(Model.)

H. B. MURDOCK.

INJECTOR.

No. 281,389. Patented July 17, 1883.

Fig. 1

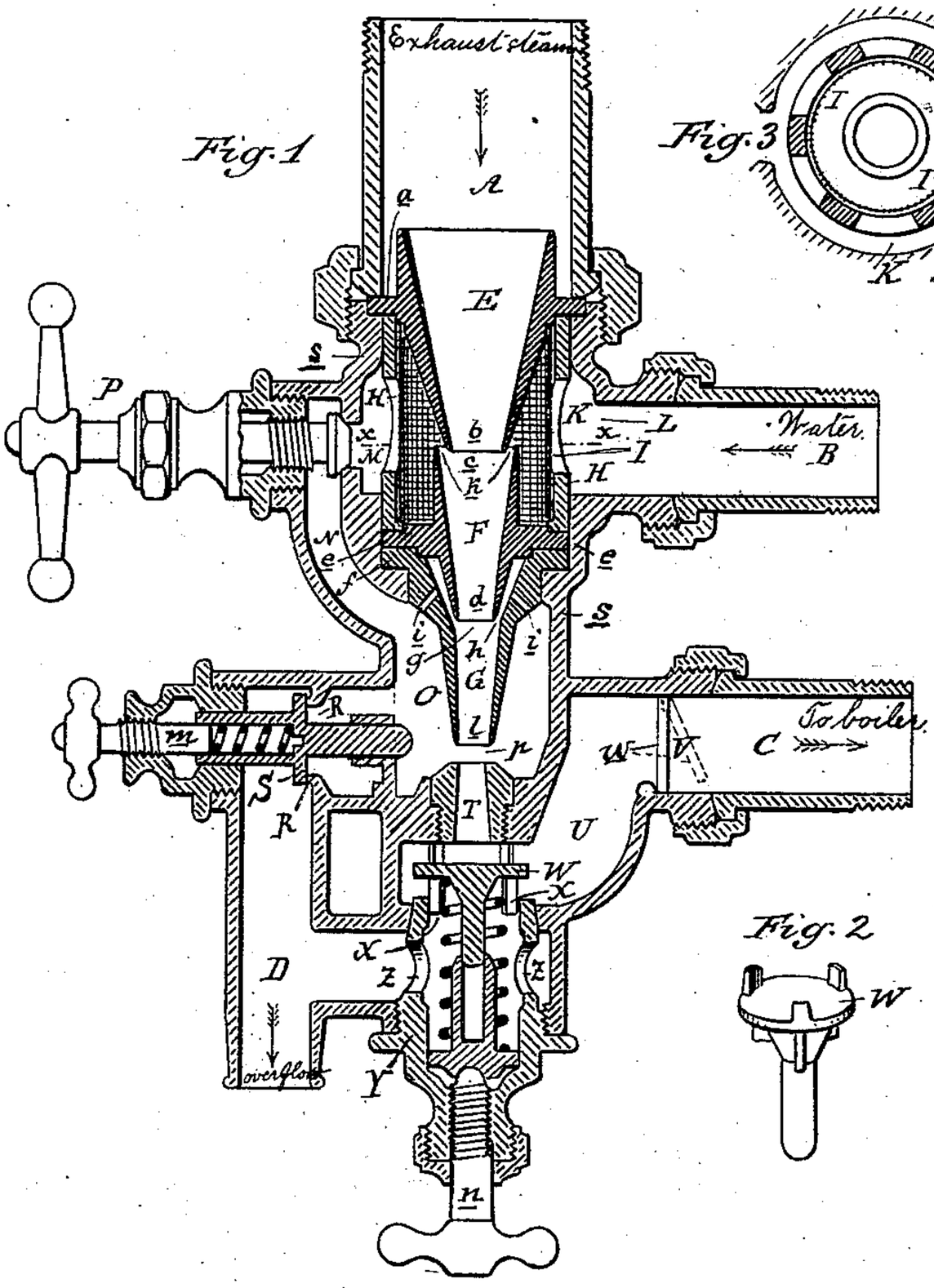

Fig. 3

Fig. 4

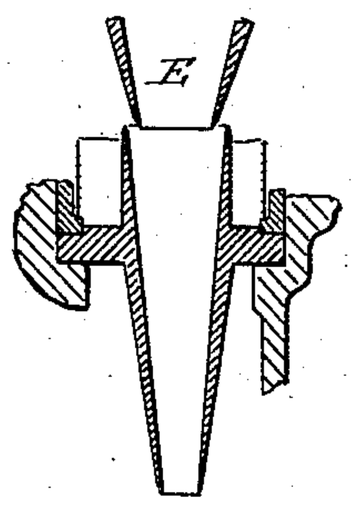

Fig. 2

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UNITED STATES PATENT OFFICE.

HORACE B. MURDOCK, OF DETROIT, MICHIGAN.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 281,389, dated July 17, 1883.

Application filed April 3, 1883. (Model.)

To all whom it may concern:

Be it known that I, HORACE B. MURDOCK, of Detroit, in the county of Wayne and State of Michigan, have invented new and useful Improvements in Injectors; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to new and useful improvements in injectors—such as are used for the purpose of feeding steam-generators; and the invention consists, primarily, in the construction and arrangement of the different parts, whereby the operation of starting may be mechanically performed by the device itself, and, secondarily, in constructive features, which give the device great simplicity combined with perfect adjustment, and extra facility for manufacturing, all as more fully hereinafter described.

The injector herein described is unprovided with a lifting device, as it is intended to be operated by the exhaust-steam from the engine, and the water is taken, with its ordinary pressure, from city mains, or from a tank which gives it a corresponding pressure.

Figure 1 is a vertical central section of my injector. Fig. 2 is a detached perspective of the valve-disk of the spring-valve below the discharge-nozzle. Fig. 3 is a cross-section on line X X in Fig. 1. Fig. 4 is a vertical central section of a modified form of combining-tube.

In the accompanying drawings, which form a part of this specification, A is the inlet-pipe for the exhaust-steam. It connects the device with the exhaust-pipe of the engine in any convenient manner.

