

(Model.)

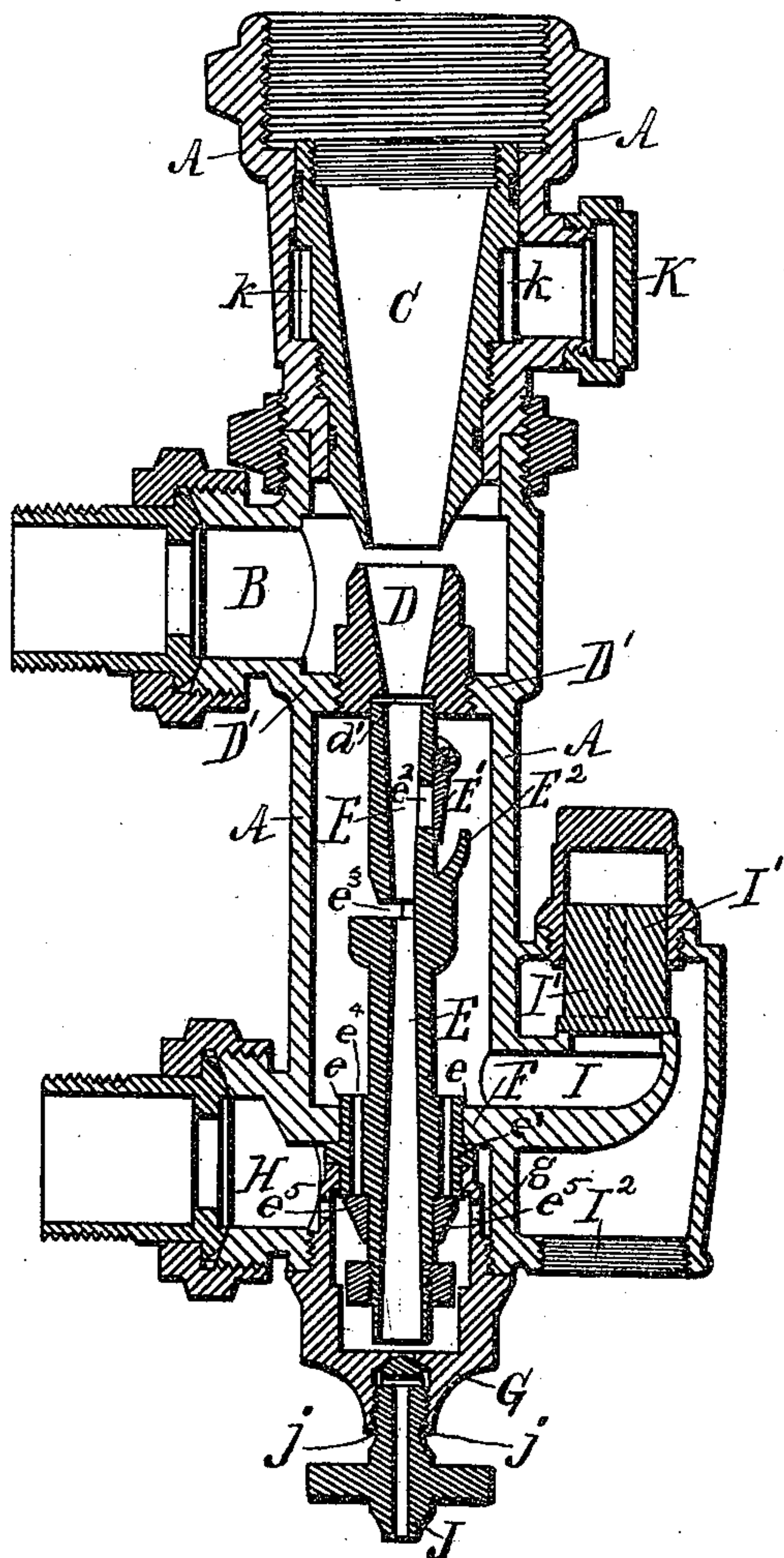
2 Sheets—Sheet 1.

H. B. MURDOCK.  
INJECTOR.

No. 440,184.

Patented Nov. 11, 1890.

Fig. 1.



WITNESSES

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(Model.)

