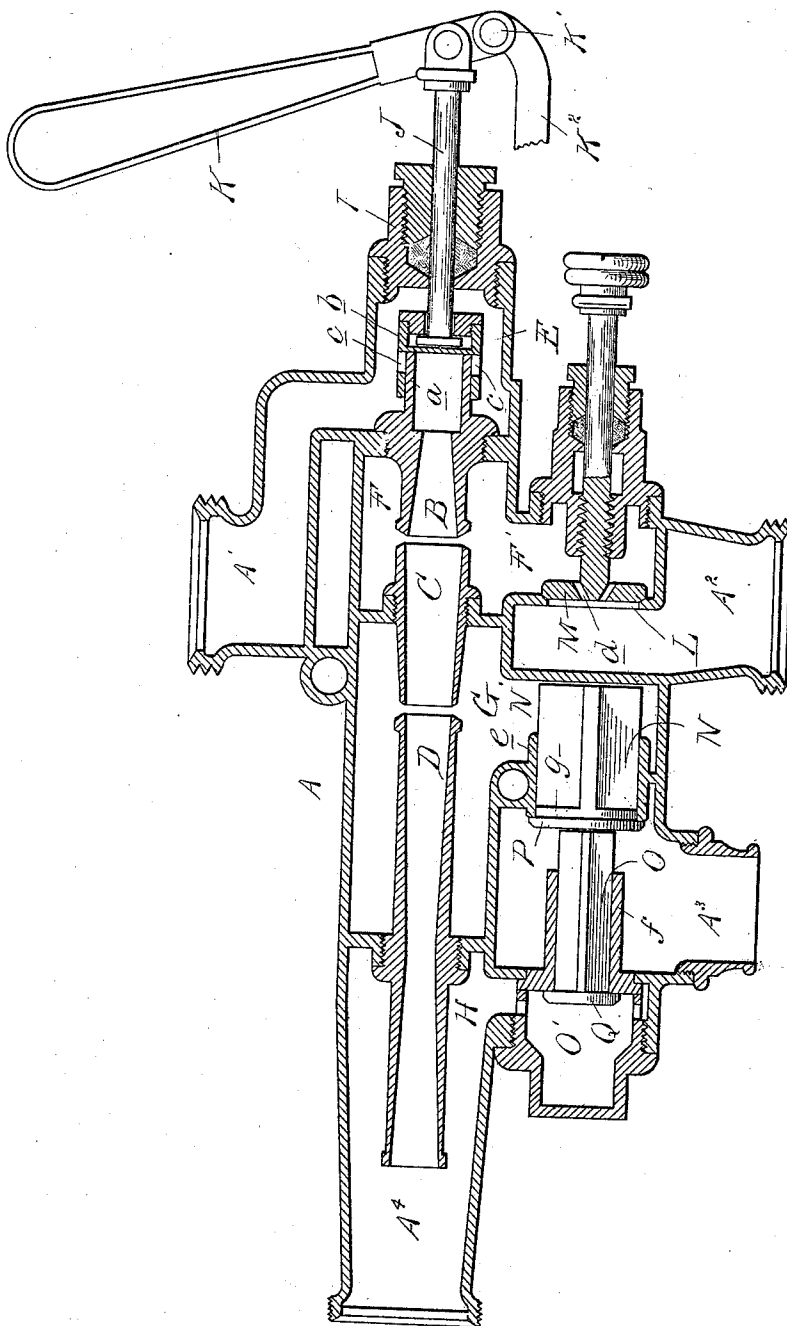


(Model.)

J. DESMOND.
STEAM INJECTOR.

No. 513,559.

Patented Jan. 30, 1894.



—Witnesses—

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UNITED STATES PATENT OFFICE.

JOHN DESMOND, OF DETROIT, MICHIGAN, ASSIGNOR TO THE PENBERTHY INJECTOR COMPANY, OF SAME PLACE.

STEAM-INJECTOR.

SPECIFICATION forming part of Letters Patent No. 513,559, dated January 30, 1894.