B is the water-supply pipe, which connects the device with the water-mains, or with an elevated water-tank. It is provided at a convenient point with the usual globe-valve, so as to allow the water to be turned on or off.

C is the feed-pipe connecting the device in the usual manner with the steam-generator, and it is also provided with the usual check-valve, *w*.

D is the overflow, allowing the water not forced into the steam-generator to escape.

E is a steam-nozzle to contract the inflowing exhaust-steam into a powerful steam-jet. It is seated by means of an annular flange, *a*, as shown.

F is the combining-tube, immediately below and in axial line with the steam-jet. It is seated, by means of an annular flange, *e*, on top of the combining-tube G, which is, in the main, a continuation of the combining-tube F, but is made in a separate piece, and is seated within the walls *s* of the device by means of its annular flange *f*.

Between the combining-tubes F and G is an annular space, *h*, which communicates with the chamber O through the passages *i* in the combining-tube G.

Between the discharge end *b* of the steam-nozzle E and the inlet *c* of the combining-tube F is an annular space, *k*, which forms the water-inlet, and its area is made greater than that of the discharge-opening *l* of the combining-tube G for the purposes hereinafter described.

H is a perforated metal cylinder, lined on the inside with a fine-meshed wire-cloth, I. It extends between the flanges *a* and *e* of the tubes E F and forms the means for holding the tubes F and G in position.

K is the chamber surrounding the tubes E and F, between the flanges *a* and *e*, and connects, through the inlet L, with the water-supply pipe B. The screen I forms a partition in this chamber, and all water which passes in through the inlet L into the annular space *k* has to pass through the screen partition.