2 Sheets—Sheet 2.

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FIG. 2-

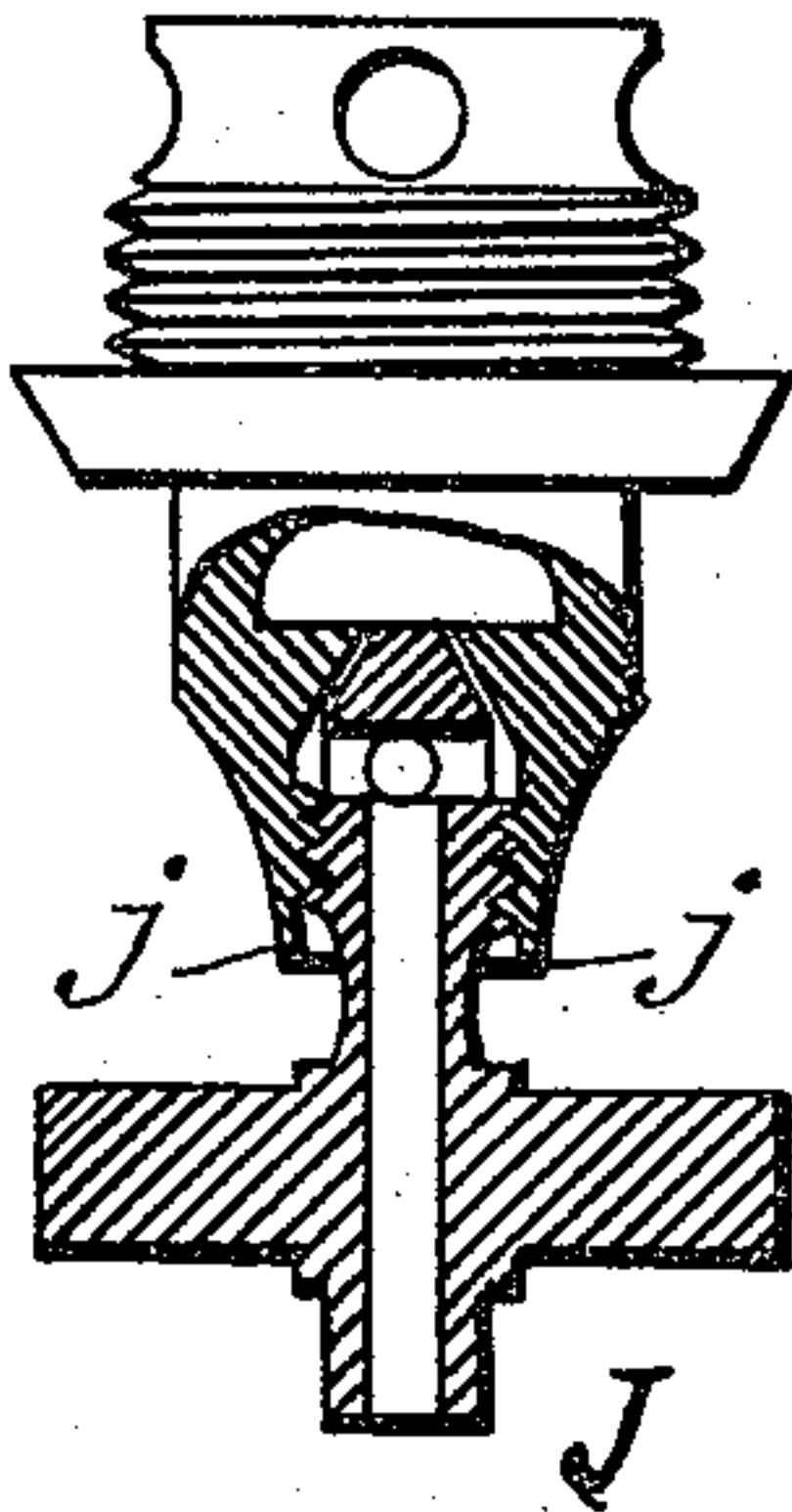
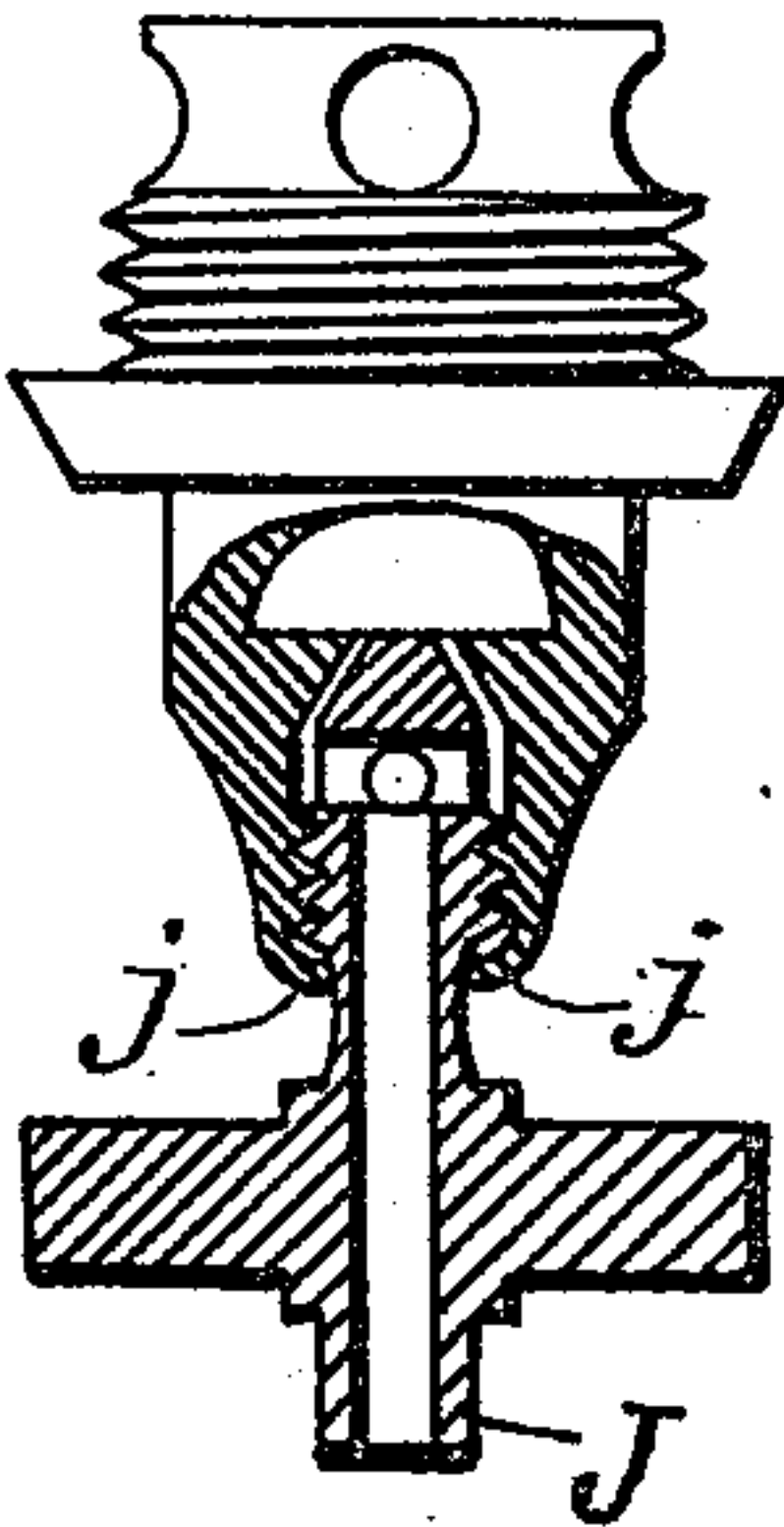


