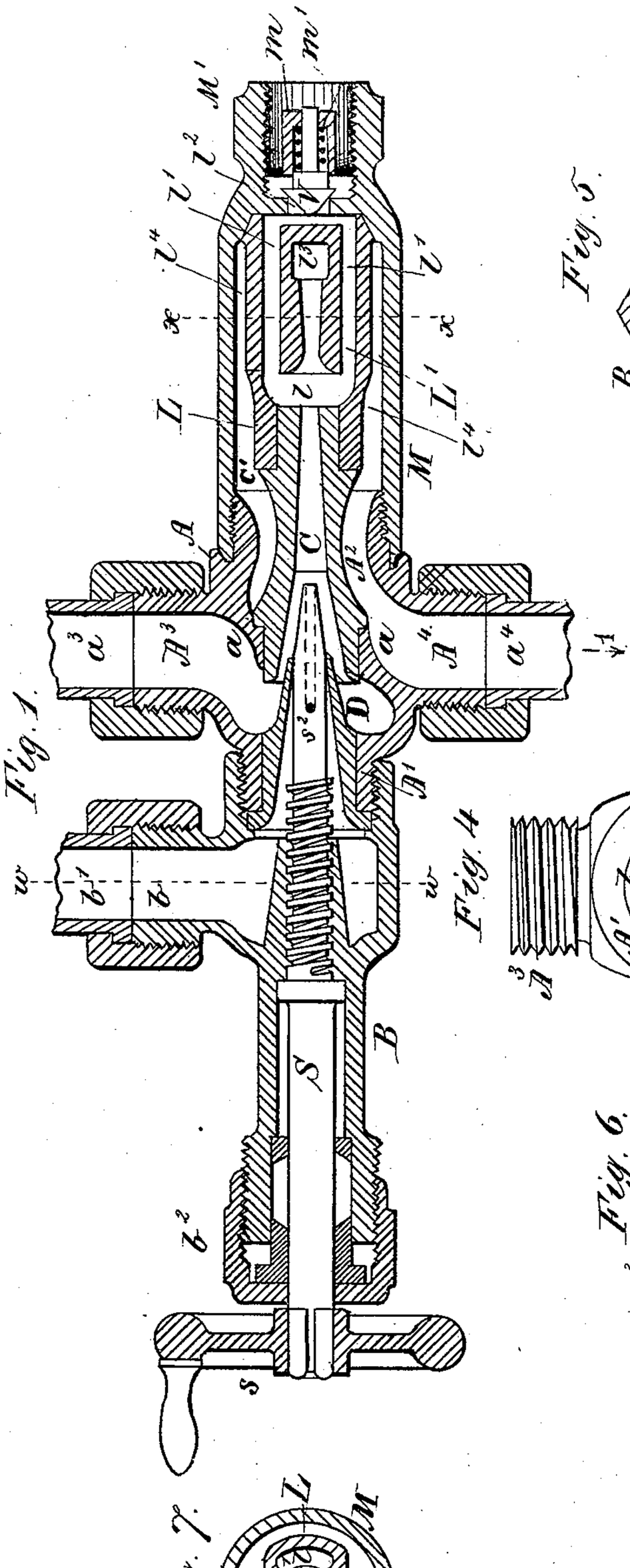

Fig. 1.

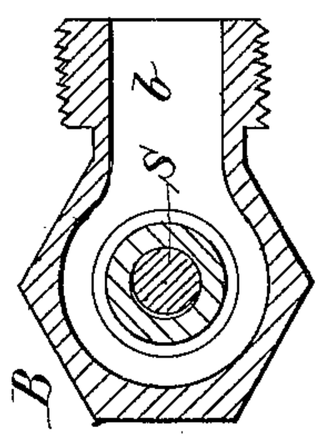

Fig. 5.