M is a port leading from the chamber K into the passage N, connecting it with the chamber O, which latter surrounds the lower end of the combining-tube G.

P is a faucet-valve for closing or disclosing the port M. The axis of the faucet-valve P, port M, and inlet L coincide and pass through the plane of the annular space *k*, which latter lies central within the chamber K. The chamber O communicates with the water-chamber K through the combining-tubes, and likewise by means of the passage N and port M. The ports *i* connect it with the annular space *h* between the combining-tubes, and the port R connects it with the overflow D. The port R is

controlled by the spring-valve S, which opens outwardly, and has a screw-plug, *m*, by which the tension of its spring can be regulated.

T is the discharge-tube, in the same axial line with the tubes E, F, and G, and communicates, through the passage U and outlet V, with the feed-pipe C.

W is a spring-valve which controls the port X in the passage U and opens inwardly.

Y is a tube forming the valve-case and valve-seat for the spring-valve W, and also forming a passage between the port X and the ports Z, which latter communicate with the overflow-pipe D.

n is a screw-plug to adjust the tension of the spring of the valve W. The axis of the tubes E, F, and G coincides with the axis of the discharge-nozzle T, port X, and spring-valve W. The axis of the spring-valve S coincides with the axis of the outlet V.

In practice, with the device connected as indicated above, the exhaust-steam from the engine will pass into the device through the pipe A, and, after being converted into a jet by the nozzle E, will find an easy passage through the open spring-valve W into the overflow-pipe D, and thence out. Now, if the water-supply is turned on, the chamber K will fill and water will pass through the annular space *k* into the combining-tubes, and part of it will pass out through the discharge-opening *l* into the discharge-tube T and find its way through the open spring-valve into the overflow; but as the annular space *k* admits more water than the discharge-opening *l* can carry off, the surplus will have to pass through the annular space *h* and ports *i* into the chamber O, which is soon filled. Now, with the spring-valve S so adjusted that it opens as soon as the water in the chamber O has pressure, the water filling the chamber O will force the spring-valve S open and allow it to escape into the overflow-pipe D. This action of the valve S, in connection with the ports *i* and annular space or overflow *h*, is necessary to prevent the water from rising into the nozzle E and defeating the proper action of the steam-jet, which now is free to act upon the water flowing through the combining-tube, which soon acquires the necessary velocity to overcome the boiler-pressure. Now, the valve W is so adjusted that it will keep open and allow the water to pass through it into the overflow until its velocity and consequent pressure exceeds the boiler-pressure, and, raising the check-vave *w* from its seat, flows into the boiler. It is clear that as long as the water is forced out through the port X there is a pressure on both sides of the valve-disk of the valve W; but as soon as the water finds its way into the generator the pressure upon the under side of the valve-disk is relieved and the valve will be seated forcibly under the action of the stream from the discharge-nozzle upon the upper side of the valve. It is clear that after the action of the steam-jet upon the water passing through the combining-tube is well established no more water will pass through the annular space *h* and ports *i* into the chamber O, and a vacuum will soon form therein, as all the air or water will be drawn in at *p* and the valve S will be forcibly closed upon its seat. As will be seen, this whole action of starting has been performed mechanically by the device itself, and no other attention was required beyond the turning on of the water. To adjust the injector so that it will work to its utmost capacity, the valve P comes now into play, and by opening it water will be admitted through the port M and passage N into the chamber O, and, if the supply of it is in proper relation to the force of the stream passing from the combining-tube into the discharge-tube T, it will be drawn in at *p* and carried to the steam-generator. If more water is admitted than the steam can take care of, it will destroy the vacuum in the chamber O by filling it up, and after forcing the valve S open will find an exit into the overflow. This appearance of water at the overflow indicates that the supply of water through the port M has to be reduced. Whenever during the operation cold water appears at the overflow, it indicates that it comes through the port R, while the appearance of warm or hot water at the overflow shows that the valve W is open. This may, while the valve is in operation, be easily made use of to procure a quantity of hot or cold water at the overflow at the will of the operator.