Application filed April 21, 1893, Serial No. 471,260. (Model.)

To all whom it may concern:

Be it known that I, JOHN DESMOND, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Steam-Injectors, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates particularly to new and useful improvements in automatic steam injectors.

The main object of my invention is to provide a steam injector of this kind with simple and efficient means for automatically starting the injector, and for maintaining the stream under extreme conditions of temperature of the feed water and pressure of the steam.

To this end my invention consists of an injector having two separate overflow valves automatically controlling the initial and the secondary overflow respectively and adapted to be reciprocally unseated by the pressure of the initial overflow and seated at the proper time independently of each other by the pressure of the secondary overflow.

My invention further consists in the novel construction and arrangement of a valve for regulating the quantity of the incoming water solely in relation to abnormal pressures of steam, and further in certain details of construction, combination and arrangement of parts, substantially as hereinafter fully set forth and particularly pointed out in the claims.

In the accompanying drawing my improved injector is shown in vertical longitudinal sectional view.

A represents the casing of the injector which is provided with the steam inlet branch A', the water inlet branch A², the overflow branch A³ and the delivery branch A⁴ to each of which is connected the respective pipe connection (not shown) all constructed and arranged to operate as in the usual manner.

B is the steam inlet tube, C is the suction tube and D is the combining and delivery tube, all in suitable relation to each other and secured in suitable partitions in a shell, which divide the casing into a steam chamber E, a

water chamber F, an exhaust or overflow chamber G and a delivery chamber H. The steam inlet branch communicates into the steam chamber E, the outer end of which is closed by a screw plug I through which the stem J of the valve passes. This stem is pivotally secured to a lever K which is fulcrumed at K' to a vibratory link K² which is secured in any suitable manner to the casing.

The steam tube B is provided with a tubular extension *a* which forms a guide bearing for the sleeve *b* of the valve. This sleeve is secured to the valvestem by means of a swivel connection which affords a slight play for the sleeve to be guided freely by the extension *a* in opening and closing the valve, and openings *c* are formed in the sleeve for steam admission ports.

The water chamber F is provided with an extension F' into the water branch and communicates therewith through a valve controlled opening L. The valve M controlling said opening has one or more ports *d* and is operated by a screw threaded spindle which passes through a suitable plug and stuffing box in the casing and carries on the outside a suitable knob or handle for turning the spindle to seat or unseat the valve M. The overflow arm which extends downwardly from the underside of the casing communicates through lateral openings N and O, formed on opposite sides and in axial line with each other with the valve chambers N' O', the former of which communicates with the overflow chamber G and the latter with the delivery chamber H. The openings N O into the overflow arm are controlled by the horizontally sliding wing valves P Q, which are in axial line with each other and of different areas, the valve P having the larger area. These valves are supported in position by suitable tubular guide bearings *e f* formed around the openings for the wings to slide on, and the stem of the valve Q extends in contact with or in such close proximity to the valve P that the two valves act one upon the other in unseating and seating the valves. Thus in unseating the valve P the valve Q will be unseated also, and in seating the valve Q the valve P will be seated also if not otherwise closed. The valve P is provided with a shoulder *g* which extends into

the seat of said valve and thereby the valve A in seating the valve P will be held still open some distance when the valve P is already closed, thus closing the initial overflow in advance of the secondary overflow. The tubular guide bearing *f* extends toward the valve P a sufficient distance to form a stop which limits the opening of the valve P and when thus open it obstructs the discharge of the overflow through the opening O.