FIG. 3-



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# UNITED STATES PATENT OFFICE.

HORACE B. MURDOCK, OF DETROIT, MICHIGAN, ASSIGNOR TO THE AMERICAN INJECTOR COMPANY, OF SAME PLACE.

## INJECTOR.

SPECIFICATION forming part of Letters Patent No. 440,184, dated November 11, 1890.

Application filed July 26, 1889. Serial No. 318,743. (Model.)

*To all whom it may concern:*

Be it known that I, HORACE B. MURDOCK, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Injectors; and I do 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 pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

In the drawings, Figure 1 is a longitudinal central section of an injector embodying my invention. Figs. 2 and 3 are detail views, partly in section, of a portion of the device illustrating a modified construction.

My invention relates, first, to the combination, with the delivery-tube, of a valve located on the side thereof governing a large overflow-opening, whereby when the injector is started water is prevented from backing up to the top of the delivery-tube; second, in joining the upper end of the delivery-tube directly with the exit end of the combining-tube, whereby the establishment of a flow through the injector to the boiler is more quickly and readily accomplished; third, in the provision of a perforated diaphragm between the overflow-chamber and the delivery-chamber and an automatic valve adapted to close said perforations or openings, the construction being such that water passing through the delivery-tube into the delivery-chamber may find exit through this diaphragm and out through the overflow-chamber until the current has become so well established as to close the said valve by pressure from beneath; fourth, in the provision of a petcock at the lower end of the injector, whereby it may be thoroughly emptied to prevent freezing when not in use, and whereby a reacting pressure that would otherwise exist in the delivery-chamber may be relieved in starting the injector and so facilitate the establishment of the current to the boiler.

In carrying out my invention, A is the case of the injector.

B is the lifting or feed tube, to which water may be lifted if employed as a live-steam in-

jector or fed by gravity if employed as an exhaust-steam injector.

C is the steam-nozzle, made adjustable up and down in the case by a screw engagement therewith or in any other convenient way.

D is the combining-tube seated in the diaphragm D'.

E is the force-tube or delivery-tube, fitted at *e* through the diaphragm F, and provided with a flange *e'*, which seats up beneath the diaphragm F, the whole being held in place by the plug G, which screws up against it from beneath, and by removing which the delivery-tube may be withdrawn from the case.