It will be seen that the axial position of the faucet-valve P and inlet L, valve S and discharge V, and valve W and steam-inlet A affords peculiar facility in manufacturing the device, as the different valve-seats and other interior parts which have to be finished can be easily centered upon the lathe. In seating the steam-nozzle and combining-tubes in the manner described I gain great facility for removing these parts for the sake of examination or repair.

In Fig. 4 I show the combining-tubes F and G combined into one single tube, leaving the rest of the device unchanged. With this modification the operator has to start the device himself by turning on the water-supply, but gradually taking care to prevent the appearance of cold water at the overflow, which indicates that he is admitting too much water into the device. After the device is started he may open the supply-valve to its full capacity, as all the water admitted at *k* will then be taken care of by the steam-jet. The arrangement of the wire-cloth so as to form the largest possible area, and placing it concentrically around the annular ring, thereby screening all the water which passes through the device without interrupting its free flow to any extent, is also a desirable improvement.

It is clear that under certain circumstances it may be desirable to have a branch pipe from

the exhaust-steam-supply pipe A to the generator, so as to work the injector with live steam from the generator when a contingency may arise.

What I claim as my invention is—

1. In an injector, the combination, with an auxiliary overflow-port, of an auxiliary overflow-valve opening outward under the pressure of such supply-water in the injector which is not flowing through the discharge-tube, substantially as and for the purposes set forth.

2. In an injector, and in combination with a valve-case having an overflow-passage and an internal chamber connected to said passage by two ports, combining-tubes arranged to form an annular space between them, and valves controlling the overflow-ports, one to open by pressure and the other to close when the pressure exceeds the pressure within the boiler, as set forth.

3. In an injector, the combination, with an auxiliary water-supply port communicating with the water-supply pipe and controlled by a faucet-valve or its equivalent, of a passage forming a communication with said port and the inlet-opening of the discharge-tube, substantially as and for the purpose described.

4. In an injector, the combination of an auxiliary water-supply port controlled by a faucet-valve, a passage forming a communication with said port and the inlet-opening of the discharge-tube, and an auxiliary overflow-port controlled by a valve which opens outwardly under the pressure of said water in the injector which is not flowing through the discharge-tube, substantially as and for the purpose specified.

5. In an injector, the combination of two overflow-ports mechanically controlled by valves, one of which opens with the pressure of such water in the injector which cannot pass through the discharge-tube, and the other closes as soon as the water flows into the generator, substantially as and for the purpose set forth.

6. In an injector, a cylindrical screen extending around the outside of the water-chamber, between the steam-tube and combining-tube, and placed concentrically to the annular opening between the steam and combining tubes, substantially as and for the purposes specified.

7. In an injector substantially as described, and in combination with the jet-tube, the overflow, and the valve W, the combining-tubes F and G, and the valve S, as set forth.

8. In combination with the jet-tube E and overflow leading from the chamber O, the tubes F and G, arranged to form an annular space, *h*, and the channels *i*, connecting the said chamber O and space *h*, as set forth.

9. In an injector substantially as described, and in combination with the water-connection B and steam-connection A, the perforated cylinder K, the jet-tube E, having flange *a*, the combining-tubes F and G, having flanges *e* and *f*, respectively, and the body-castings, as set forth.

10. In combination with the casting having inlets A and B, the perforated cylinder K, forming the chambers L M, the channels N, connecting with the overflow-chamber O, the screen I, and valves, as set forth.

11. In an injector substantially as described, the combination, with the check-valve *w* and inwardly-opening valve W, of the spring for holding such valve W open until the pressure has overcome the pressure against the valve *w*, and means *n* for adjusting the force of said spring, as set forth.

HORACE B. MURDOCK.

Witnesses:

H. S. SPRAGUE,

E. SCULLY.