(Model.) 2 Sheets—Sheet 1.

J. N. DERBY.

STEAM INJECTOR.

No. 484,302. Patented Oct. 11, 1892.

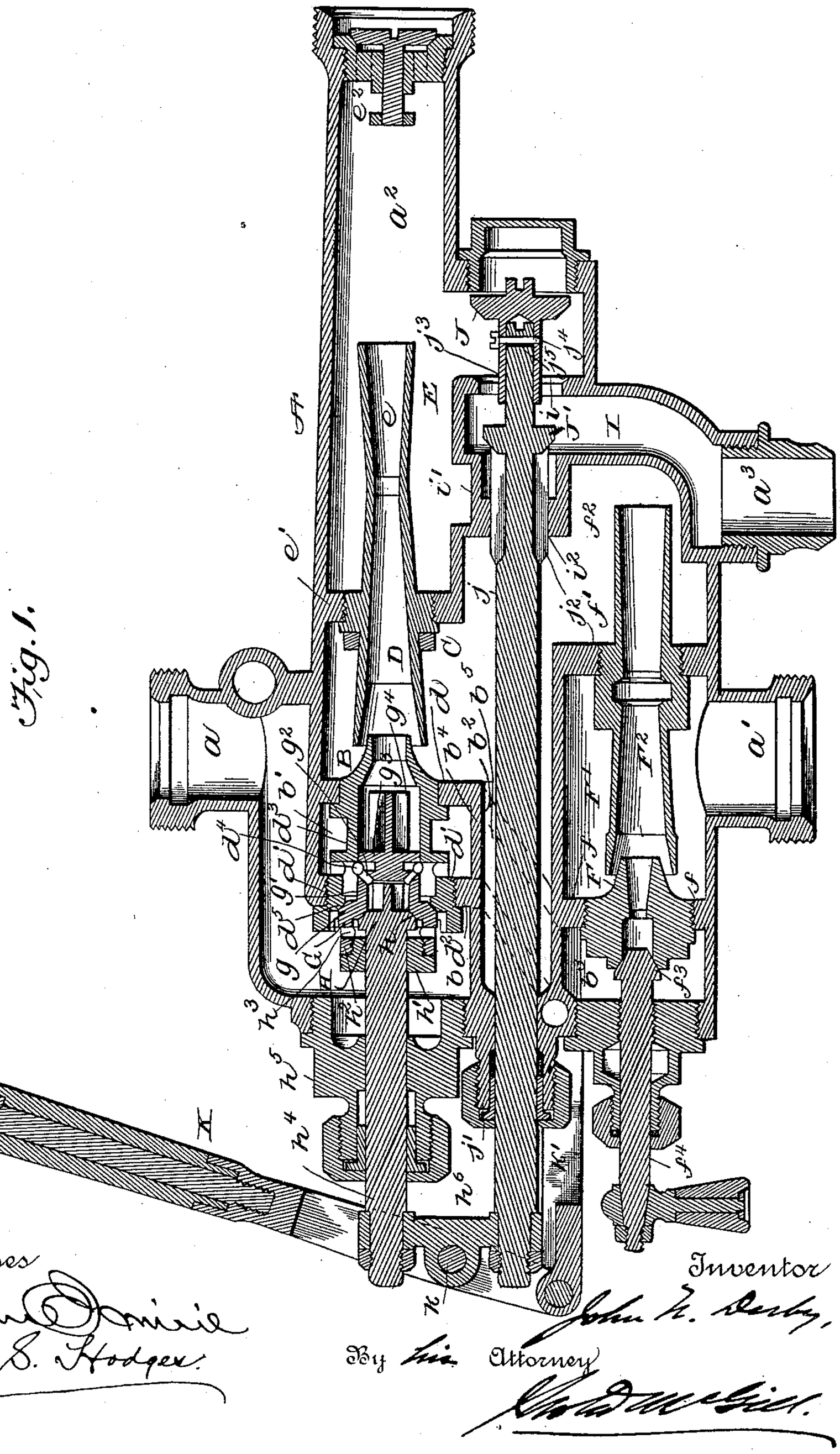

Fig. 1.

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(Model.) 2 Sheets—Sheet 2.