H is the delivery-chamber, which leads off in the usual way through a check-valve (not shown) to the boiler. The plug G is provided with orifices *g*, affording free communication with the delivery-chamber.

I is the overflow-chamber, and I' the overflow-valve which permits the overflow water to escape through the exit I<sup>2</sup>.

The upper end of the delivery-tube E is fitted within an opening *d'* in the combining-tube or its diaphragm D', there being sufficient space above the end of the delivery-tube to accommodate the expansion and contraction of the tube without binding.

E' is a valve attached to the side of the delivery-tube near its upper end and governing a large overflow-orifice *e*<sup>2</sup> in the side of the tube.

E<sup>2</sup> is a lip which prevents the valve E' from swinging out too far and so prevents it from catching in the case when the tube is being withdrawn.

*e*<sup>3</sup> is the usual overflow-orifice at the restricted throat of the delivery-tube.

*e*<sup>4</sup> represents orifices which lead past the diaphragm F and communicate between the overflow-chamber and the delivery-chamber.

*e*<sup>5</sup> is an automatic check-valve adapted to close the said orifices, but which remains down and open by gravity when the injector is not in operation.

J is a petcock adapted to draw off drip-water at the bottom of the injector to prevent freezing when the injector is not in use. It may also be employed in starting the injector to relieve any pressure which would



otherwise accumulate within the delivery-chamber to retard the establishment of the current to the boiler.

5 K is a cap or plug covering an orifice through which a suitable tool may be inserted to engage with notches  $k$ , whereby the steam-nozzle may be turned and so adjusted toward or from the combining-tube.

10  $j$  represents a fin, which may be turned around the stem of the petcock, as shown in Fig. 3, and so prevent the latter from becoming unscrewed and lost.

The operation of this device is as follows: Steam enters through the steam-nozzle in the usual way into the chamber B, and entering 15 with the water into the combining-tube D the water is forced down into the delivery-tube. The resistance to the flow of the water causes it to overflow at  $e^2$ , but as soon as accelerated past this point the valve  $E'$  closes by suction. The escape continues at  $e^3$  until the flow is established and sufficiently accelerated past this point. In the meantime the water 20 flowing from the base of the delivery-tube escapes upward through the conduits  $e^4$ , and with the other overflow-water finds exit through the overflow-valve. Soon, however, the flow becomes so rapid down through the mouth of the delivery-tube that the rush of 25 water back through the orifices  $e^4$  lifts the check-valve  $e^5$ , thus closing the said orifices and compelling the water to seek its exit into the boiler. This free escape from the delivery-chamber may, if desired, be aided by opening 30 the petcock until the water has become sufficiently accelerated through the delivery-tube.

What I claim is—

1. The combination, in an injector, of a 40 fixed delivery-tube extending from the delivery-chamber into the overflow-chamber, conduits upon its exterior communicating from one chamber to the other, and an automatic valve adapted to close the lower ends 45 of said conduits, substantially as and for the purposes described.

2. In an injector, the combination of its

delivery-tube extended from the delivery-chamber up through the dividing wall or flange 50 into the overflow-chamber, conduits exterior to the tube communicating between the two chambers, a valve adapted to close the lower ends of the conduits, and a petcock communicating with said delivery-chamber, substantially as and for the purposes described. 55

3. In an injector, the combination, with its case, of a delivery-tube projecting from the delivery-chamber up into the overflow-chamber and adapted to close the opening between 60 the two chambers, conduits exterior to the bore of the delivery-tube communicating from one chamber to the other, a valve adapted to close the lower ends of said conduits, and a perforated plug adapted to screw into the case 65 from beneath and hold the delivery-tube in place, substantially as described.

4. In an injector, a delivery-tube provided with an orifice  $e^2$  at one side of the same, and a swinging valve  $E'$ , journaled to said tube and adapted to cover said orifice, substan- 70 tially as and for the purposes described.

5. The combination, with the delivery-tube provided with the opening  $e^2$  and hinged valve 75  $E'$ , of the lip  $E^2$ , substantially as and for the purposes described.

6. The injector consisting of case A, the combining-tube, a delivery-tube extending 80 from the delivery-chamber up through the overflow-chamber into a cavity at the base of the combining-tube, and in connection therewith the valve  $E'$ , orifices  $e^4$ , valve  $e^5$ , retaining-plug, and petcock, all substantially as described.

7. In an injector, the combination, with a petcock at the bottom thereof, of a fin  $j$ , turned 85 in toward its stem and adapted to prevent the unscrewing and loss of the petcock, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

HORACE B. MURDOCK.

Witnesses:

W. H. CHAMBERLIN,

L. A. DOELTZ.