(Model.) 3 Sheets—Sheet 1.

J. REICHMANN.

INJECTOR.

No. 301,004. Patented June 24, 1884.

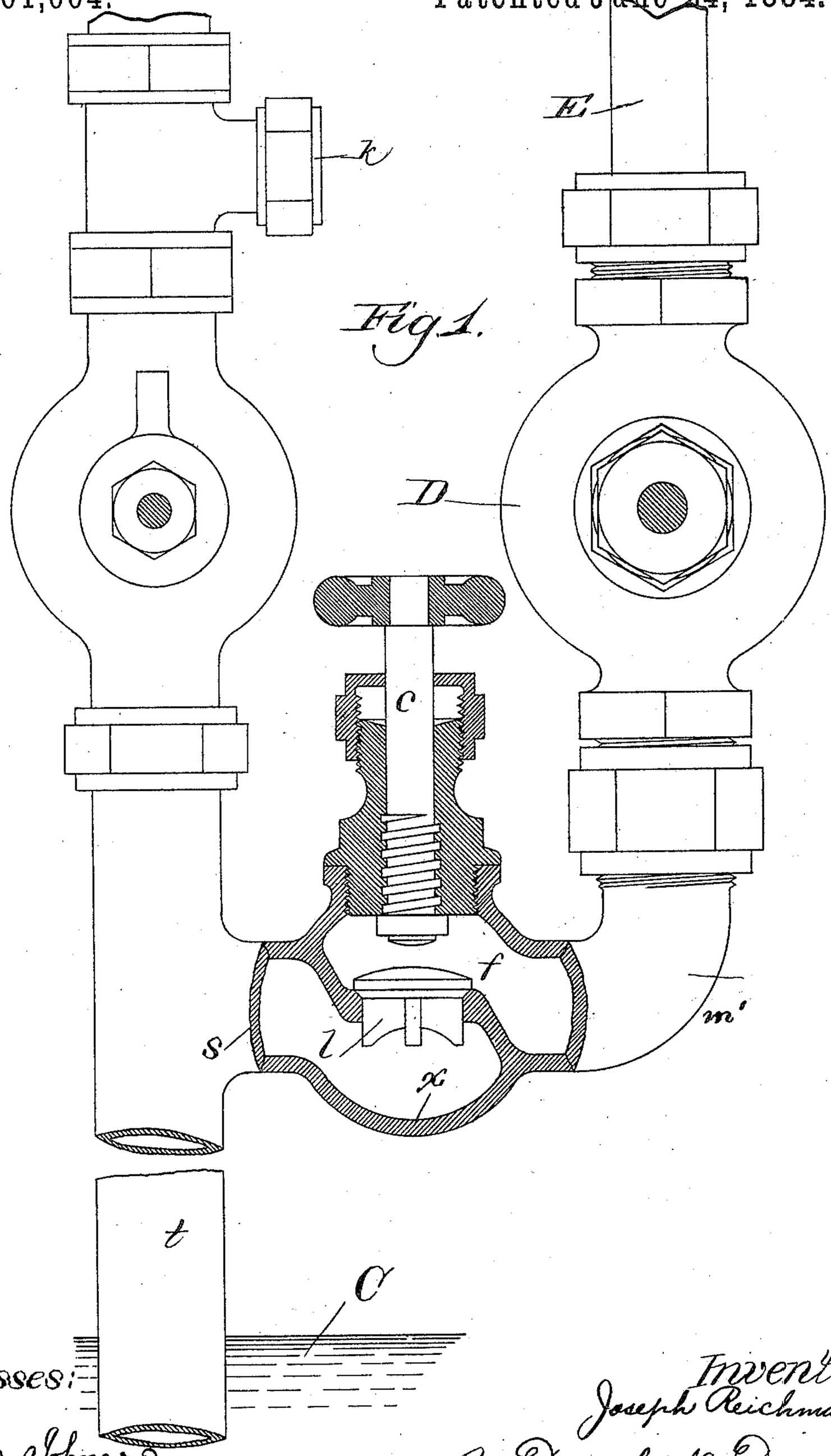

Fig. 1.

Witnesses:
Arthur Johnson.
Douglas Dyrenforth

Inventor:
Joseph Reichmann,
by Dyrenforth and Dyrenforth,
Attorneys.

(Model.)

3 Sheets—Sheet 2.

J. REICHMANN.

INJECTOR.