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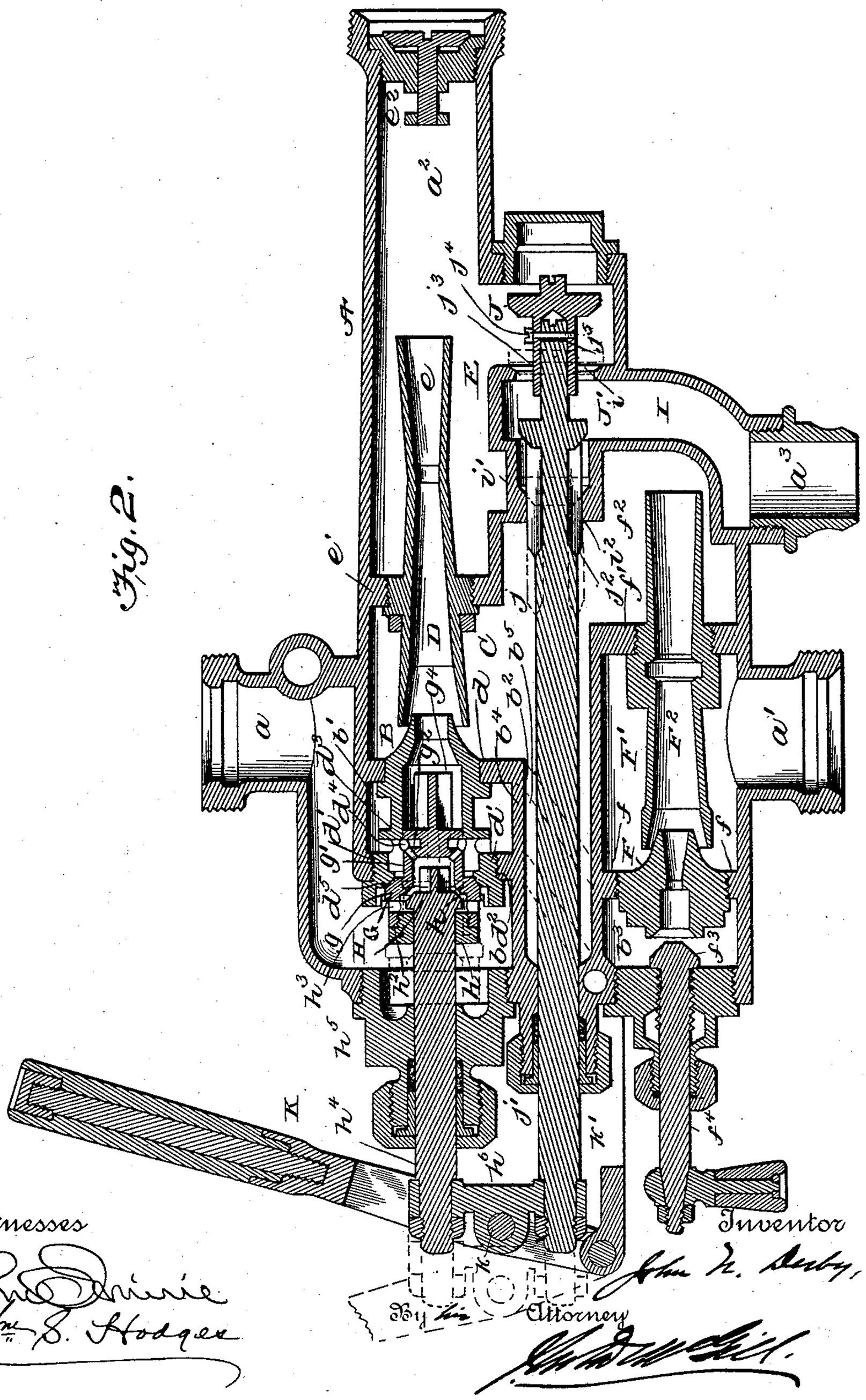
Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN NORMAN DERBY, OF BROOKLYN, ASSIGNOR TO THE HAYDEN & DERBY MANUFACTURING COMPANY, OF NEW YORK, N. Y.

STEAM-INJECTOR.

SPECIFICATION forming part of Letters Patent No. 484,302, dated October 11, 1892.

Application filed March 12, 1892. Serial No. 424,691. (Model.)

To all whom it may concern:

Be it known that I, JOHN NORMAN DERBY, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Steam-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.

This invention relates to certain new and useful improvements in steam-injectors, having reference to that class of injectors known as the "double jet," in which the water is first lifted into the ejector by one set of tubes and forced to the boiler by a second set of such tubes.

