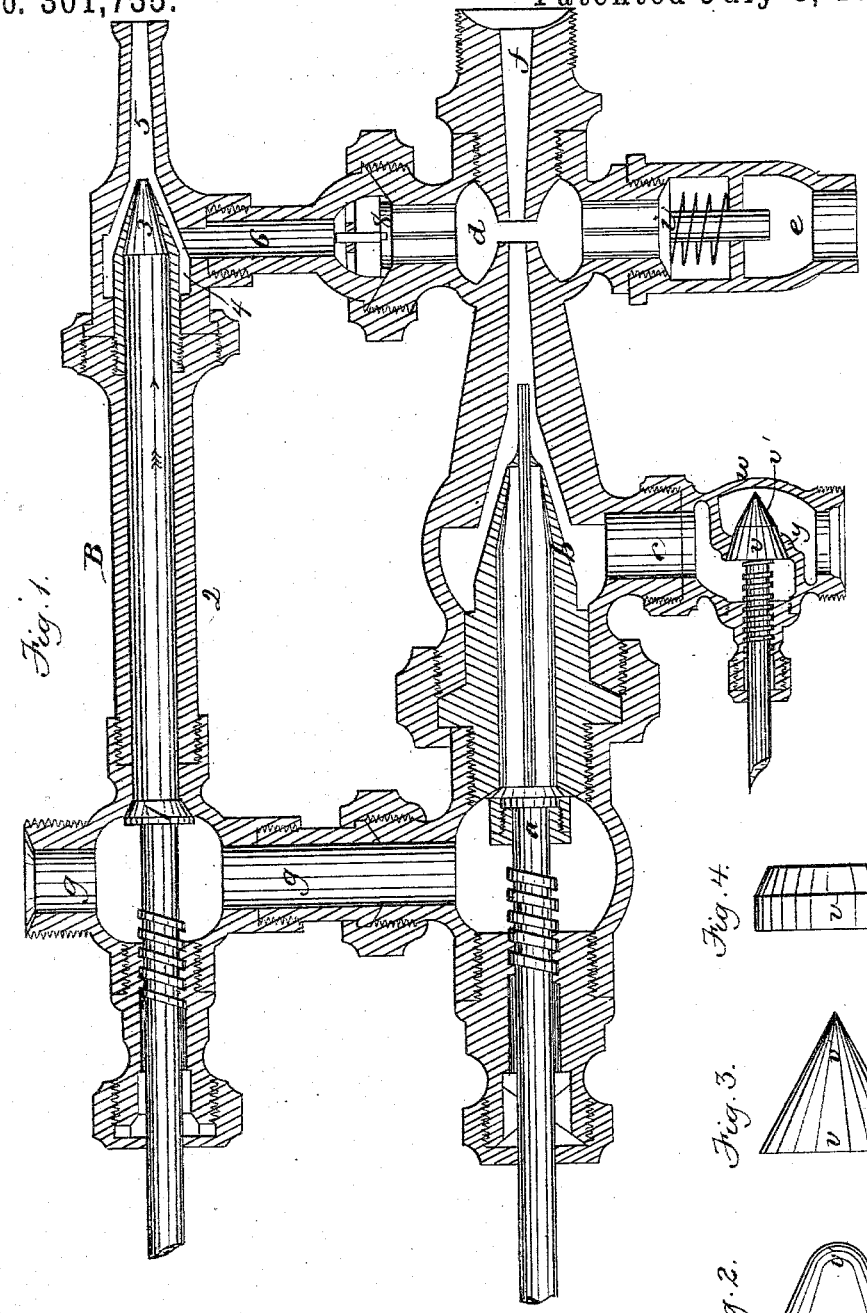
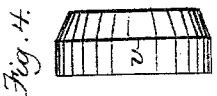
(No Model.)

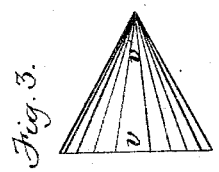
W. B. MACK.

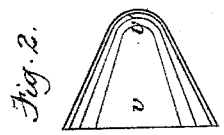
INJECTOR.

No. 301,735. Patented July 8, 1884.









Witnesses.
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UNITED STATES PATENT OFFICE.

WILLIAM B. MACK, OF BOSTON, MASSACHUSETTS.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 301,735, dated July 8, 1884.

Application filed January 19, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. MACK, of Boston, in the county of Suffolk and State of of Massachusetts, have invented certain Improvements in Injectors, of which the following is a specification.

This invention has for its object, first, to provide an attachment whereby an ordinary injector may be enabled to raise water from a considerable depth with a moderately-low pressure of steam.

This invention also has for its object to provide an improved form of water-valve for an injector, whereby the water supplied to the injector will be condensed into a solid stream comparatively free from air.

