(Model.) 2 Sheets—Sheet 1.

J. REICHMANN.

INJECTOR.

No. 332,002. Patented Dec. 8, 1885.

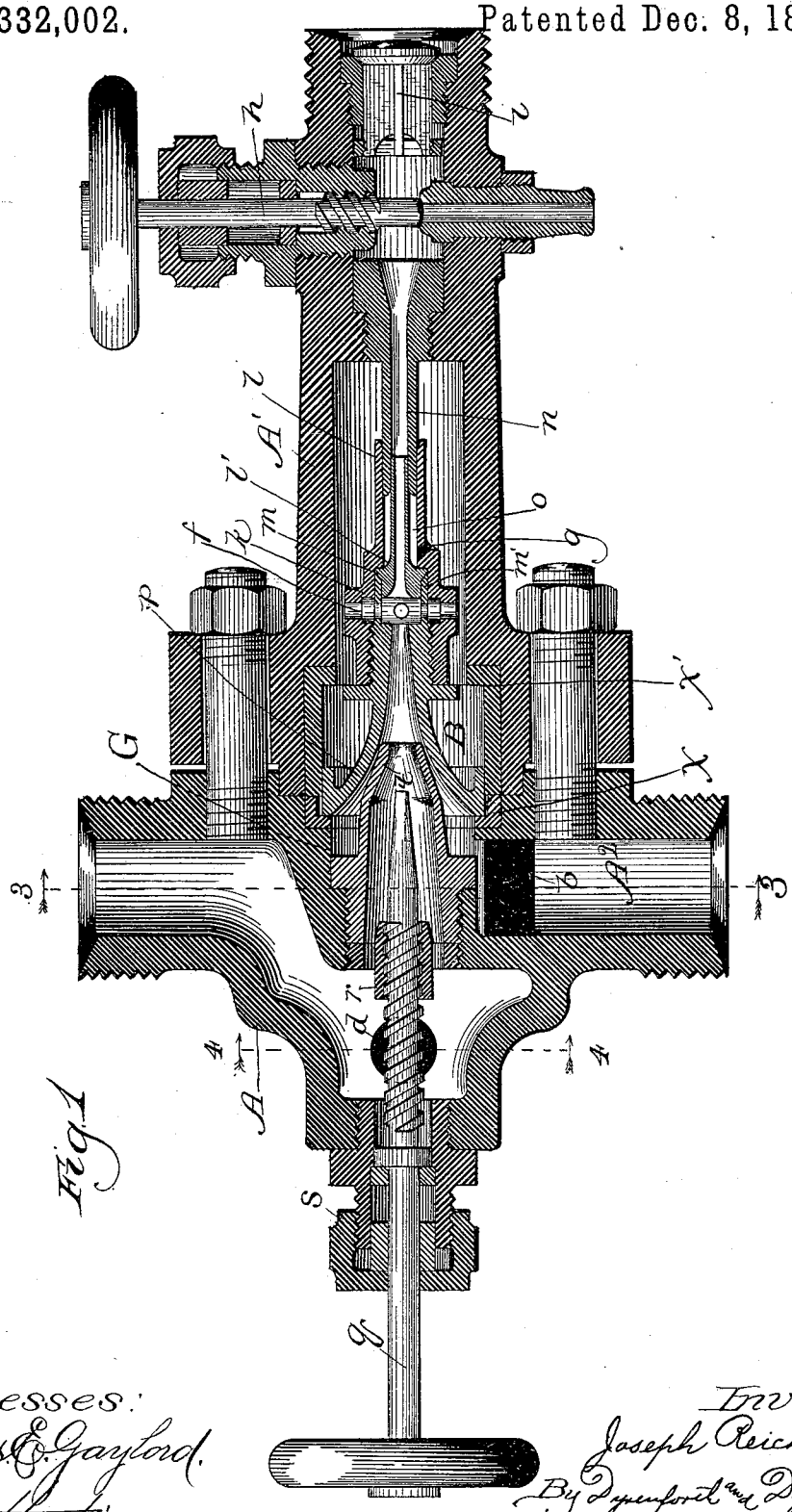


Fig 1

Witnesses:
Chas. E. Gaylord.
Wm. Hostins

Inventor:
Joseph Reichmann,
By Dyrenforth and Dyrenforth,
Attys

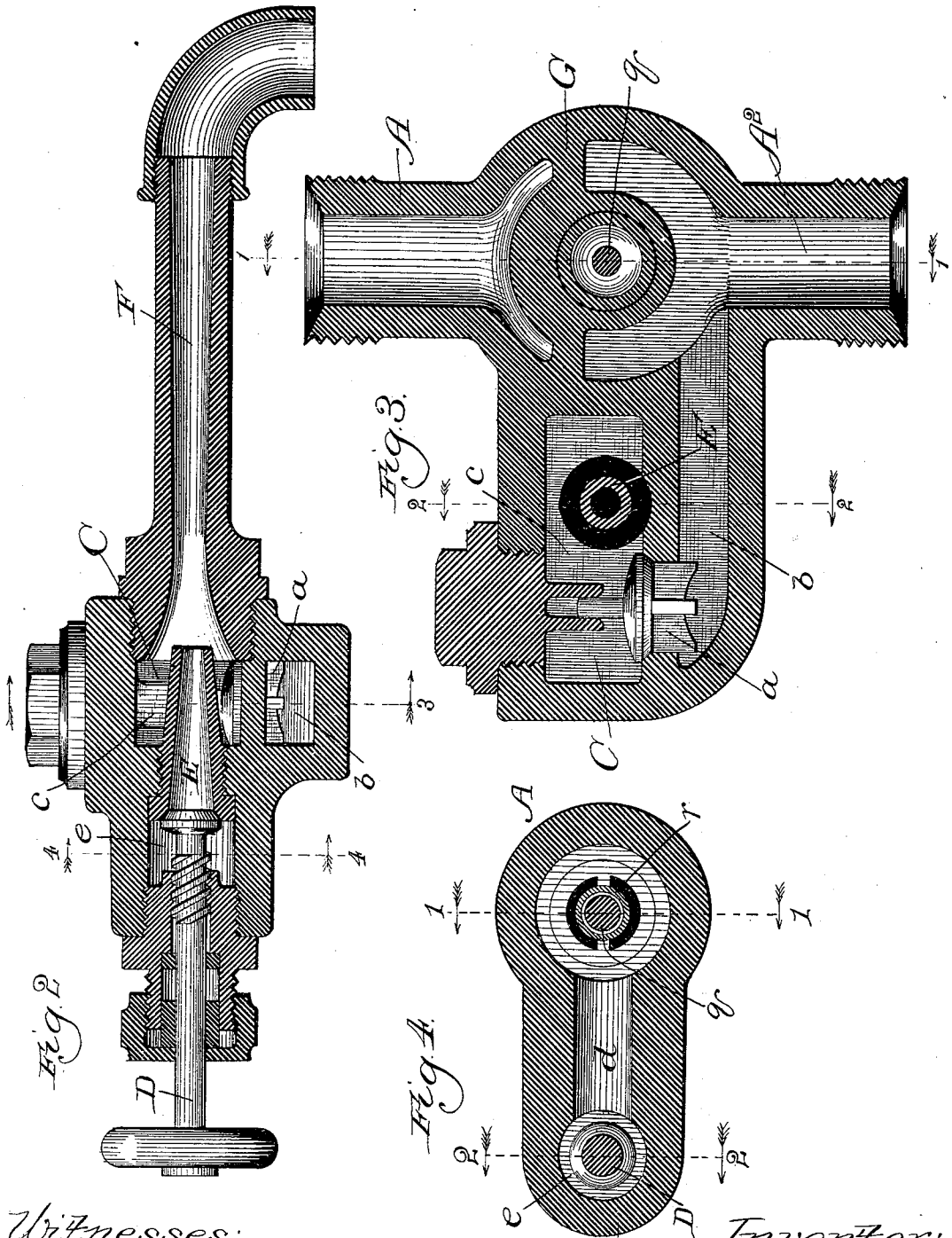
N. PETERS. Photo-Lithographer. Washington, D. C.

(Model.) 2 Sheets—Sheet 2.

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No. 332,002. Patented Dec. 8, 1885.



Witnesses:
Chas. E. Gaylord.
Wm. Hoskins.

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Joseph Reichmann,
By Dyrenforth and Dyrenforth,
Attys.

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UNITED STATES PATENT OFFICE.

JOSEPH REICHMANN, OF CHICAGO, ILLINOIS.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 332,002, dated December 8, 1885.

Application filed March 18, 1885. Serial No. 159,272. (Model.)