The object of the invention is to provide an injector of this class in which the relative formation of the parts shall be such that the steam-pressure on the steam-inlet valve or valves, when open, shall exert a corresponding pressure on the primary outlet or overflow valve and hold the same to its seat.

A further object is to provide an injector of this class with improved simple highly-efficient means by which the steam-inlet valves and overflow-valves will be under the control of a single operating-lever.

The invention consists in a lifting or forcing injector having its steam-inlet valve or valves directly under the control of an operating-lever and its discharge-valves connected with said lever, whereby said latter valves and one or both of said steam-inlet valves can be operated simultaneously and the steam-pressure on said inlet valve or valves will hold one of said overflow-valves to its seat, the pressure on said overflow-valve being equal to the steam-pressure on the area of the cross-section of the stem of the steam-inlet valve.

The invention further consists in a lifting and forcing injector provided with two steam-inlet valves, one acting on the other, so that steam can be successively admitted to the lifting and then to the forcing apparatus by means of a single operating-lever.

The invention further consists in a lifting and forcing injector having the overflow-valves of both the lifting and forcing apparatus directly under the control of a single rod or valve-stem connected to the main operating-lever.

The invention further consists in a lifting and forcing injector having the overflow-valves of both the lifting and forcing apparatuses connected to or under the control of a single rod or valve-stem, which is in turn under the direct control of the operating-lever, to which is also connected the stem of the steam-inlet valve or valves.

The invention also comprises the detail construction, combination, and arrangement of parts, substantially as hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal sectional view of my improved steam-injector, showing the position of the parts when out of operation. Fig. 2 is a similar view showing in full lines the position of the parts in starting the injector or when the lifting apparatus alone is to be used and in dotted lines the position of such parts when both the lifting and forcing apparatuses are in operation.

Referring to the drawings, A designates the casting or casing, provided with the steam-inlet arm or branch a, the water-inlet arm a', the delivery-arm a^2, and the overflow-arm a^3. Within this casing is the steam-inlet chamber b, adjacent to which is a secondary chamber b', which communicates through a cored passage b^2 with a lower steam-chamber b^3 of the lifting apparatus, said cored passage being on both sides of a circular wall b^4, forming a cylindrical chamber b^5.

B is the steam-inlet tube of the forcing apparatus, which fits snugly in a wall or diaphragm d, separating the secondary steam-inlet chamber b' from the water-chamber C, said steam-inlet tube being held to its place by an outer threaded extension d', screwed into a circular flange or wall d^2, dividing the steam-inlet chamber b from the secondary chamber b'. The cylindrical portion d^3 of this steam-inlet tube B is provided with a series of holes or ports d^4, which open into the secondary steam-chamber b'. An inner peripheral flange d^5 of the threaded extension d' is beveled to form a valve-seat.

D is the combining-tube, and *e* the delivery-tube secured thereto, the whole being secured in a wall or diaphragm *e'*, dividing the main water-chamber C from the overflow-chamber E, into which the delivery-tube projects. At the outer end of this overflow-chamber is a sliding check-valve e^2 to prevent backflow from the boiler entering the injector.

Of the lifting apparatus, F is the steam-inlet tube, screwed into a wall or diaphragm *f*, separating steam-inlet chamber b^3 from the water or suction chamber F'.

F^2 is the combining and delivery tube, screwed into a wall or diaphragm *f'* between the chamber F' and the primary discharge-chamber f^2, which opens into the water-chamber C of the forcing apparatus. An ordinary valve f^3 controls the admission of steam into the steam-inlet tube F of the lifting apparatus, which valve is generally left open. Its handled stem f^4 is projected through a nut and housing screwed into the casing.

G is the main steam-inlet valve, which is provided with a beveled flange *g*, designed to be normally seated against the valve-seat formed by flange d^5 of extension *d'* of the steam-tube B. The inner portion *g'* of this valve is cylindrical and provided with diagonal holes or ports g^2, and from the inner end of this cylindrical portion projects a piston-like flange g^3, having wings g^4, designed to fit snugly within steam-inlet tube B. Within this steam-inlet valve G is a second primary inlet-valve H, which is designed to be seated, when closed, against a beveled seat *h*, formed on the outer end of the cylindrical portion *g'* of valve G, and, when opened, against a nut *h'*, screwed into an outer cylindrical portion h^2 of valve G. In this cylindrical portion h^2 are steam-inlet holes or ports h^3. The stem h^4 of the primary valve H is extended through a central opening in nut *h'* and also through a plug or housing h^5, screwed into the casing, the extreme outer end of said stem being rigidly secured to a yoke h^6.