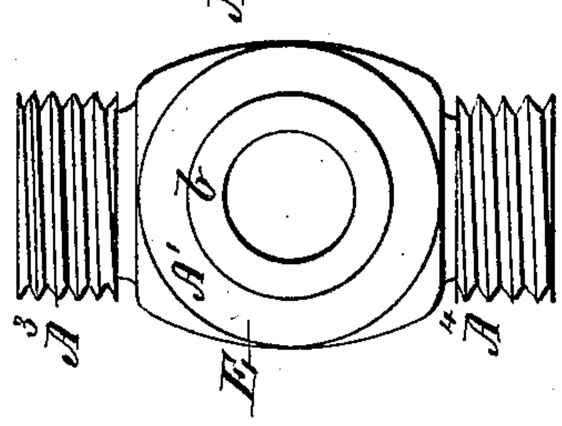

Fig. 4.

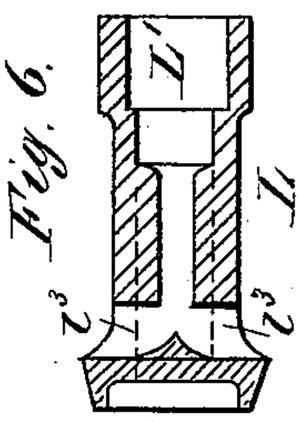

Fig. 6.

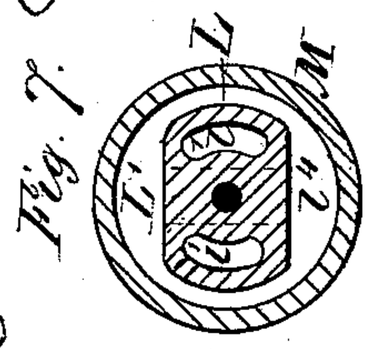

Fig. 7.

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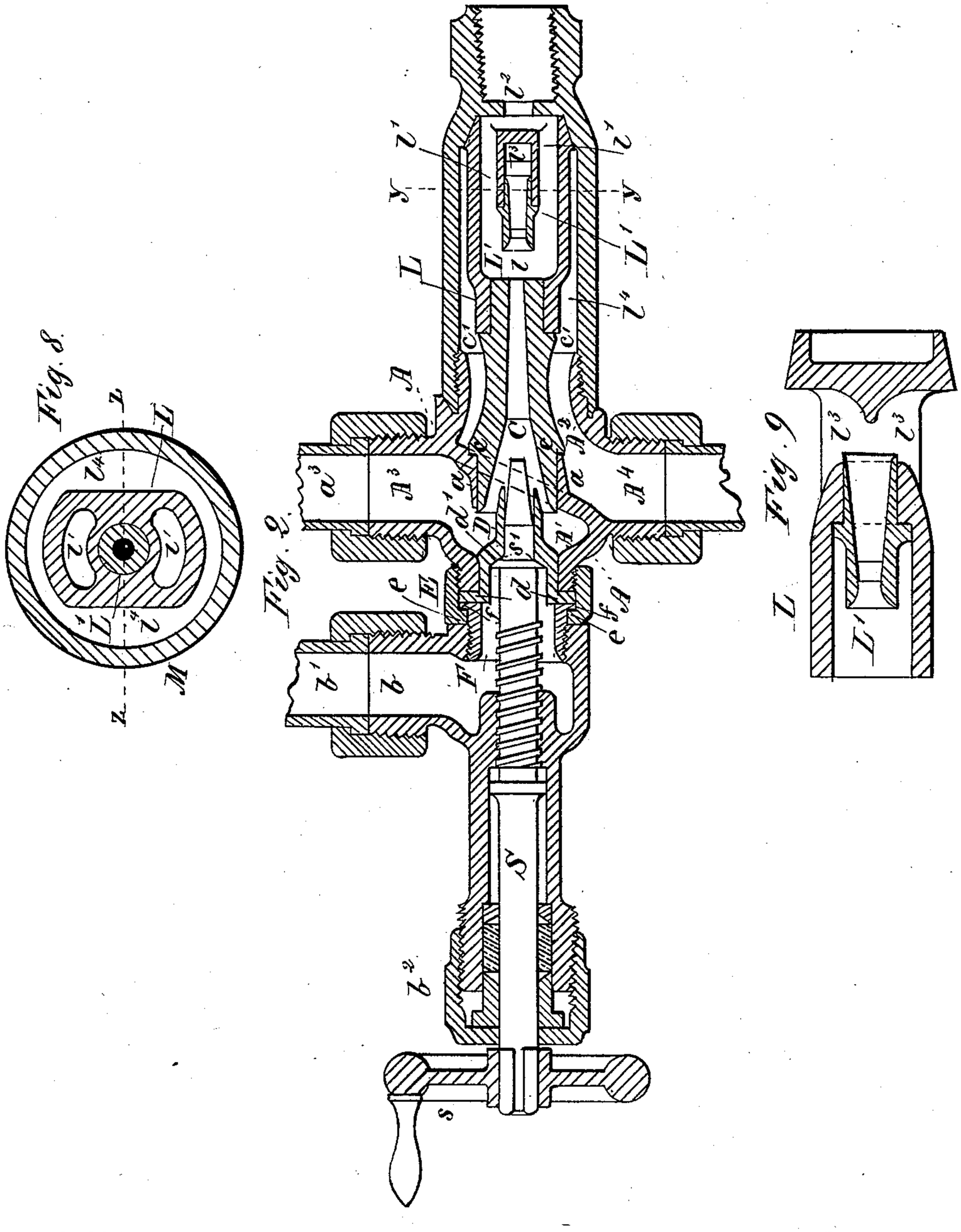
(Model.) 2 Sheets—Sheet 2.

