(Model.)

F. B. MAXWELL.

STEAM BOILER INJECTOR.

No. 308,507. Patented Nov. 25, 1884.

Fig. 1.

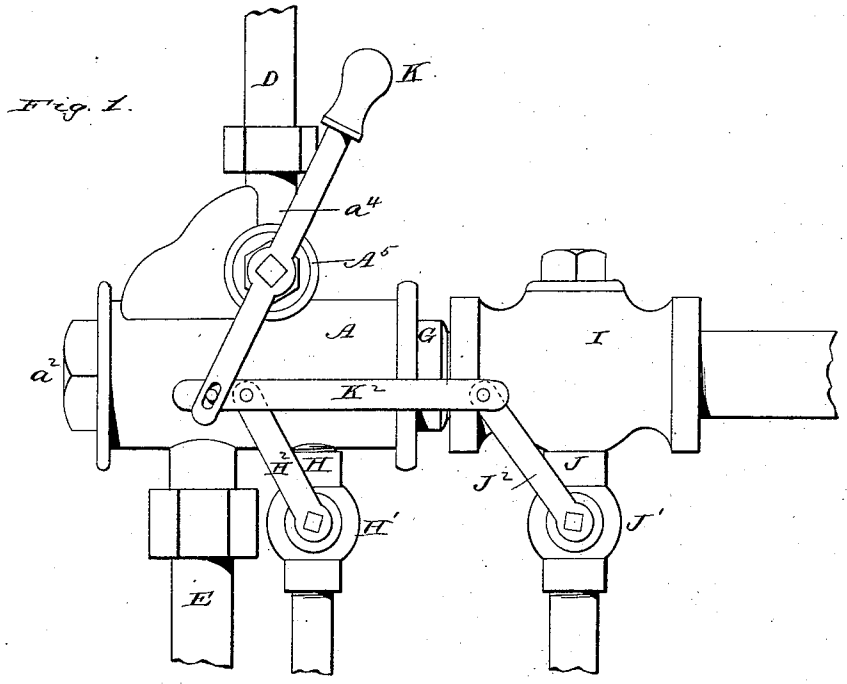
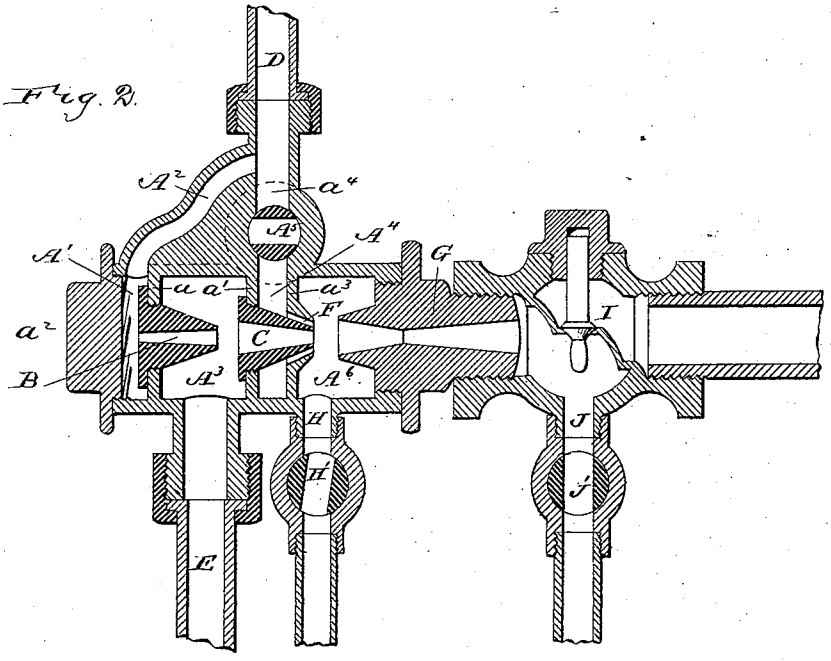


Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANCIS B. MAXWELL, OF JACKSON, MICHIGAN.

STEAM-BOILER INJECTOR.

SPECIFICATION forming part of Letters Patent No. 308,507, dated November 25, 1884.