The invention consists, first, in the combination, with an injector, of an ejector so arranged that the passage of steam through it will exhaust the air as far as possible from the pipe through which the water enters the injector and from the spaces in the injector through which the water passes, and thus cause the water to rise and fill said pipe and spaces before steam is admitted to the injector, and a valve which automatically shuts off all communication between the ejector and the water-spaces in the injector when steam is shut off from the ejector, thereby preventing ingress or back action of air into the water-space of the injector, and holding the water therein.

The invention consists, secondly, in providing the water-valve with an extension or breast against which the entering water impinges, and by which the water is caused to pass without agitation through the opening between the valve and its seat, all of which I will now proceed to describe.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a longitudinal central section of an injector provided with my improved valve. Figs. 2 and 3 represent modifications in the form of the valve. Fig. 4 represents the ordinary form of valve.

The injector A (shown by way of illustration of my invention) is of the class shown in Letters Patent of the United States granted to W. B. and J. D. Mack, August 1, 1882, No. 262,070, and has the steam-valve *a*, combining-cone *b*, water-inlet *c*, overflow-chamber *d*, overflow-pipe *e*, and delivering-cone *f*, substantially as shown in said patent.

B represents the ejector, which consists of a tubular body, 2, communicating at its rear end with the steam-pipe *g*, which supplies steam to the injector, (or with an independent steam-pipe, if preferred,) and having at its front end a steam-cone, 3, surrounded by a chamber or space, 4, which is extended into a delivering-nozzle, 5, opening into the atmosphere. The space or chamber 4 surrounding the steam-cone communicates through a vertical pipe, 6, with the overflow-chamber *d* of the injector, so that when steam under sufficient pressure is allowed to pass through and out of the ejector, in the direction indicated by the arrow, it will draw air powerfully through the pipe 6 from the overflow-chamber and the spaces communicating therewith, including the space around the combining-cone and in the water-pipe *c*. This action of the ejector takes place before steam is allowed to pass through the injector, the valve *a* of the latter being closed. The partial vacuum thus produced in the above-named spaces in the injector causes the water to rise from a considerable depth and fill said spaces, this fact being indicated by the drippings from the overflow-pipe *e*, caused by the downward pressure of the water on the upwardly-closing spring-valve *i* of said overflow-pipe. Steam may then be shut off from the ejector by closing the valve 7 at the rear end thereof. The moment this is done a downwardly-closing valve, 8, in the pipe 6 falls upon its seat by gravitation, aided by atmospheric pressure from above. Air is thus prevented from entering the injector through the ejector and the pipe 6, and the water raised into the injector by the action of the ejector is prevented from falling back through the water-supply pipe. The injector may now be put in operation by opening the valve *a*, the steam thus admitted acting on the water in the usual manner, and causing a continuous flow of water to the boiler or other receptacle to be supplied. I have found by practical tests that by the described preliminary action of the ejector the injector is enabled to lift water more than seventeen feet with steam at a pressure of forty-five pounds, while without this assistance an injector of the same

construction cannot lift water more than six or eight feet. The steam passing through the injector not having free vent as in the ejector, cannot acquire sufficient force to exhaust the air from water-supply pipes extending to a considerable depth. I attribute the success of the ejector attachment, therefore, first, to the fact that the steam, being allowed to escape freely, has sufficient power to quickly exhaust the air from the water-pipe and the intermediate injector-spaces; and, secondly, to the automatically-closing valve 8, which, after the action of the ejector ceases, retains the water in the position to which it was raised and holds it in readiness for the action of the steam in the injector, the valve 8 acting on the same principle of the valves of a lift-pump in holding the water in the pipes far above the level from which it is drawn.

v represents my improved valve, and *w* the casing thereof. I provide the valve *v* with a projection, *v'*, extending through the opening in the valve-seat *y*, and presenting to the incoming water a salient curved surface of such form that the water will not be agitated and converted into spray, or become mixed with air-bubbles in passing between the raised valve and its seat. The projection *v'* is preferably conical and formed at a slight angle with the portion of the valve that bears upon the seat when closed, as shown in Fig. 1, although, if preferred, the projection and valve may be in the form of a true cone, as shown in Fig. 3, or may be rounded, as shown in Fig. 2. Heretofore the valve has been flat, as shown in Fig. 4, on the side against which the water strikes. Said form of valve causes the water to turn abruptly and become considerably agitated in passing through the valve-seat, so that the water is in a frothy condition or contains a considerable quantity of air when it enters the injector. The presence of air-bubbles in the water within the injector prevents the injector from throwing a solid stream of water, and is therefore objectionable. By the provision of a salient surface or projection on the valve to meet the incoming water, as shown, much of the agitation of the water heretofore experienced is obviated, and the water enters the injector in a less frothy or aerated condition than heretofore.

I claim—

1. An injector of the class described, provided with an ejector communicating with the water-spaces in the injector and adapted to exhaust air therefrom, and a valve whereby communication between the ejector and injector is automatically cut off when the ejector ceases to act, as set forth.

2. In an injector, a water-valve having a salient extension, substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 15th day of January, 1884.

WILLIAM B. MACK.

Witnesses:

C. F. BROWN,

A. L. WHITE.