S. BORLAND.

INJECTOR FOR STEAM ENGINES.

No. 255,920. Patented Apr. 4, 1882.



Witnesses.
G. B. Towles
Kenton Cranford.

Inventor:
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UNITED STATES PATENT OFFICE.

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

INJECTOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 255,920, dated April 4, 1882.

Application filed August 30, 1881. (Model.) Patented in England June 21, 1880, in France November 16, 1880, in Belgium November 18, 1880, and in Germany November 18, 1880.

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 for Steam-Engines; 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.

My invention has for its object to so construct an injector as to adapt it for use with or without an adjustable spindle—that is to say, to adapt it for use in raising water, or when the water is not to be raised, in which case the usual screw-spindle may be removed and steam admitted direct to the steam-cone and ejector; and it has for its further object to so construct an ejector that its branch to which is connected the steam-pipe that brings the working steam to the injector shall be capable of rotation to bring said branch into any desired position for connection with said steam-pipe; and it has for its further object to so construct an injector that the branches for the pipes that bring the steam and water to and take it from the injector need not be disturbed when it becomes necessary to examine its interior parts or relieve the latter of obstructions; and it has for its further object to so construct the internal parts of an injector as to adapt them to be readily removed therefrom and replaced by others when worn.

The invention consists, first, in the peculiar construction of a union-piece or casting provided with four branches or junctions, and having an internal sleeve or annular bearing formed by a partition-wall that cuts off direct communication between two of the branches, and which bearing is adapted to receive the combining-cone, as and for the purposes hereinafter more fully described; second, in the peculiar construction and combination of the steam-branch with the injector, whereby said branch is free to rotate upon the injector, substantially as and for the purposes hereinafter more fully set forth; third, in the peculiar construction of the receiving, discharging, and overflow cone and its combination with the injector, substantially as and for the purposes hereinafter fully described; fourth, in the peculiar arrangement of the screw-spindle and its combination with the injector, whereby said screw-spindle may be readily removed, substantially as and for the purposes hereinafter fully described; and, lastly, the invention consists in certain details of construction, and in the combination of the various parts of the injector with each other, substantially as hereinafter fully set forth.