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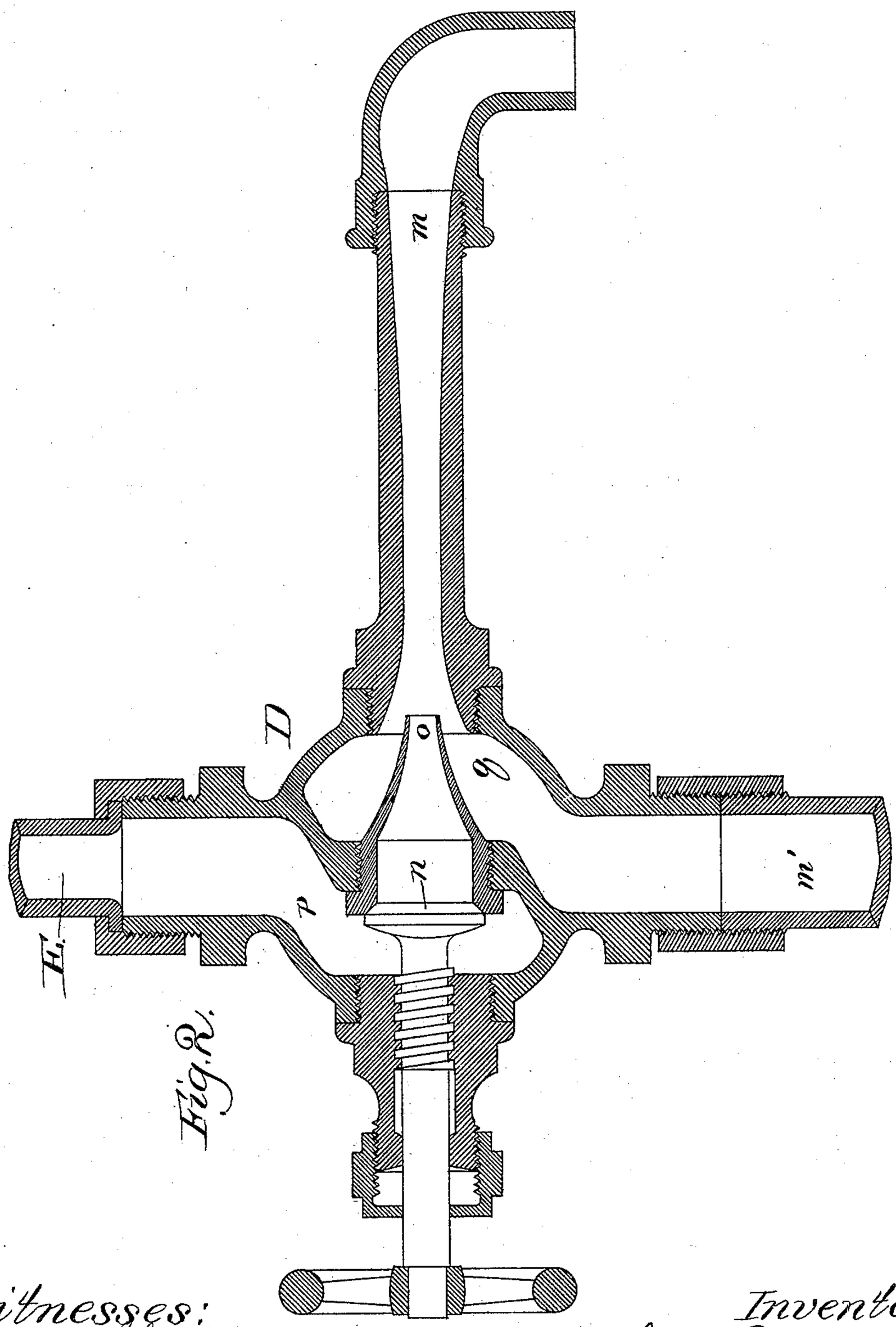

Fig. 2.

Witnesses:
Arthur Johnson.
Douglas Dyrenforth

Inventor:
Joseph Reichmann,
by Dyrenforth & Dyrenforth
Attorneys.

(Model.)

3 Sheets—Sheet 3.

J. REICHMANN.

INJECTOR.

