(Model.)

J. HUBER.

INJECTOR.

No. 604,233. Patented May 17, 1898.

Fig. 1.

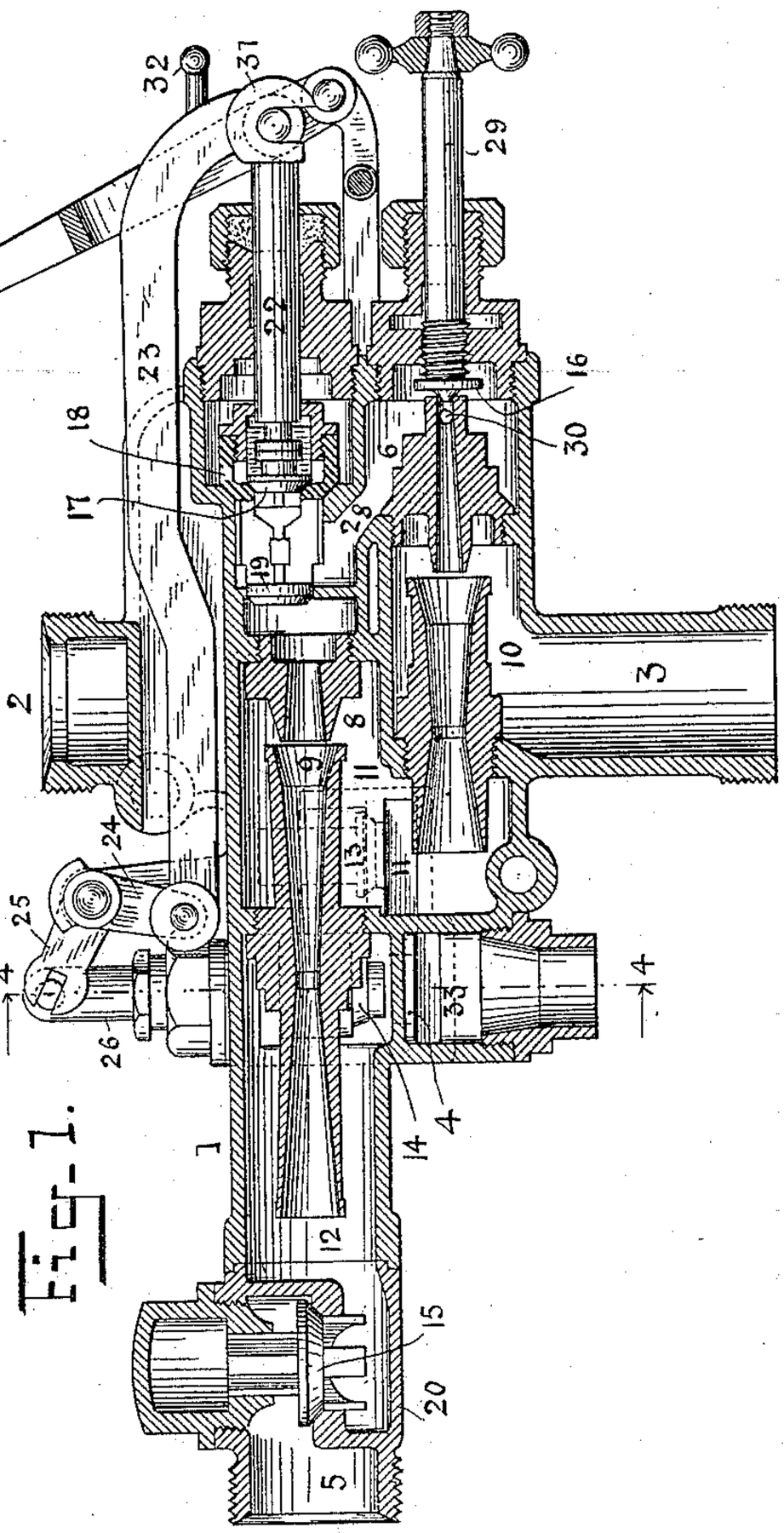


Fig. 2.

