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L. E. HOGUE.

INJECTOR.

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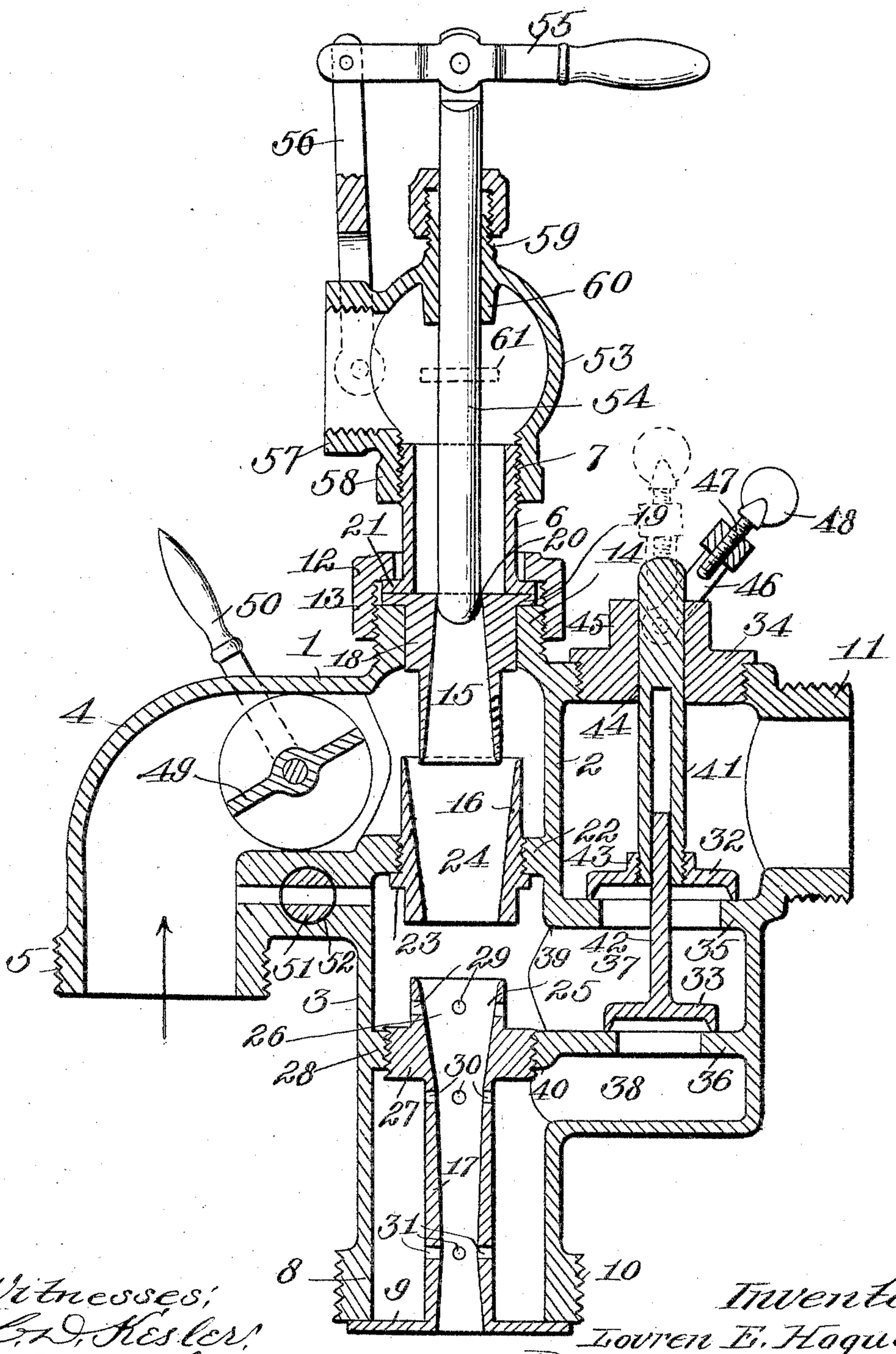
NO MODEL.