In the accompanying two sheets of drawings, Figure 1 is a longitudinal section of my improved injector. Fig. 2 is a like view of the same, showing a slight modification of construction. Fig. 3 is an elevation of the injector, looking in the direction of arrow 1, Fig. 1. Fig. 4 is a plan view of Fig. 3. Fig. 5 is a transverse section taken on line *w w* of Fig. 1. Fig. 6 is a longitudinal section, taken at right angles to that shown in Fig. 1, of the receiving, discharging, and overflow cone detached. Fig. 7 is a transverse section on line *x x* of Fig. 1, and Fig. 8 is a transverse section taken on line *y y* of Fig. 2; and Fig. 9 is a longitudinal section, taken on line *z z* of Fig. 8 and at right angles to that shown in Fig. 2, of a two-part receiving, discharging, and overflow cone.

Like letters of reference are employed to indicate like parts in all the figures of drawings.

A is a union or junction piece or casting of the injector, to which all the other parts are connected. It is provided with four branches, A' A^2 A^3 A^4, arranged at right angles to each other and on opposite sides of the casting—that is to say, the branches A' and A^2 have their axis on the same line with the longitudinal axis of the casting and form the opposite ends thereof, while the branches A^3 A^4 form the opposite ends of the transverse axis of said casting A, which is bored out interiorly to form the tubular partition or sleeve or tubular bearing *a*, that serves to receive one end of the combining-cone C.

To the branch A^3 is screwed or otherwise at-

tached the water-branch a^3, and to the branch A^4 is similarly attached the pipe a^4, leading to the boiler or other receiver.

To the branch A′ is screwed a casing, B, that has a steam-branch, *b*, flanged or screw-threaded for coupling with the steam-pipe *b′*, said casing carrying the adjustable spindle S, by means of which the volume of steam from the branch *b*, passing to the steam-cone D, that is fitted within the branch A′, is adjusted or entirely cut off, the spindle being adapted for use as a valve, as shown in Figs. 1 and 2, when the spindle S is screwed down to close the steam-cone D.

Under certain circumstances it is desirable that the steam-branch *b* should be capable of adjustment, and for this purpose I preferably connect the casing B with the branch A′ in such manner that said casing may be rotated in any direction to bring the branch *b* into the desired position for connecting the same with the steam-pipe of the boiler or other source of steam-supply. As shown in Fig. 2, I employ a short sleeve, E, that is screw-threaded interiorly for a certain distance from its inner end, to be screwed upon the branch A′ of the casting A, while at its outer end it has an annular inwardly-projecting flange, *e*, against which bears the flange *f* at the inner end of the coupling-piece F, that is screw-threaded at its outer end to receive the casing B, and, as will be readily seen by an inspection of said Fig. 2, adapts said casing to be rotated with the coupling-piece or sleeve F upon the steam-cone and within the sleeve E and at the same time form a perfectly-tight joint. This construction also serves to hold the steam-cone D in proper position, said cone having a flange, *d*, that bears on the one hand upon the face of the branch A′ and on the other hand against the sleeve E and the face of the flange *f* of the coupling-piece F.

The casing B is provided at its upper end with a stuffing-box, b^2, through which passes the stem of the spindle S, that carries at its outer end the hand-wheel *s*, by means of which said spindle is adjusted.

To adapt the spindle S for use as a valve it is provided with an annular beveled shoulder, *s′*, which, when the spindle is screwed down, will be seated upon a like shoulder, *d′*, formed within the steam-cone D, as shown. The spindle S is also provided with an axial passage and ports s^2, that communicate therewith for the passage of the steam, as is well understood.

The combining cone C is fitted at one end within the sleeve *a* of the casting A, said cone being provided with an annular shoulder, *c*, that is seated against the face of said sleeve, and at its other end said cone is fitted within a casing, L, in which are formed the overflow-orifice and the receiving and discharging cone L′, said combining-cone being provided at that end with an annular shoulder, *c′*, that is seated upon the face of said casing L.