The parts being thus constructed and arranged as shown and described they are intended to operate as follows: As shown in the drawing no steam is admitted to the injector but on opening the steam admission valve by means of the lever K the steam will be admitted into the interior of the injector. The water is admitted into the water chamber from the water branch through the ports *d* (although the valve L may be closed) and it is drawn up and into the suction tube as soon as a vacuum is created by the flow of steam into the injector. The valves Q and P are either open when the steam enters or will be opened by the first impulse of steam or steam impelled water on account of there being a larger pressure on the larger valve P against a smaller pressure against the smaller valve Q, thus unseating the valve P which also forces open the valve Q. The water drawn through the suction tube C will in the first stage of the operation mainly escape into the overflow chamber G and from there out through the initial overflow opening N into the arms A³, and hold the valve P open, but as the force of the stream increases and carries the water into the delivery chamber, the secondary overflow will be established through the opening O', and the tubular bearing *f* (aided by the wings of the valve Q) will direct the overflow against the valve P (which is in its way) and thus tend to close it against the force of the initial overflow. With the increasing force of the stream the secondary overflow increases in force while the initial overflow correspondingly decreases and thus the valve P is moved to close at the proper time by the preponderating force of the secondary overflow acting directly upon it. The valve P is thus adapted to be closed by the force of the secondary overflow independent of the valve Q and if it is not fully closed in this way it will be closed as soon as there is a vacuum created in the chamber G. The valve Q when fully open is virtually balanced and thus it can remain open while the valve P is closing. It is closed at the proper time by the frictional force of the escaping overflow along the wings of the valve which force at the proper time overcomes the frictional resistance of the valve on its bearings and draws it to its seat and thereby establishes the stream into the boiler. Each valve is thus adapted to be closed by the secondary overflow at the proper time one after the other and independently of each other. At

the same time should the valve P from any cause not close of its own accord the valve Q reciprocally closes the valve P, but on account of the shoulder *g* the valve P nevertheless closes in advance of the valve Q and the latter cannot close until the proper conditions for seating it have been established. This relation of the valves provides for the automatic working of the injector under different conditions. Thus if a very copious overflow should take place in the chamber G by reason of very hot feed water for instance, the valve P would at the proper time be forced to close by the valve, Q, and the stream would thus be established into the delivery chamber and thence into the boiler and the boiler pressure acting on the valve Q would keep the valve P closed by said pressure and hence the injector is enabled to work with very hot feed water which it could not do if the valve P were not so held. On the other hand the closing of the valve P may be independently effected at the proper time solely by the force of the secondary overflow, and thus the vacuum in the chamber G is quickly established if the proper conditions exist.

The valves P and Q are horizontally sliding valves and thus the action of gravity does not constitute any factor which governs their automatic operation and to distinguish this specific feature of the valves from other valves which are acted on by gravity, I will distinguish them as "floating valves" meaning thereby valves which float with the current of steam or water. Thus while the valve P is adapted to unseat the valve Q and hold it open by the force of the initial or primary overflow, the valve Q is adapted reciprocally to seat the valve P and hold it closed by the force of the secondary overflow. At the same time both valves are adapted to be seated at the proper time independent of each other by the force of the secondary overflow.

The specific arrangement of the valves P and Q in relation to the overflow arm and to the casing is important in one particular, namely, should the check valve in the connection with the boiler become leaky and hot water thus leak into the injector, it cannot find its way into the water branch A² but has a chance to escape freely from the overflow chamber G through the valve chamber N' and by forcing the valves P and Q open out into the overflow arm.

I will now explain the peculiar advantage of the valve M, by supposing the injector to be used on a locomotive. Here the pressure of the steam varies within large limits and therefore the quantity of water which the injector can take care of varies considerably. In the use of an injector on a stationary boiler the engineer can readily detect by watching the overflow whether his injector has enough water or too much and can thereby regulate the quantity of water admitted by an ordinary valve. On locomotives this is different.

There the overflow pipe carries the water away to a place below the foot board (as a measure of necessary protection) and the engineer therefore cannot see it. Therefore I arrange

5 the valve L in such a manner that when closed, the ports *d* admit enough water for any variation of steam pressure between fixed limits say between twenty-five pounds and one hundred and twenty-five pounds. Should
10 the steam gage therefore indicate a pressure above one hundred and twenty-five pounds he would know that he has not enough water (without consulting the overflow) and must open the valve. Suppose now he knows that
15 by giving the valve one half turn he admits a quantity of water of which the injector can take care of, say between a pressure of seventy-five pounds and two hundred pounds. He has all the provision he needs to regulate
20 the water supply without consulting the overflow and he needs only to distinguish between the closed position and a fixed open position of the valve M (which may be made visible by a suitable mark or index on the handle).
25 I am aware that it is not broadly new to form an injector with two overflow chambers, which are controlled by automatic valves.