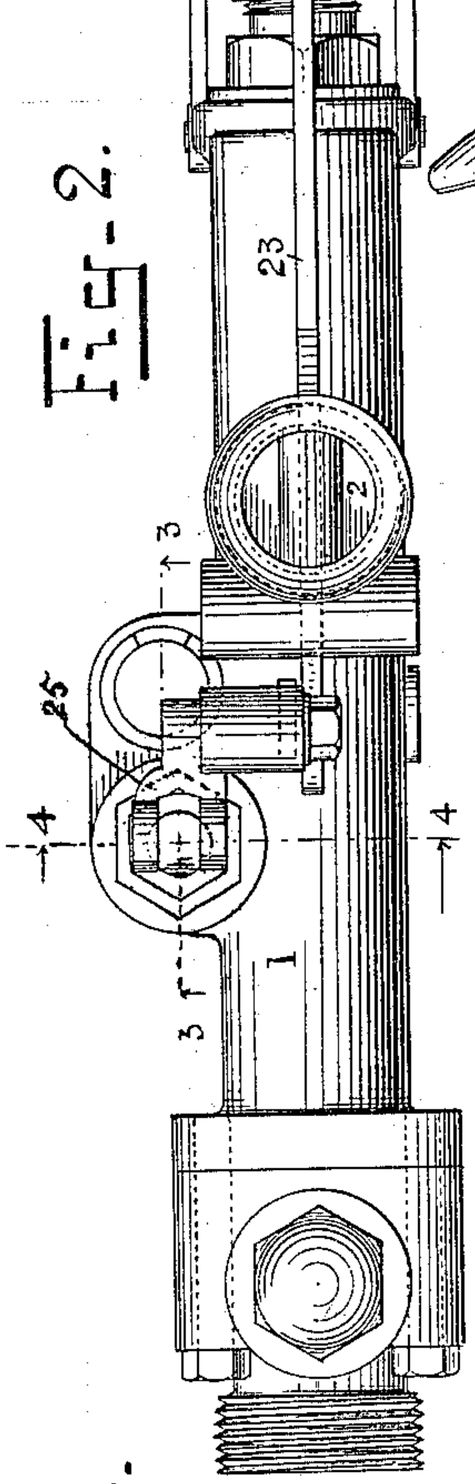


Fig. 3.

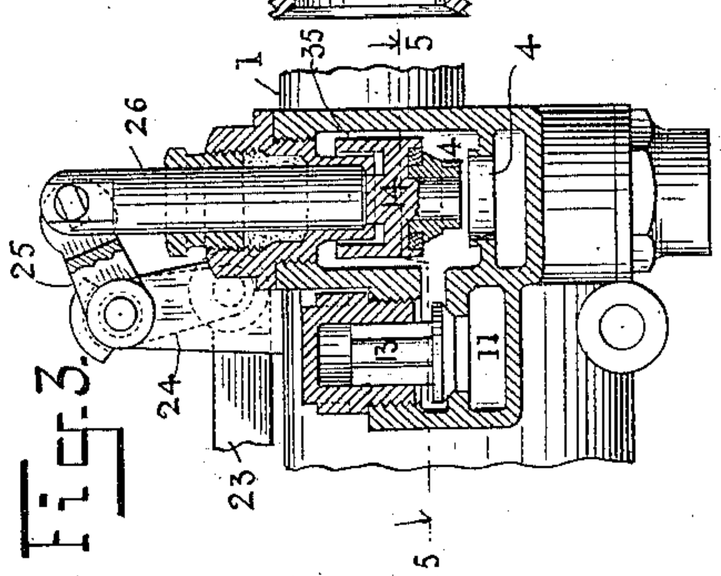


Fig. 4.