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UNITED STATES PATENT OFFICE.

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INJECTOR.

SPECIFICATION forming part of Letters Patent No. 776,840, dated December 6, 1904.

Application filed August 8, 1904. Serial No. 219,952. (No model.)

To all whom it may concern:

Be it known that I, LOVREN E. HOGUE, a citizen of the United States, residing at Greenville, in the county of Mercer and State of Pennsylvania, have invented new and useful Improvements in Injectors, of which the following is a specification.

This invention relates to injectors of the upright class; and primarily it consists of two barrels or inclosures, one barrel containing three tubes consisting of an upper steam-injecting tube, an intermediate lifting-tube, and a lower forcing-tube, the latter having suitable openings for hot and cold overflow, a diaphragm or other obstructive medium being interposed between the two overflows, the other barrel containing two valves coöperating with the overflows with respect to an exhaust opening or connection.

The invention further consists in the details of construction and arrangement of the several parts, which will be more fully hereinafter set forth.

The primary object of the present invention is to provide an injector organization wherein a positive operation ensues to overcome disadvantages heretofore encountered in devices of this class and whereby at least one-third more water may be introduced into a boiler under the control of what may be termed a "throttle-valve" when it is necessary to use the injector with high steam-pressure; further, to provide means for throwing water into a boiler with lower steam-pressure than has heretofore been possible without in the least detracting from the sufficiency of supply of water and to effect a condensation of the steam and concentration of the full force at a proper point in the delivery or forcing tube to carry the water into the boiler and also relieve the pressure on the exhaust-valves to allow the latter to drop to their seats and shut off the ingress of outside air into the working barrel or inclosure; furthermore, to employ a structure whereby the valves controlling the exhaust will be covered with water to form a seal during a certain operation of the injector to resist the entrance of outside air; further, to provide means in the suction-pipe in the form of a grading-cock to increase the flow of water into the boiler, especially when running with high steam, by permitting water to flow into the injector below the suction-tube to a point adjacent the inlet of the delivery-tube after condensation has taken place, and, further, to generally improve injectors and extend their range or scope of efficiency in consonance with surrounding conditions or exigencies.

The drawing illustrates a sectional view of an injector embodying the features of the invention, a portion of the same being shown in dotted lines to illustrate the locked position of a part of the valves.

The numeral 1 designates a casing for the parts of the injector, which is shaped and proportioned to provide two barrels or inclosures 2 and 3, the former having a suction pipe or nozzle 4, with an exterior screw-threaded extremity 5 for attachment to a source of water-supply, such as a pipe, a steam-injecting nipple or tubular coupling 6, with an exteriorly screw-threaded end 7, and a boiler-attaching extremity or end 8, provided with an annular inclosing plate 9 and a circumferential screw-threaded enlargement 10 for the reception of a pipe or enlargement with any other means for attaching the injector to a boiler. The barrel or inclosure 3 has a screw-threaded exhaust-coupling collar 11, and said barrel is of less longitudinal extent than the barrel 2. The nipple or tubular coupling 6 may be of any length and is separably connected to the casing by means of a coupling-ring or analogous device 12, having a screw-threaded flange 13 to coöperate with a vertical extension 14 of the casing, which will be more fully hereinafter set forth. In the barrel 2, disposed in longitudinal alinement, are a steam-tube 15, a lifting-tube 16, and a forcing-tube 17, the steam-tube having a circumferential bearing-boss 18 on the exterior of its upper extremity from which projects a flange 19, disposed on the upper edge of the vertical extension 14, the bore or opening 20 extending through the steam-tube gradually increasing in diameter toward the lower terminal of said tube. The bore 20 opens into the center of the lower portion of the nipple or tubular coupling 6, and the latter has a base-flange 21, which bears on the