What I claim as my invention is—

1. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflows, of separate valves controlling the discharge of the overflow from said chambers and operating automatically and in their turn one upon the other to unseat by the force of the initial overflow and to seat by the force of the secondary overflow, substantially as described.

2. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflows, of separate valves controlling separate discharge openings from said chambers and operating automatically and in their turn one upon the other to unseat by the pressure of the initial
45 overflow against the valve controlling said overflow and to seat independently of each other by the pressure of the secondary overflow against each valve, substantially as described.

3. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflows of separate valves controlling separate discharge openings from said chambers and operating
55 automatically and in their turn one upon the other to unseat by the force of the initial overflow and to be seated by the force of the secondary overflow, the valve controlling the initial overflow being provided with a shoulder, substantially as described.

4. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflow, of two separate floating valves controlling the discharge
65 of the overflow from said chambers and operating automatically by the force of said over-

flow acting reciprocally upon said valves to unseat and seat the same at the proper time said valves being adapted to unseat and seat one another, substantially as described.

5. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflow, of two floating valves controlling the overflow from said chambers and operating automatically one
75 upon the other and in their turn to unseat by the pressure of the initial overflow against the valve controlling said overflow and to be seated by the secondary overflow upon one or both of said valves, the valve controlling the
80 initial overflow being of larger size and having a shoulder, substantially as described.

6. In an injector, the combination with the casing, provided with separate overflow chambers for the initial and secondary overflow, of
85 an overflow arm provided with lateral overflow openings on opposite sides through which said chambers communicate into said overflow arm, horizontally sliding wing valves of different area controlling said overflow open-
90 ings, tubular guide bearings formed around said overflow openings in which the wings of said valves are slidingly supported, and valve chambers intermediate between the overflow openings and the overflow chambers in the
95 casing, substantially as described.

7. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflow, of an overflow arm having lateral openings on opposite
100 sides through which said chambers communicate into the overflow arm, floating valves automatically controlling the discharge of the overflow from said openings into the overflow arm and valve casings intermediate between
105 the discharge openings and the overflow chambers, said valve casings, overflow openings and overflow arm being located below the overflow chambers in the casings and adapted to carry off the leakage into the injector, sub-
110 stantially as described.

8. In an injector, the combination with the casing provided with separate chambers for the initial and secondary overflow, of the horizontally sliding valves P and Q controlling
115 separate overflow openings from said chambers and adapted to operate automatically one upon the other to unseat and seat by the pressure of the initial and secondary overflow and the tubular guide bearing *f* around
120 the stem of the valve Q extending in proximity to the valve P, substantially as described.

9. In an injector, the combination with the casing provided with the overflow chamber G and delivery chamber H, of the overflow arm
125 A⁸, the lateral openings N, O, through which said chambers discharge into the overflow, the horizontal sliding wing valves P Q of unequal area controlling the said openings and operating automatically one upon the other to un-
130 seat and seat by the pressure of the initial and secondary overflow respectively, the valve

chambers N' O' intermediate between the openings N O and the overflow chambers respectively, the tubular guide bearings *e f* around the openings N, O, and the shoulder *g* 5 on the valve P extending into the tubular guide bearing *e*, all substantially as described.

10. In an injector, the combination with a casing and water chamber formed therein, of a water inlet branch communicating with the 10 chamber through a fixed port and a valve in-

terposed between the inlet branch and chamber for increasing the flow from the branch into the chamber, substantially as described.

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

JOHN DESMOND.

Witnesses:

M. B. O'DOGHERTY,
N. L. LINDOP.