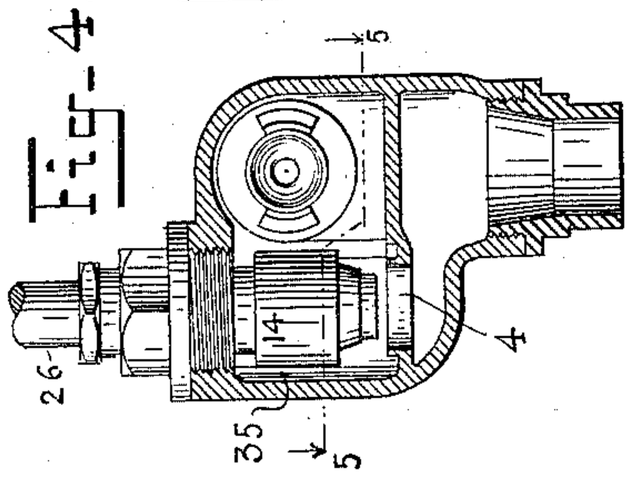
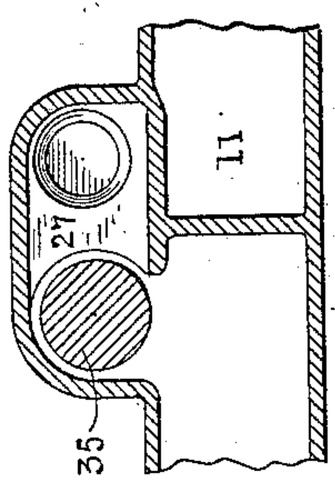


Fig. 5.



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INJECTOR.

SPECIFICATION forming part of Letters Patent No. 604,233, dated May 17, 1898.

Application filed February 12, 1898. Serial No. 670,036. (Model.)

To all whom it may concern:

Be it known that I, JACOB HUBER, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented a certain new and useful Improvement in Injectors, of which the following, taken in connection with the accompanying drawings, is a specification.

The invention relates principally to that class of injectors known as the "double tube;" and the object is to construct an injector that embraces all the modern refinements of operation that long experience in practical use has developed in a compact and simplified form by making the operative parts strong and durable and so reorganizing the same relatively that large spaces or chambers and extended communicating passages are dispensed with and the operative parts made accessible and of such character as to be safely removed and repaired by an ordinary mechanic.

Heretofore in this class of injectors the cooperative parts have been too widely separated, involving the intercession of either chambers of extraordinary size or of additional chambers or spaces and extended passages that form the necessary communication between them. In the present invention these objections have been overcome in locating such coöperative parts in juxtaposition, which has not only reduced the injector in size, but avoided delay in the method of operation and rendered the instrument in this respect more certain and efficient. The type and location of the valves have also rendered the same easy of access and adapted for repairs by the user or by an ordinary workman, as will hereinafter more particularly appear.

In order that others may understand and use the invention, I will first proceed to describe a device embodying it and subsequently will point out in the claims its novel characteristics.

In the drawings, Figure 1 represents a longitudinal section; Fig. 2, a plan view; Fig. 3, a sectional view on line 3 3, Fig. 2; Fig. 4, an end view, partly in section, on the line 4 4, Figs. 1 and 2; Fig. 5, a transverse section on the line 5 5, Figs. 3 and 4, of an injector embodying the invention.

1 represents the casing; 2, the steam-inlet; 3, the water-inlet; 4, the final overflow-port; 5, the discharge-outlet to the boiler; 6, the lifting steam-nozzle; 7, the lifting combining-tube; 8, the forcing steam-nozzle; 9, the forcing combining-tube; 10, the suction-chamber of the lifter; 11, the discharge-chamber of the lifting apparatus and the inlet-chamber of the forcing combining-tube; 12, the discharge-chamber of the forcing apparatus; 13, an automatic valve controlling a port leading from the discharge-chamber of the lifting apparatus; 14, a final positive overflow-valve that controls the overflow-port 4; 15, a check-valve opening toward the boiler-inlet; 16, a steam-throttling valve to the lifting steam-nozzle; 17, an auxiliary steam-valve; 18, the main steam-inlet valve, with an extended plug 19, controlling a port leading to the forcing steam-tube.