I is a duct or channel leading from within the casing A to the overflow arm or branch a^3. In one side wall of this duct or channel is an opening *i* into the main overflow-chamber E, and in a diametrically-opposite cylindrical extension *i'* is an opening i^2 into the primary discharge-chamber f^2. The discharge openings *i* and i^2 are designed to be closed by valves J J', respectively secured to or controlled by a rod or stem *j*, passed through the cylindrical chamber b^5 and out through an opening and plug or housing *j'* in the end of the casing, the outer end of said stem being connected direct to the lower end of yoke h^6. The valve J' is preferably formed integral with stem *j*, and from it and said stem extend lateral wings j^2, which fit snugly within discharge-opening i^2. The valve J is provided with a sleeve j^3, fitted on stem *j* and held by a transverse pin j^4, passed through a loosely-fitting slot j^5 in said stem, so as to permit said valve to have limited play to allow of both valves being always tightly seated, even if there should be a varying expansion of the valve-stem.

The operating-lever K is pivotally connected by a bolt *k* to yoke h^6 and at its lower end is fulcrumed on an arm *k'*, secured to the end of the casing. Hence this lever causes the steam-inlet-valve stem and the stem of the overflow-valves to move simultaneously.

The operation of my improved injector is as follows: Steam is admitted through the steam-inlet arm and passes into the steam-chamber *b*. The operator, pulling upon the lever K just as steam is first admitted, will unseat the primary steam-inlet valve, but not sufficient to cause the latter to engage the rear end of the main valve G. The steam will pass into the cylindrical portion of said latter valve and out through the holes or ports therein into the secondary steam-chamber *b'* and from the latter through cored passage b^2 into the lower steam-chamber b^3, and (valve f^3 of the lifting apparatus being open) it will thence pass through steam-tube F and combining-tube F^2 into primary chamber f^2 and through opening i^2 into the overflow-arm to the atmosphere, creating a vacuum in water or suction chamber F' and effecting the raising of water thereinto. In this initial operation the movement of the lever also effected a slight movement of the stem of the overflow-valves, but not sufficient to close either of said valves. Hence most of the steam and water passing through the tubes of the lifting apparatus will pass through the primary overflow-opening i^2, and as soon as the water appears at the overflow-arm a^3 the operating-lever is pulled back still farther, causing the primary inlet-valve H to partially unseat valve G and its piston, but not to its full extent, permitting some steam to pass through the steam-inlet tube of the forcing apparatus. At the same time the movement of the lever caused the overflow-valve J' to enter the cylindrical extension *i'*, thus forcing the water into the main water-chamber C and through the combining and delivery tubes of the forcing apparatus into the main overflow-chamber and out through the discharge-opening *i*. Then by pulling the lever out to its full extent the piston of the main steam-inlet valve is entirely withdrawn from the steam-inlet tube, admitting a full supply of steam to the tubes of the forcing apparatus, and by this final movement both valves J and J' are brought firmly to their seats and the water is caused to pass to the boiler. It is this arrangement of the overflow-valves that constitutes one of the important advantages of my invention. The pressure of the water in the main overflow-chamber constantly tends to hold the overflow-valve J tight against its seat, while the valve J' is held securely to its seat by the steam-pressure acting on the inner vertical sides or portions of the primary and main steam-inlet valves, the pressure exerted on

said latter overflow-valve corresponding to the steam-pressure on an area equal to the cross-section of the primary valve-stem. This and other advantages of my invention are apparent to those skilled in the art to which it appertains. It will be specially observed that the injector is free of all complication and that the steam-inlet and overflow valves are under the operation or control of but two rods or stems, connected to a single yoke, causing them to act in unison.

I claim as my invention—

1. In a lifting and forcing injector having the upper and lower series of jets or tubes and double overflows, the primary steam-inlet valve and primary overflow-valve for said lower series of jets or tubes, said valves being secured with relation to each other, whereby their operation will be simultaneous and said primary overflow-valve will be held to its seat by the steam-pressure exerted on the face of said primary steam-inlet valve, as set forth.

2. In a lifting and forcing injector having the upper and lower series of jets or tubes and double overflows, the primary steam-inlet valve provided with a projecting stem, and a primary overflow-valve for said lower series of jets or tubes and also having a stem which is connected with that of said steam-inlet valve, whereby the operation of said valves is simultaneous and said primary overflow-valve will be held to its seat by the steam-pressure exerted on the face of said primary steam-inlet valve, as set forth.