flange 19, the coupling-ring when applied to the extension 14 securing the flanges 21 and 19 in firm engagement with each other. The lower end of the steam-tube slightly projects into the upper extremity of the lifting-tube, and such extremity of the latter is of materially greater diameter than the lower end of the steam-tube to effect the desired operation with respect to the water entering the barrel 2. The lifting-tube is secured by threads or other analogous means to an annular support 22, located within the barrel or inclosure 2, and to limit the upward movement of the lifting-tube a circumferential stop-shoulder 23 is formed in said tube and bears against the under side of the support. The opening or bore 24 of the lifting-tube decreases in diameter toward the lower end of said tube, and the upper end of this tube around the lower end of the steam-tube is fully open and adjacent to the communicating opening between the suction nozzle or pipe 4 and the barrel 2. The forcing-tube 17 has an upper flared extremity 25, and the bore 26 therethrough gradually reduces toward the lower end of said tube. The upper extremity of the tube is formed with a circumferential partition projection 27, which is connected by screw-threads or other analogous means to an annular support 28 in the barrel or inclosure 2, and by this means a partition is provided in the valve between the upper and lower extremities of the forcing-tube, and likewise the support 22 establishes a partition in the barrel with respect to the lifting-tube 16. The lower end of the forcing-tube is continuous with or has the closing-plate 9 secured thereto, and when the lower end of the barrel or inclosure 2 is applied the said plate will be projected into the coupling means for making the connection between the injector and the boiler. Between the lower end of the lifting-tube and the upper end of the forcing-tube a space is provided, preferably about one-half inch in extent, to facilitate the operation, which will be hereinafter explained, and coöperating with four openings 29 in the upper end of the forcing-tube above the partition projection 27, these openings serving as cold-water overflow means and vents for steam until the water arrives at a proper point within the injector. Below the partition projection 27 the forcing-tube has spaced series of holes or openings 30 and 31, which provide means for the overflowing of hot water, and also serves as steam-vents until the water reaches a proper point.

The barrel or inclosure 3 contains two valves 32 and 33 and a cap 34, the valves 32 and 33, respectively, coöperating with partition valve-seats 35 and 36, forming compartments 37 and 38, having openings 39 and 40, communicating with the barrel or inclosure 2 at points adjacent to the hot and cold overflows or openings in the forcing-tube 17. The upper valve 32 has a hollow stem 41, into which is movably inserted the solid stem 42 of the lower valve 33 to permit both valves to be carried up against the cap 34 to fully clear the compartments or chambers 37 and 38 and establish unobstructed escape means for the hot and cold overflows in the barrel or inclosure 2. The opening through the upper partition valve-seat 35 is of such diameter that the valve 33 will pass therethrough and insure a complete telescope operation of the two valves 32 and 33 when said valves are open. On the upper valve 32 a collar 43 is cast or otherwise secured to contact with the under side of the cap 34 when forced up against the latter by the steam-pressure within the injector when said valves 32 and 33 are free to be influenced by such pressure. This collar 43 when in engagement with the under side of the cap 34 forms a closing means for the opening 44 in the cap, through which the stem 41 has movement, and thereby prevents the escape of steam at this point. The cap 34 has an upper boss or enlargement 45, and thereto is pivotally attached a stirrup 46, provided with a set-screw 47, having a suitable thumb-engaging head 48, the said screw working downwardly through the stirrup and adapted to be brought into contact with the upper end of the valve-stem 41. Under ordinary conditions or when the injector is used with stationary engines the stirrup 46 and the set-screw 47 will lie over the top or cap 34 of the barrel or inclosure 2, and the stem 41 and the valves coöperating therewith will be free for upward movement. When the injector is used on locomotives, the stirrup 46, acting in conjunction with the valve-stem 41 to hold the valves 32 and 33 closed, will serve the same purpose as a frost-cock. When locomotives are on side tracks or the injector is not in use in cold freezing weather, the stirrup is raised to perpendicular position and the set-screw 47 is adjusted to bring the same in contact with the upper end of the stem 41 and forces the valve 32 closely down to its seat, thereby shutting off the natural outlet for steam and forcing it back through the suction pipe or nozzle 4 into the water-tank or other water-supply source to warm the pipes and water in the tank to prevent freezing.