In the construction as shown in Fig. 3 I preferably place the automatic valve 13 in a short passage 27, leading from the discharge-chamber 11 of the lifting apparatus to an adjacent supplementary passage which also communicates with the discharge-chamber 12 of the forcer and contains the final positive overflow-port 4 and valve 14. The final positive overflow-valve 14 is located in this supplementary passage to clear the mouth of the passage 27 and form an annular space 35, in communication with the chamber 11, so that when it is moved toward its seat to close the final overflow-port 4 it will retard or check the flow of water through the passage 27 and annular space 35, but allow at all times a free communicating opening from the discharge-chamber 12 of the forcing apparatus through the passage 27 and space 35 to the top of the automatic valve 13. This arrangement also provides for a free direct outlet from the discharge-chamber 11 of the lifting apparatus to the overflow-port 4, there being no intervention of enlarged chambers to allow the undue expansion of steam before it reaches the final overflow-port.

The operation of this injector is substantially like all injectors of this class. The

steam-inlet and final overflow valves are conjointly operated by the lever-handle 21, connected valve-stem 22, connecting-rod 23, levers 24 and 25, and overflow-valve stem 26, substantially in the usual way, except as hereinafter explained, steam being first admitted to the lifting apparatus by means of a slight movement of the lever-handle 21, which opens the auxiliary inlet-valve 17 of the valve device 18. The steam passes through the passage 28 and through the lifting steam-nozzle 6 and the lifting combining-tube 7 to the chamber 11, lifting the automatic valve 13, then passing through the passage 27 into the supplementary chamber and through the overflow-port 4. The passing of the steam from the nozzle 6 through the tube 7 produces a vacuum in chamber 10, which causes the water to enter through the water-inlet 3 to join the steam, whereby the latter is condensed, and the water follows the route of the preceding steam through the overflow. The lever-handle 21 now being given a further movement causes the overflow-valve 14 to move toward its seat, which acts to retard the flow of water from the passage 27 and thus force a portion of the water into and through the forcing combining-tube 9. A still further movement is given the handle 21, which withdraws the plug 19, allowing steam to flow through the forcing steam-nozzle, mixing with the water already flowing through the forcing combining-tube 9, thereby driving it through said tube at a high velocity and causing a high pressure in the chamber 12, which is instantly exerted on top of the automatic valve 13 through the communication around the valve 14 and the passage 27, thus causing the valve 13 to be seated and held to its seat by the pressure exerted on its top. A still further movement of the lever 21 causes the final overflow 14 to close the overflow-port 4, which diverts the water from the overflow into the boiler through the check-valve 15 and discharge-outlet 5.

The independent spindle 29 and valve 16 are intended to regulate the flow of steam to the lifting apparatus for the regulation of its capacity, as is well understood by those conversant with the apparatus. An aperture 30 is provided in the steam-nozzle of the lifter of such size that it will admit sufficient steam to the lifter to enable the injector to start and work at its minimum capacity should the operator seat the valve 16.

The advantages derived by having the overflow-valve 14 located in close proximity to the mouth of the passage 27, leading from the discharge of the lifting apparatus, and so constructed and located that its movement will retard the flow of water through this passage are that it drives the required amount of water under pressure through the forcing combining-tube 9 to insure, without fail, the proper combining of the steam as it issues from the forcing steam-nozzle. Without this partial throttling it is necessary in practice to so time the movements of the valve admitting steam to the forcing steam-nozzle and the final overflow-valve in relation to each other that the automatic valve must not only seat, but remain seated, with the first impulse of steam issuing from the forcing steam-nozzle. Under certain conditions that at times exist, especially when starting the injector, there is a tendency of the pressures on top and underneath the automatic valve to balance, which renders the instrument so sensitive as to require great care in operating the valves, and it is also difficult for a mechanic unskilled in the manufacture of the device to make repairs and maintain the proper relative adjustment or timing of the parts. In injectors of this class where a positive tightly-fitting valve is used to direct the flow of water to the forcing combining-tube, instead of from the overflow, it requires a valve fitted with a precision and careful adjustment relative to the movement of the steam-inlet valves beyond the skill of an ordinary mechanic to properly repair the instrument.