The receiving and discharging cone L′ may be formed of one piece with the casing L, as shown in Figs. 1, 6, and 7; or they may be formed of two pieces, as shown in Figs. 2, 8, and 9, in which figures the cone L′, made of a separate piece, is seated within the casing L.

The receiving, discharging, and overflow cone is constructed as follows: The casing L has a cylindrical upper portion for the reception of the lower end of the combining-cone C, as above set forth. Below this cylindrical portion is formed a chamber, *l*, that communicates with the axial passage of the casing L, which passage constitutes the receiving and discharging cone L′. This axial passage, through which the combined steam and water are forced, does not extend entirely through the casing L, but terminates at or near the lower end of said casing in a transverse passage, l^3, communicating at both ends with the chamber l^4, formed by casing M, casing L, the combining-cone C, and partition *a*. Upon opposite sides of the axial passage or cone L′ and upon opposite sides of the transverse passage l^3 the casing L has two vertical overflow-passages, *l′*, into which the overflow from chamber *l* passes and is discharged at the lower end of the casing L, passing out of the injector through port l^2.

It will be seen that both the overflow and combined water and steam are discharged at the same end of the cone L L′, the overflow passing directly from chamber *l* through the casing, while the combined water and steam pass through the axial opening or cone L′, and thence at right angles through the casing into the chamber l^4, and from the latter to the delivery-branch A^4.

When the receiving, discharging, and overflow cone is made in two parts, as shown in Figs. 2, 8, and 9, the chamber *l* is enlarged and made of greater depth, and the cone L′ is seated therein, it being provided with a suitable flange or shoulder, and its lower end projecting into the transverse passage l^3, as shown.

The port l^2 for the overflow is or may be closed against the admission of air by a check-valve, V. This valve is held to its seat by a coiled spring, the resistance of which is such as to yield to the pressure of the water from within and allow it to escape and close when said pressure ceases to be exerted.

The stem of the valve V is fitted in a bearing or guide, *m*, provided with discharge-passages *m′*, and said bearing is screwed into the end M′ of cap M, which itself is screwed or otherwise connected with the branch A^2 of the casting A.

The object of applying a check-valve to the lower end of the casing L is, as above stated, to prevent admission of air to the injector when first started to facilitate the obtaining of a vacuum in the combining-cone. The velocity of the steam carries the jet as if a solid body across the overflow orifice or passage into the receiving-cone. This escaping steam draws the water to the injector, and the water con-

denses the steam in the combining-cone, and as there is a vacuum in said cone, the comparatively solid mass of combined water and steam is kept together, exerting no lateral pressure, and is shot, as it were, from the combining-cone into the receiving-cone. The latter gradually increases in diameter from the nozzle outward until the extreme velocity of the jet is gradually diminished, when the combined steam and water commence to exert pressure in all directions. As long as the steam and water are properly adjusted there is no overflow, but the reverse. The passing-jet will sink in air at the overflow-orifice, and the valve is used to shut against the admission of air, and, instead of the jet escaping at the overflow, it can be made to take in more water.

When the injector is employed under conditions where the water is not to be raised—that is to say, under such conditions that will not necessitate the use of the screw-spindle S—I unscrew the casing B from the branch A′ of the casting A and screw thereto the steam-pipe, admitting steam direct to the injector, as shown in Figs. 3 and 4.

From what has been said above, it will be readily seen that by unscrewing the cap or casing M from the branch A^2 the combining, receiving, and discharging cones may be readily removed for inspection or for the purpose of removing obstructions therefrom, or for the purpose of replacing either or both by new ones, if required, without in any manner disturbing the connections with the water and steam supply or the connection of the injector with the boiler or other receiver. For this purpose neither of said parts is connected by screw-threads with the injector, all of said parts having ground joints and seats to connect them with each other and with the injector, as shown; and, further, that the injector may be employed with or without a screw-spindle for purposes above set forth, and that when the screw-spindle is used it may be employed as a valve to cut off the supply of steam.