The inlet or suction nozzle or pipe 4 has a valve 49 mounted therein, which may be of any type suitable for the purpose, but preferably of the butterfly form, and is substituted for the usual lazy-cock, the stem of the valve on one side being disposed in any preferred form of stuffing-box and provided with a terminal lever-handle 50, the stuffing-box operating when properly packed to keep the air from entering the suction-pipe. The suction-pipe opposite the stuffing-box on the exterior is formed with a suitable receptive means, such as a boss or the terminal of the stem which incloses the latter and excludes the air on its side.

The injector as thus far described is com-

plete for many applications and will have a positive operation with advantageous effect in the injection of water into a boiler, and the additions, which will be presently set forth, serve only as valuable auxiliaries to render the injector more effective in its operation. The first of these auxiliaries consists of a grading cock or valve 51, disposed in a suitable seat 52 therefor between the inner lower portion of the suction-pipe 4 and the adjacent wall of the barrel or inclosure 2. The opening controlled by this grading-cock is from the suction-pipe into the space in the barrel or inclosure 2 below the lower end of the lifting-tube 16, and by the use of this valve extra water is furnished to the delivery or forcing tube 17 and will increase the flow of water into the boiler about one-third from a comparative standpoint, especially when running with high steam-pressure. The tube 16 is not a lifting-tube until after the injector is in operation, as it will be observed that while steam-pressure is in the working barrel 2 it will be forced back into the suction-pipe. After the steam is condensed in the lifting and forcing tubes the grading-cock is opened to cause water to be drawn into the forcing or delivery tube and add very materially to the supply of water to the boiler, as well as insuring condensation under high steam-pressure. In other words, the grading-cock is never used until after condensation has taken place.

The second auxiliary consists in an attachment for controlling the entrance of steam into the nipple 6 and comprises a globe-casing 53, a vertically-shiftable stem 54, having its lower end adapted to serve as a valve, and a lever 55, attached to the upper end of the stem and also connected to a fulcrum-lever 56, movably secured to the side of an attaching-collar 57 for the connection of a steam-pipe. The lower portion of the globe-casing 53 has a collar 58 to engage the nipple 6, the collar 57 being practically in a plane at right angles to the collar 58. The stem 54 moves through a gland or stuffing-box 59 on the upper central portion of the globe-casing 53, and projecting downwardly from the latter into the interior thereof is a stop-sleeve 60, with which projections 61, which may be of any preferred form, are adapted to contact to limit the upward movement of the stem 54. The lower end of the stem 54 normally closes the upper open terminal of the steam-tube, said end of the stem being of such diameter as to closely fit in the upper reduced portion of the bore in said tube.

As before indicated, the lower end of the barrel or inclosure 2, containing the forcing-tube 17, is attached to the water-space in a boiler, the suction pipe or nozzle 4 being connected to a tank or other water-supply and the exhaust collar or member 11 secured as usual to a suitable exhaust tube or pipe. Under ordinary conditions the valve 49 will be partially opened and the valves 32 and 33 free to act, except as hereinbefore noted, when the injector is used on a locomotive and freezing is liable to ensue. Steam is admitted to the nipple 6, and by raising the stem 54 it passes downwardly through the steam-tube 15 and into and through the lifting-tube, thereby creating a suction which will draw the water into the injector through the suction-pipe 4. The steam continues downwardly into the forcing-tube 17 and passes out through the openings heretofore explained and thence enters the barrel or inclosure 3, which may be properly termed the "exhaust-barrel," the pressure of the steam in the lower end of the valve raising the valves 32 and 33 and establishing a clearance or passage to the exhaust collar or member 11. As soon as water arrives in the injector it condenses the steam and concentrates its full force on the small openings in the forcing or delivery tube and carries the water into the boiler and also relieves the pressure on the exhaust-valves 32 and 33, allowing them to drop to their seats to prevent the entrance of outside air into the barrel or inclosure 2, the valves 32 and 33 being disposed below the exhaust-outlet, especially the lower valve 33, induces the establishment of a water seal which will prevent the entrance of outside air into the injector, with obvious advantages. The operation of the injector will thus continue regularly until the valve-stem 54 is lowered to shut off the ingress of steam, it being understood that this valve-stem may be normally operated at any time either to open or close the steam-tube 15. The globe-casing 53 and stem 54, together with the parts coöperating with the latter, may be properly termed a "controller" for the injection of steam into the improved device. Furthermore, the valve 49 may be adjusted, as required, to control the opening between the barrel or inclosure 2 and the suction tube or nozzle 4, and at a proper time the grading-cock 51 may be opened to admit water from the suction tube or nozzle 4 to a point between the lifting and forcing tubes, as hereinbefore referred to. As before indicated, however, the operation of the injector in the main is not dependent upon the use of the butterfly-valve 49, the grading-cock 51, or the globe-casing 53 and stem 54, these parts being auxiliary means to adapt the injector to various contingencies. It will also be understood that changes in the proportions, dimensions, and minor details may be resorted to without departing from the spirit of the invention and also that suitable packings may be introduced at points where found necessary to avoid leakage.