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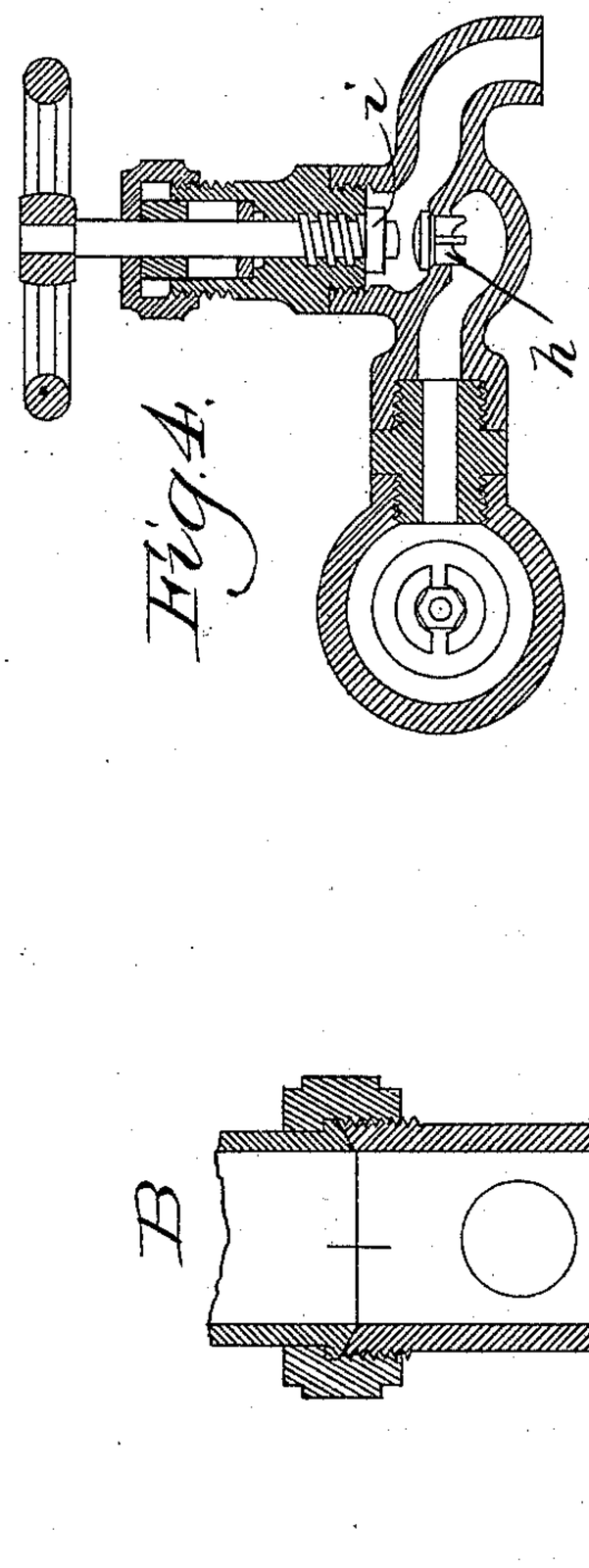

Fig. 4.