Application filed January 9, 1884. (Model.)

To all whom it may concern:

Be it known that I, FRANCIS B. MAXWELL, a citizen of the United States, residing at Jackson, in the county of Jackson and State of Michigan, have invented certain new and useful Improvements in Steam-Boiler 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.

My invention relates to improvements in steam-boiler injectors of the well-known Giffard type.

It consists, partly, in providing the injector with a steam-jet orifice between the combining-tube and delivery-tube, whereby a supplemental forcing-jet of steam may be thrown in line with and in the same direction as the stream which enters the combining-tube. I have also provided the injector with two overflow pipes and cocks, one between the combining-tube and delivery-tube and the other between the delivery-tube and check-valve, by which the operation of the device is rendered more effective. The cock which governs the supplemental or force jet and those closing the overflows may be so connected that they can be operated by a single handle.

I will now proceed to describe the construction and operation of an injector in which my invention is carried into effect, having reference to the accompanying drawings, in which—

Figure 1 is a side elevation of an injector. Fig. 2 is a vertical section of the same.

A is the main body or casing of the injector. It is provided with cross partitions or diaphragms *a a'*, having apertures for the insertion of the lifting-jet nozzle B and combining-tube C, preferably screwed therein.

A' is a steam-chamber situated at the rear of the lifting-jet nozzle and between the partition *a* and the cap or plug a^2. The cap a^2 closes the end of the casing A, and is constructed to be readily detached therefrom to allow the jet nozzles and tubes in line with which it is situated to be cleaned.

A^2 is a duct connecting the chamber A' with the main steam-pipe D, which latter is coupled to the injector in any suitable manner.

A^3 is the water-chamber situated between the lifting-jet nozzle B and the combining-tube C. A water-supply pipe, E, communicates with this chamber.

a^3 is another partition, forming, with the partition *a'* and the walls of the casing, the steam-chamber A^4. A duct, a^4, which may be opened or closed by the steam-cock A^5, connects this chamber with the main steam-pipe D. Preferably the casing A and partition a^3 are cast in one piece, the central orifice, F, of the latter being reamed out to a proper form and size. The aperture F, situated in line with those in the other partitions, is for the force-jet. If desired, the walls of the aperture F may form a projecting nozzle pointing in the same direction as the nozzle B. The aperture F is partly filled by the end of the combining-tube C, leaving an annular passage for the steam-jet. If the wall of the aperture F be tapered in the form of a hollow cone, and the end of the combining-tube be correspondingly cone-shaped, (see Fig. 2,) the force-jet will be so directed as to more effectively act upon the stream of water, which when the machine is in operation issues from the combining-tube C. The size of the annular jet-orifice F can in such case be regulated by adjusting the combining-tube longitudinally in the casing.

The delivery-tube G is secured to the casing A in line with the combining-tube. In the construction shown it is formed in a bushing, which closes the end of said casing, making, with the parts already described, the chamber A^6.

By making the ends of the tube C and the annular jet-nozzle substantially flush with one another, and interposing the chamber A^6 between said ends, the jet from tube C and the supplemental jet from orifice F will meet and mingle with one another in said chamber. At their point of meeting there is therefore formed an air or steam cushion, which will enable the annular jet to be turned on abruptly without causing any shock to the injector or pipes. An overflow-pipe, H, governed by a cock, H', communicates with this chamber. It will be observed that the rear end of the delivery-tube G acts as a combining-tube for the force-jet, and is properly flared for this purpose. The delivery-tube communicates with the boiler in the usual way, the check-valve I being interposed.

Between the delivery-tube G and the check-valve I, I prefer to place another overflow-pipe, J, and cock J', which add to the efficiency of the device.