Having thus fully described the invention, what is claimed as new is—

1. In an injector of the class set forth, the combination of communicating barrels or inclosures, one having a suction-pipe attached

thereto, with an adjustable valve therein and a grading-valve at a plane below the adjustable valve, and also provided with steam, lifting, and forcing tubes, and the other having a valved exhaust-outlet, the barrel having the exhaust-outlet being in communication with that provided with the tubes.

2. In an injector of the class set forth, the combination of two barrels in communication with each other, one barrel having a suction-pipe coöperating therewith, and a grading-valve at a plane below the said suction-pipe and also provided with longitudinal alined, steam, lifting and forcing tubes, and the other valve communicating with the one having the tubes and provided with a valved exhaust-outlet.

3. In an injector of the class set forth, the combination of two barrels or inclosures, the one having a suction-pipe with a valve therein and a grading-valve below the former valve and also provided with steam, lifting and forcing tubes in alinement, the steam-tube projecting into the lifting-tube and the latter and the forcing-tube spaced apart from each other, a valved-steam-injecting pipe secured to said barrel or inclosure having the steam, lifting and forcing tubes therein, and directly communicating with one extremity of the steam-tube, the remaining barrel or inclosure having an exhaust-outlet and valves operating therein.

4. In an injector of the class set forth, the combination of two barrels or inclosures, the one having a double-valved suction-pipe and provided with steam, lifting, and forcing tubes in longitudinal alinement, and the other having communication with the former and provided with an exhaust-outlet and two telescopically-associated valves which are automatically operative under steam-pressure.

5. In an injector of the class set forth, the combination of two barrels or inclosures, one having a suction-pipe with an adjustable valve therein and a grading-valve at a plane below the adjustable valve and also provided with steam, lifting, and forcing tubes, and the other having an exhaust-outlet in communication with the former and provided with dual valves automatically operative by steam-pressure to give access to the exhaust-outlet, the one valve having guiding means movable into similar means of the other.

6. In an injector of the class set forth, the combination of two barrels or inclosures in communication with each other, the one having a valved suction-pipe, and also provided with steam, lifting and forcing tubes, and a steam-injecting tube communicating directly with one extremity of the steam-tube, the contiguous ends of the lifting and forcing tubes being separated from each other, and the forcing-tube having separated openings for hot and cold overflows, the remaining barrel or inclosure being provided with an exhaust and dual telescopic valves, one of the latter having means for locking it against movement.

7. In an injector of the class set forth, the combination of two barrels or inclosures in communication with each other, the one barrel having a suction-pipe with two valves therein coöperating with the said barrel, the first-named barrel having steam, lifting, and forcing tubes therein, the steam-tube projecting into the lifting-tube and the latter and the forcing-tube having ends spaced apart from each other, the forcing-tube also having separated openings therein, the remaining barrel or inclosure having an exhaust-outlet and telescopic valves operating therein.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LOVREN E. HOGUE.

Witnesses:
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