To all whom it may concern:

Be it known that I, JOSEPH REICHMANN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Injectors for Steam-Boilers; and I hereby declare the following to be a full, clear, and exact description of the same.

My present invention, which is in the nature of an improvement upon a device for a similar purpose, for which Letters Patent of the United States No. 301,004 were granted to me June 24, 1884, relates particularly to the construction and operation of the delivery-tube and parts immediately connected therewith, and to a simplified and compact construction of the ejector portion. The present device belongs to the class of self-adjusting injectors in which the general object of the feature of adjustability in the mechanism is to enable the operation of raising the feed-water to be effected equally well with any variation in the steam-pressure by a limited longitudinal movement of the combining-tube, whereby the capacity of the closed overflow-chamber is increased or diminished, according to whether the steam operating to create the vacuum for the purpose of drawing the water produces too large or too small a supply for the capacity of the device.

It is the object of my present improvement to provide an injector which will not only be adjustable in the manner above set forth, but which will operate to raise the feed-water from great depths without having its efficiency varied either by a variation in the steam-pressure or in the level or temperature of the feed-water. To accomplish this purpose, both the combining and delivery tubes must be permitted to move in a longitudinal direction sufficiently far to produce union with the steam-jet of the feed-water which surrounds it, for which purpose such feed-water requires a space proportionate to its gravity and temperature. Of course, if the device is used, as it may be, not only for raising the feed-water previous to injecting it, but to operate below the feed-water level, the space between the receiving and combining tubes need be only short to effect the union of the feed-water with the forcing steam-jet, owing to the absence, to a great extent, of the necessity for overcoming the gravity of the feed-water, in which operation atmospheric pressure materially assists; but, naturally, where the device has to raise the water from a depth before injecting it, a greater space is required, owing to the gravity to be overcome and to the reduction in degree of the force of atmospheric pressure. In the latter case, therefore, with an equal steam-pressure, the space between the receiving and combining tubes must greater than in the former.

It is a further object of my construction to prevent the counter-pressure from the boiler from effecting the efficacy of the delivery-tube, which would tend to cause leakage; and it is also my object to avoid by my particular construction the wear upon the delivery-tube incident to other constructions wherein the combining-tube rests upon and is supported by the movable delivery-tube.

To accomplish the foregoing purposes, my invention consists in constructing the adjustable combining-tube to carry the movable delivery-tube, and to be supported independently of the delivery-tube.

My invention further consists in constructing the movable delivery-tube internally and externally of cylindrical form; and my invention still further consists in certain details of construction and combinations of parts, all as hereinafter particularly set forth.

Referring to the drawings, Figure 1 is a longitudinal section of the injector portion of the device, taken on the line 1 1 of Figs. 3 and 4; Fig. 2, a similar view of the ejector portion, taken on the line 2 2 of Figs. 3 and 4; Fig. 3, a transverse vertical section of the injector and ejector, taken on the lines 3 3 of Figs. 1 and 2; and Fig. 4, a similar view taken on the lines 4 4 of Figs. 1 and 2.

A A′, Figs. 1, 3, and 4, is the casing of the injector G. To the part A of the casing the receiving-tube *t* is secured, as also a stuffing-box, *s*, and nut *r*, through which latter the steam plug or valve *q* passes. The part A′ of the casing contains suitable chambers for the combining-tube *p*, delivery-tube *o*, and guiding-tube *n*, and is bolted, as shown, to the part A. The delivery-tube comprises a cylinder or tube of very small external diameter,