The operation of the injector is as follows:

The overflow-cocks H′ J′ being open, steam is admitted through the main pipe D by opening a cock therein. (Not shown.) The cock A^5 being closed, steam passes through duct A^2 and chamber A′, and issues through the nozzle B into the water-chamber A^3 in the form of a jet. The aspirating action of this jet operates in the well-known manner to carry a stream of water through the combining-tube C, and consequently draw water up the pipe E, the steam itself becoming condensed in the operation. The cock A^5 is now opened, admitting steam to the chamber A^4, and producing an annular jet of steam through the orifice F, greatly increasing the velocity of the stream already issuing from the combining-tube C, and passing with it into the rear end of the delivery-tube G, or escaping through the overflow H, the force-jet also becoming condensed on meeting the water. At the same time that the cock A^5 is opened the overflows may be closed, preferably the cock H′ shortly before the other, J′. The force of the jets now overcomes the pressure upon the check-valve I and the water enters the boiler.

As the cocks A^5 H′ J′ may be operated nearly simultaneously, I have devised connections by which they may be turned by one movement of the engineer.

K is a hand-lever, attached rigidly to the stem of the cock A^5, and loosely pivoted at one end to a bar, K^2. To this bar are connected handles H^2 J^2, which operate the cocks H′ J′. In the position shown in the drawings the cock A^5 is closed and cocks H′ J′ open. The two latter are so arranged, either by varying the length of the handles H^2 J^2 or the position of the openings H J, that the cock H′ shall close before the cock J′ by an interval of any desired length.

I am aware that injectors have been made adapted to produce an annular steam-jet in the aspiration or water chamber, and I do not claim such construction as my invention.

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

1. In an injector, the combination of a lifting-jet nozzle, a combining-tube, and a delivery-tube, all mounted in a suitable casing, an annular supplemental or force jet orifice situated between the combining-tube and the delivery-tube, and concentric with the former, and an air or vapor chamber situated between said supplemental-jet orifice and the delivery-tube, substantially as set forth.

2. In an injector, the combination of a lifting-jet nozzle, a combining-tube, and a delivery-tube, all mounted in a suitable casing, an annular supplemental or force jet orifice situated between the combining-tube and the delivery-tube, and concentric with the former, the ends of the combining-tube and the annular jet-nozzle being substantially flush with one another, and an air-chamber formed between said ends and the delivery-tube, substantially as set forth.

3. In an injector, the combination, with the jet-producing devices and the delivery-tube, of an overflow situated between said devices and delivery-tube, and a second overflow situated between the delivery-tube and check-valve, substantially as set forth.

4. In an injector, the combination, with the jet-producing devices and the delivery-tube, of an overflow situated between said devices and delivery-tube, a second overflow situated between the delivery-tube and check-valve, and valve-operating devices and connections, substantially as set forth, whereby said overflows may be governed by a common handle, for the purposes described.

5. In an injector, the combination of a lifting-jet nozzle, a combining-tube, and a delivery-tube, all mounted in a suitable casing, a supplemental or force jet orifice situated between the combining-tube and the delivery-tube, and adapted to throw a steam-jet in the same direction as the former, an overflow situated between the combining-tube and the delivery-tube, and a second overflow situated between the delivery-tube and the check-valve, substantially as set forth.

6. In an injector having means for producing a lifting-jet and a supplemental forcing-jet, substantially as described, the combination of an overflow communicating with the chamber into which said jets are directed, a cock for closing said overflow, a second overflow situated between the delivery-tube and the check-valve, a cock for closing said second overflow, and means whereby said cocks are connected with the valve which controls the steam-supply of the force-jet, and operated by the same handle, substantially as set forth.

7. In an injector having means for producing a lifting-jet and a supplemental forcing-jet, substantially as described, the combination of an overflow communicating with the chamber into which said jets are directed, a cock for closing said overflow, a second overflow situated between the delivery-tube and the check-valve, a cock for closing said second overflow, and means whereby said cocks are so connected with a common operating-handle that by its movement the former cock shall be closed before the latter, substantially as set forth.

8. In an injector, the combination, with the casing, of a lifting-jet nozzle, a combining-tube, a water-chamber situated between said nozzle and tube, a delivery-tube, and an annular supplemental or force jet orifice situated between the combining-tube and the delivery-tube, and concentric with the former, the delivery end of the lifting-jet nozzle terminating in said chamber outside of the combining-tube, substantially as set forth.

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

FRANCIS B. MAXWELL.

Witnesses:
H. R. HALL,
N. B. HALL.