3. In a lifting and forcing injector having the upper and lower series of jets or tubes and double overflows, the primary and main steam-inlet valves for said upper and lower series of jets or tubes and primary and main overflow-valves for said double overflows secured with relation to each other, whereby the operation of said primary steam and overflow valves will be simultaneous and said primary overflow-valve will be held to its seat by the steam-pressure exerted on the face of said primary steam-inlet valve, substantially as set forth.

4. The herein-described improved lifting and forcing injector, comprising the primary and main steam-inlet valves, said primary valve having a stem projecting therefrom and designed to unseat said main steam-inlet valve, the primary and main overflow-valves secured to a common stem, the yoke connecting both of said stems, and the operating-lever secured to said yoke, as set forth.

5. The herein-described improved lifting and forcing injector, comprising the casing having the lifting and forcing tubes, two steam-supply chambers, a secondary steam-chamber communicating with the steam-chamber of said lifting apparatus, the main steam-supply valve having holes or ports therein, and the primary steam-inlet valve normally seated in said main steam-inlet valve, whereby steam will be successively admitted through said main steam-inlet valve into said tubes of the lifting and forcing apparatus, as set forth.

6. The herein-described improved lifting and forcing injector, comprising the casing having the lifting and forcing tubes, two steam-supply chambers, a secondary steam-chamber communicating with the steam-chamber of said lifting apparatus, the main steam-inlet valve of said forcing apparatus for controlling the admission of steam to said forcing apparatus and having communication with said secondary steam-chamber, and the primary steam-inlet valve for controlling the admission of steam to said main valve, substantially as set forth.

7. The herein-described improved lifting and forcing injector, comprising the casing having two steam-supply chambers, a secondary steam-chamber adjacent to the steam-chamber of the forcing apparatus and communicating through a cored passage with the steam-chamber of the lifting apparatus, the steam-inlet tube of said forcing apparatus having holes or ports opening into said secondary steam-chamber, the main steam-inlet valve located in said steam-inlet tube and also having holes or ports opening thereinto, and the primary steam-inlet valve for controlling the admission of steam into said main steam-inlet valve, substantially as set forth.

8. The herein-described improved lifting and forcing injector, comprising the casing having the lifting and forcing tubes, the main steam-inlet valve having a cylindrical portion provided with holes or ports, and a piston fitting in the steam-tube of said forcing apparatus, and the primary steam-inlet valve having a forward seat against the outer end of the cylindrical portion of said main steam-inlet valve and designed to engage the rear end of said latter valve when withdrawn, and thereby effect the withdrawal of said piston from said steam-tube, as set forth.

9. The herein-described improved lifting and forcing injector, comprising the casing having the overflow-arm, a duct or channel leading thereto, provided with opposite discharge-openings, and the primary and main overflow-valves designed to be seated against said openings and under the control of a common stem, said main overflow-valve having a limited independent movement and held to its seat by the pressure in the main overflow-chamber, as set forth.

10. The herein-described improved lifting and forcing injector, comprising the casing having the overflow-arm, a duct or channel leading thereto, provided with opposite discharge-openings, the valve-stem extended through a cylindrical chamber of said casing to the outside thereof and having a primary overflow-valve rigidly secured thereto designed to be seated against the primary discharge-opening, and a second valve loosely secured on said stem designed to be seated against the main discharge-opening, substantially as set forth.

11. The herein-described improved lifting and forcing injector, comprising the casing having a cylindrical chamber therein and a duct or channel leading to the overflow-arm, provided with primary and main discharge-openings, the series of tubes of the forcing apparatus, the steam-tube of which is provided with a cylindrical portion having holes or ports and is rigidly held in a wall or diaphragm forming a secondary steam-chamber, the main steam-inlet valve having holes or ports opening into said cylindrical portion of said steam-tube and also provided with a piston at its forward end in said steam-tube and a nut in its rear end, the primary steam-inlet valve designed to be seated against the outer central portion of said main steam-inlet valve and having its stem projected through said nut and the end of said casing, the overflow-valves, the stem therefor projected through said cylindrical chamber, the yoke connected to said stems, the operating-lever fulcrumed to said yoke, and the series of tubes forming the lifting apparatus, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN NORMAN DERBY.

Witnesses:
CHAS. EDGAR MILLS,
ALFRED BROTHERHOOD.