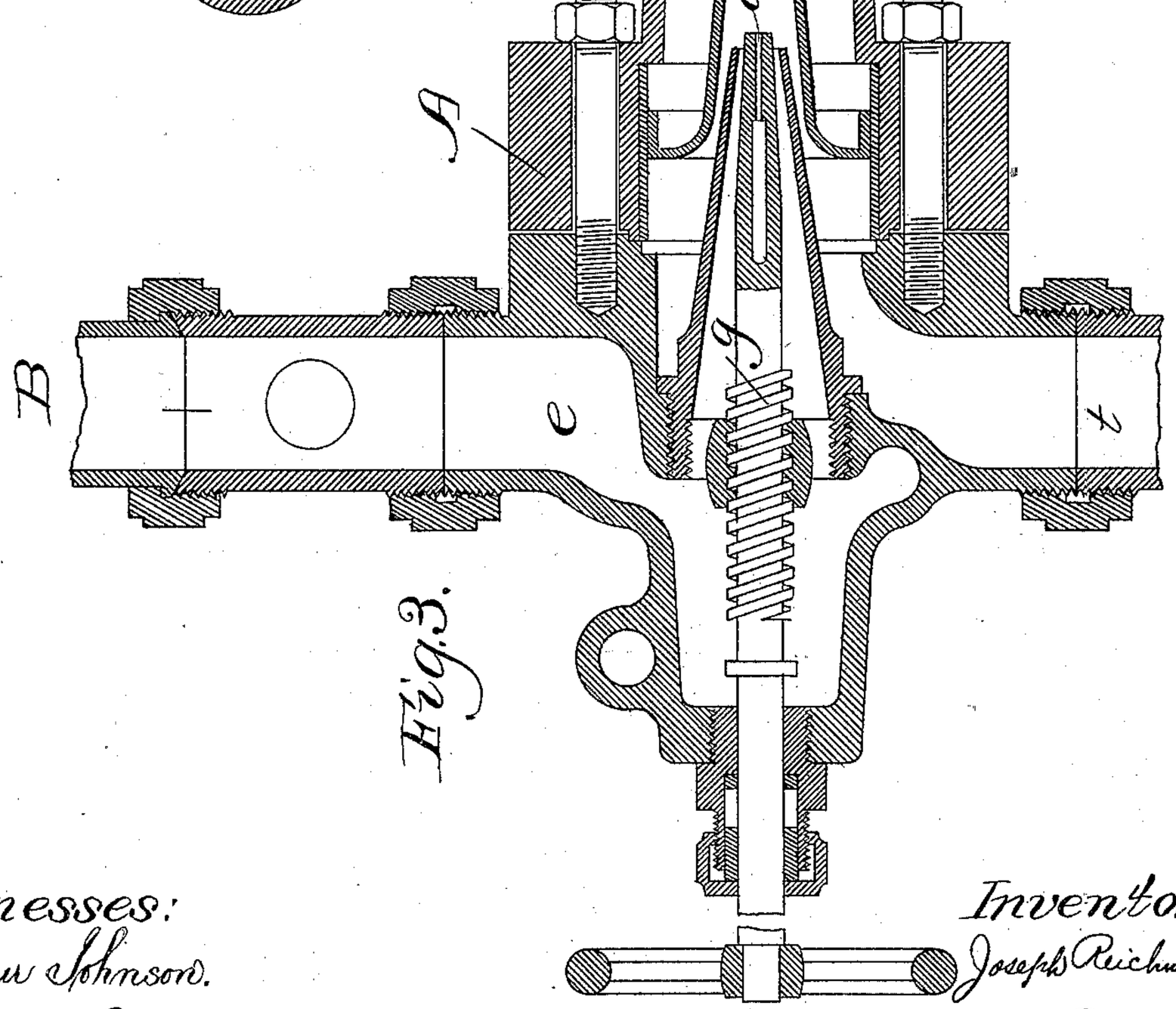

Fig. 3.

Witnesses:
Arthur Johnson.
Douglas Dyrenforth

Inventor:
Joseph Reichmann
by Dyrenforth & Dyrenforth
Attorneys.

UNITED STATES PATENT OFFICE.

JOSEPH REICHMANN, OF CHICAGO, ILLINOIS.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 301,004, dated June 24, 1884.

Application filed March 1, 1884. (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 improvement relates particularly to that part of the device known as the "auxiliary" jet or ejector, for use in connection with an injector for the purpose of starting the operation of the same.

The present invention is designed to constitute an improvement for attachment to injectors of various constructions, and it is shown, for the sake of convenience, in connection with the well-known Sellers injector, the injector portion of my device differing from that of Sellers only in the fact that mine is provided with an additional valve or substitute for the same in the overflow. It is my object to provide means which shall operate automatically to raise the feed-water from a reservoir located below the level of the injector, and to inject the water thus raised in a continuous stream into the boiler; and to this end my invention consists in providing an ejector for the purpose of starting the operation of the injector, which ejector shall communicate with the overflow and water-supply passages of the injector in a manner to create a vacuum for the purpose of raising the feed-water by exerting suction from two opposite directions—viz., from the overflow through the combining-tube and from the feed-water supply-pipe.

My invention consists, further, in providing the injector with means to serve the purpose of excluding air from the interior of the injector while a vacuum is being produced; and my invention still further consists in certain details of construction and combinations of parts, all as hereinafter more fully set forth.

In the drawings, Figure 1 is an end elevation and part section of an injector provided with my improved ejector; Fig. 2, a longitudinal vertical section of my improved ejector; Fig. 3, a similar view of an injector provided with an additional valve; and Fig. 4, a transverse sectional view of a detail, showing a modification taken on the line 4 4 of Fig. 3.

A is an injector similar to the Seller's injector in all its parts, excepting as hereinbefore stated. A detailed description of the internal structure of this device is not deemed necessary, further than shall be required to enable a clear comprehension of the operation of my improvement in connection with it, since the construction comprising the usual steam-nozzle, combining-tube, and discharge-tube is well known to those skilled in the particular art to which it relates.