In practice, for the purpose of readily disconnecting the parts of the injector, I provide the junctions or branches A′ A^2 A^3 A^4 with screw-threads upon their exterior periphery to receive the casing B, the cap M, the water-branch, and the pipe leading to the boiler or other receiver.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an injector for steam-engines, a junction-branch for the steam-supply pipe capable of being rotated around the injector, as described, for the purpose specified.

2. In an injector for steam-engines, a casting or junction piece having a feed-water branch, A^3, and a delivery-branch, A^4, at the opposite extremities of its transverse axis, and an interior partition arranged to form a tubular bearing on a line with its longitudinal axis, in which bearing is seated the combining-cone, said partition serving also to cut off direct communication between the feed-water branch and the delivery-branch, as specified.

3. In an injector for steam-engines, the casting A, having the branches A′ A^2 A^3 A^4, arranged at right angles to each other, and an interior tubular partition, *a*, in combination with the steam and combining cones, arranged as set forth, whereby direct communication between the branches A′ A^3 A^4 is intercepted, substantially as and for the purpose specified.

4. In an injector for steam-engines, a junction or union piece or casting A, having the branch A′ screw-threaded exteriorly, in combination with the steam-cone D, seated upon said branch A′, the spindle S, and its casing B, carrying the steam-branch, and arranged to hold the steam-cone to its seat when said casing is connected with the said branch A′, substantially as set forth.

5. The combination of the junction or union piece A, its branch A′, the spindle-casing B, and its coupling F with the sleeve E, substantially as and for the purpose specified.

6. The combination of the junction or union piece A, its branch A′, the steam-cone D, and the coupling-sleeve E with the spindle-casing B, its coupling F, and the steam-branch *b*, all arranged, constructed, and operating substantially as and for the purpose specified.

7. The receiving, discharging, and overflow cone consisting of the casing L, within which is formed the receiving and discharging cone, so as to leave an overflow-passage, *l l′*, between said cone and casing, all constructed of one piece, substantially as and for the purpose specified.

8. The receiving, discharging, and overflow cone consisting of an outer casing, L, arranged to receive the discharge end of the combining-cone and having lateral passages l^3, the interior cone, L′, arranged to form the overflow-passages *l l′* between it and said casing L, and which cone is in direct communication with said lateral passages, substantially as and for the purpose specified.

9. In an injector for steam-engines, the combination, with the steam and combining cones, of a receiving, discharging, and overflow cone, L L′, arranged relatively to said steam and combining cone in such manner that both the combined steam and water and the overflow will be discharged at the same end of said cone L L′, substantially as described.

10. The combination, with the union or junction piece A and its branches A′ A^2, of the steam-cone D, combining-cone C, and the receiving, discharging, and overflow cone L L′, of the cap M, removably connected with the branch A^2, all arranged and operating substantially as and for the purpose specified.

11. The combination of the cap M and the check-valve V with the receiving, discharging, and overflow cone L L′, constructed, arranged, and operating substantially as and for the purpose specified.

12. The junction or union piece A, having

branches A^2 A^4, the cap M, the steam and combining cones, in combination with the receiving and discharging cone having passages l^3 and arranged within the cap M to form the annular passage l^4, that communicates with the delivery-branch A^4, all constructed, arranged, and operating substantially as and for the purpose specified.

13. The junction or union piece A, having branch A′, screw-threaded exteriorly, and an interior tubular bearing, *a*, the combining-cone C, seated within said bearing, and the steam-cone D, seated upon the branch A′ and having the valve-seat *d*′, in combination with the casing B, carrying the steam-branch and connected with branch A′ to hold the steam-cone to its seat, and the screw-spindle S, provided with the valve-face *s*′, all arranged, constructed, and operating substantially as and for the purposes specified.

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

S. BORLAND.

Witnesses:

PETER J. LINSEY,

JAMES WOOD.