and having, toward its rear end, a collar, *m*, and a backward-projecting cylindrical bearing, *m'*, which enters a seat in the forward part of the combining-tube, which is thus made to carry the delivery-tube. A cylindrical extension, *l*, provided with an internally-screw-threaded head, *k*, having an internal chamber, *l'*, is secured upon the forward extremity of the combining-tube *p*, and holds the delivery-tube in place by the pressure of the shoulder against the collar *m*. The extension *l* projects beyond the delivery-tube, thus forming a guard and also a guide in adjusting the delivery-tube into the tube *n*, which is connected with the casing A' toward its forward extremity, as shown in Fig. 1, and leads to the boiler-pressure chamber, and the diameter of which permits it to enter the extension *l* and slide between the external surface of the delivery-tube *o* and the internal surface of the extension. The overflow-valve *h* and check-valve *i* are secured to the part A' of the casing in the usual manner. The rear end of the combining-tube *p* serves as a piston, forming a partition between the feed-water and closed overflow-chamber B, and supported within the cylinder B, in which the part *p* may reciprocate, carrying with it its extension *l* and the inclosed delivery-tube *o* between the confines *x x'*. An opening, *g*, is provided in the extension *l* to afford communication between the overflow-chamber B and the interior of the extension, and the enlarged part of the latter, by means of which it is attached to the part *p*, is constructed to provide a passage, *f*, between the combining and delivery tubes, which serves as an overflow and communicates with the overflow-chamber. The delivery-tube *o* moves freely with the reciprocal movement of the combining-tube, which supports and incases it, within the guide-tube *n*, connected with the part A' of the casing, to cause it to be in line with the combining-tube and receiving-tube *t*. The casing of the ejector C is not formed separately from that of the injector portion of the device, but is cast with it and provided with the steam-chamber *e*, having the steam-port *d*, and with the vacuum-chamber *c*, having the water-communication *b*. It contains a steam-valve, D, steam tube or nozzle E, discharging-tube F, and check-valve *a*, the construction, except as to the fact of the ejector being cast as a whole with the injector, and the operation being the same as described in my aforesaid patent.

The operation of the device is as follows: The overflow-valve *h* being first opened and the plug *q* nearly closed, steam is introduced into the chamber in the casing A, whence a small jet will pass through the overflow and prevent the entrance of air into the water-supply and vacuum chamber of the injector and ejector. The steam-valve D of the ejector portion is then opened, admitting a jet of steam into the discharge-tube F, whereby the air contained in the chamber *c* is exhausted, producing a vacuum therein and causing the check-valve *a* to rise by the pressure underneath, and thus exhausting the air from the injector portion and pipe leading to the reservoir through the chambers A^2 *b c* and the discharge-tube F. At the simultaneous appearance of water at the overflow and the discharge-tube F the operation of the ejector is stopped by closing the valve D, and the plug *q* is opened to admit a quantity of steam to give the jet sufficient force to enter into the boiler. The overflow-valve *h* is then closed, and the injector operates in the usual manner. The jet of fluid will pass through the delivery-tube *o* with sufficient velocity to enter the boiler-pressure chamber, and in consequence of the only slightly-increased diameter over the delivery-tube of the tube *n*, and to its proper length of cylindrical bore, the jet will retain sufficient of its initial velocity while passing through the guide-tube *n* to prevent any portion of the jet from being forced or held back, whereby leakage between the interior of the tube *n* and the exterior of the tube *o* would be caused, and thus, also, the boiler-pressure will not effect the operation of the delivery-tube. The adjustment of the combining-tube and delivery-tube is automatically effected by the fluid-jet and the piston *p*, which latter moves the combining-tube with the delivery-tube toward the receiving-tube *t*, when, owing to a surplus of feed-water, an overpressure in the overflow-chamber is produced, while the fluid-jet tends, by the exertion of its force, to move them in the opposite direction, which latter movement will take place in case of a deficiency of the feed-water supply, until a sufficient quantity is afforded.

My device is not limited to the operation hereinbefore described, but may be actuated in the various manners set forth in my aforesaid Letters Patent; but in the described operation steam at boiler-pressure may, if preferred, be introduced into the chamber *e* of the ejector independently of the injector, in which case the steam-communication *d* would be closed or could be omitted.

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

1. In an injector, the combination of a movable delivery-tube and a self-adjusting combining-tube supported independently of the delivery-tube by means of supports *p* and *l*.

2. In an injector, the combination of a self-adjusting combining-tube and a movable delivery-tube operating to discharge the jet into a tube wherein the initial velocity of the jet is maintained throughout most of its length.

3. In an injector, an adjustable combining-tube carrying and incasing a movable delivery-tube, in combination with a tube, *n*, into which the delivery-tube extends, substantially as and for the purpose set forth.

4. In an injector, the combination of an adjustable combining-tube carrying and incasing a movable delivery-tube, and a guide-tube

extending into the said combining-tube around the said delivery-tube, as and for the purpose set forth.

5. An injector comprising the injector portion G, having the adjustable combining-tube *l*, carrying and incasing the movable delivery-tube *o*, and supported toward one end by a guide-tube, *n*, secured within the said injector toward its forward extremity and extending backward into the said combining-tube around the said delivery-tube, and the ejector portion C, cast as a part of the said injector portion, substantially as described.

JOSEPH REICHMANN.

In presence of—
EDWARD THORPE,
MASON BROSS.