In the device shown in my invention the automatic valve is seated and held to its seat when the pressure in the discharge-chamber of the forcer apparatus is sufficiently great and constant to do so, and it will be apparent that there is no nicety required in timing the movement of the final positive overflow-valve to force the required amount of water through the forcing combining-tube in starting the injector.

The check-valve 15 is located in a casing 20, which is separable from the main casing 1 by a flanged joint. The object in constructing a separate casing or shell for the check-valve is that it is often necessary to remove the injector for cleaning or repairs when there is a pressure on the boiler, and when the check-valve is located in the main body of the injector it is impossible to remove the injector under the boiler-pressure. The advantage derived by making the casing for the check-valve independent of the injector-casing will thus become apparent; and, further, in joining the casing for the check-valve to the main casing of the injector by means of a flanged joint the injector-casing can be easily removed from the check-valve casing without rotating the injector proper, which would be necessary should the check-valve casing be screwed to the injector-casing. It frequently happens that the injector is located when piped close to the boiler, so that it is impossible to rotate it, and a joint made that requires this would be of little value. Another object in flanging the check-valve casing to the injector-casing is that when the joint is broken it gives a large and full opening in which to insert or remove the necessary internal parts, and, besides, a flanged joint, unlike a threaded connection, can be repeatedly broken without wear.

I do not confine myself to the form or ar-

rangement of the check-valve shown in the drawings, as a horizontal or other type of valve may be substituted and accomplish the same purpose.

I am aware that check-valves have been used in connection with the injector joined to the casing; but I believe I am the first to separate the casing containing the check-valve from the casing containing the operative parts of the injector by means of a flanged joint and securing thereby the advantage stated.

In the construction of the handle-lever mechanism the connecting bar or link 23 is connected to the head on the spindle 22 by means of the hooked ends or forks 31 and passes through a cored passage within the lateral limits of the injector-casing and is thereby protected. The hooked ends or forks 31 admit of this disengagement of the bar 23 from the spindle of the main steam-valve, which permits the independent closing of the overflow-valve 14 without affecting the position of the steam-inlet valves, a handle 32 being provided for this purpose. This arrangement also permits a slight amount of steam to circulate through the injector, and thus act as a heater.

What I claim, and desire to secure by Letters Patent, is—

1. In a double-tube injector, an opening or port controlled by an automatic valve between the discharge-chamber of the lifting apparatus and a passage which contains the overflow-port of the forcing apparatus, and a final positive overflow-valve constructed to choke the mouth of the communicating passage from said automatic valve without closing said passage, as set forth.

2. In a double-tube injector, an opening or port in the discharge-chamber of the lifting apparatus, an automatic valve controlling said opening or port, a communicating passage leading from said opening or port to the overflow-port of the forcing apparatus controlled by a final overflow-valve, the respective valves being located in close proximity, as shown, and with no intervening chamber wherein an expansion of the steam can take place, as described.

3. In an injector a check-valve operating within a separable section of the injector-casing, and joined thereto by means of a flanged joint, whereby the main body of the injector may be separated and removed therefrom by a longitudinal movement without rotation and the interior parts of the injector rendered accessible for removal or repair, as set forth.

4. In an injector, a casing made in two or more parts, a check-valve located in the casing containing the discharge-outlet to the boiler, said check-valve casing being joined to the main injector-casing by means of a flanged joint, whereby the injector-casing containing the operative parts of the injector can be removed from the casing containing the check-valve without disturbing or breaking the discharge or delivery connection to the boiler, as shown and described.

5. In a double-tube injector, a lifting steam-nozzle 6, a steam-valve 16 and a hole 30 in said nozzle, which shall admit sufficient steam to nozzle 6 to enable the injector to work when the valve 16 is closed, as set forth.

6. In an injector a main steam-valve, a stem to operate the same and a bar connecting with the overflow-valve, said bar having forks or prongs engaging the stem of the steam-valve, whereby the bar 23 can be disengaged from the spindle of the main steam-valve and the overflow-valve may be independently operated, as set forth.

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