B is a pipe forming a connection between the injector and the boiler, and through which steam is fed to the device.

C is a reservoir below the level of the apparatus, and containing the water which is fed to the device through the medium of the pipe *t*, which is provided with a T-branch, *s*, to afford means for the connection of the ejector D with it. The ejector D, Fig. 2, comprising the vacuum-chamber *f* and steam-chamber *p*, is provided with a steam-valve, *n*, steam tube or nozzle *o*, discharge-tube *m*, check or stop-valve *l*, Fig. 1, and the steam-pipe E, which may connect the ejector with the boiler, to provide direct communication between the two, or with the T-branch *k* of the injector, when the latter would communicate with the boiler by means of a steam-pipe.

The operation of the device is as follows: The overflow-valve *i* is opened, the overflow-passage *i'*, leading from the interior of the injector into the open air, remaining closed to the admission of atmosphere, owing to the presence of the check-valve *h*, and the steam plug or valve *g* is closed. An equivalent for the valve *h* is shown at *h'* of Fig. 3, which represents by dotted lines a pipe forming a continuation of the overflow-passage *i'*, and leading to the reservoir, whereby the overflow water is returned to the source of supply and thus saved, and air is excluded during the production of the vacuum, the construction affording a water-seal. Steam from the boiler is admitted through the pipe E into the steam-chamber of the globe-casing of the ejector D when the valve *n* is opened, admitting a jet of steam into the discharge-tube *m*, whereby the air contained in the chamber *f*, Fig. 1, is exhausted, producing a vacuum therein and causing the check-valve *l* to rise by the pressure underneath, and thus exhausting the air from the injector and pipe *t*, leading to the reser-

voir through the chamber *x*, and causing the feed-water to rise and pass through the chambers *x* and *f*, and water-inlet pipe *m'* of the ejector, and discharge through the tube *m*. The discharge from the tube *m* indicates that the necessary vacuum has been formed to raise the water from the reservoir when steam from the boiler is admitted through the connecting-pipe B to the chamber *e* of the injector, whence it passes through the passage *d* of the plug *g* and forces water through the overflow of the injector, the check-valve *h*, when used, being raised by the pressure and permitting the discharge, or the latter taking place through the medium of the pipe *h'*. The necessary vacuum having been produced and the water raised, the injector will have performed the duty required of it, and is caused to cease its operation by closing the steam-valve *n*, whereby the check-valve *l* will drop upon its seat and likewise be closed. Another way of checking the operation of the injector equally as effective would be to force the valve *l* down upon its seat by means of the stem *c*, Fig. 1, and afterward close the steam-valve *n*. The operation of the ejector being checked, the steam-plug *g*, Fig. 3, is opened wide to admit a quantity of steam into the injector sufficient to force the water into the boiler, when the overflow-valve *i* is closed and the injector operates in the usual manner.

The device may also be operated in the following manner: The overflow-valve *i* being first opened and the plug *g* nearly closed, steam is introduced into the chamber *e*, whence a small jet will pass through the overflow and prevent the entrance of air into the water-supply and vacuum chambers of the injector and ejector. On then admitting steam into the ejector, the valve *n* is opened, exhausting the air and forming a vacuum by the discharge of the steam, and water will flow simultaneously from the discharge-tube *m* and overflow of the injector. The steam-jet entering the injector is purposely confined to a small volume, in order to avoid overheating of the injector, and the force of the jet being of course dependent upon the amount of boiler-pressure, the jet, owing to the creation of the vacuum, may not have a force sufficient to pass through the overflow. As the overflow, however, will be closed by the check-valve the moment water ceases to flow through it, or by the water-seal, the operation of the ejector is not measurably affected by the failure of the jet to pass, since the steam of the jet will be condensed by the feed-water. At the simultaneous appearance of water at the overflow and discharge-tube *m*, the plug *g* is opened to admit a quantity of steam sufficient to force a stream of water through the overflow, when the action of the ejector may be checked and the feeding process continued, as hereinbefore described. For the operation last detailed, the pipe E may be connected with the T-branch *k*, Fig. 1, thus causing the injector and ejector to have a common chamber, and the check-valve *h* or pipe *h'* may be dispensed with.

If it is desired to operate the device by using the stop-valve to close the overflow, the proceeding is as follows: The valve *i* is closed, and also the steam plug or valve *g*. Feed-water may then be raised by the ejector, and as soon as it appears at the discharge-tube *m* steam is admitted into the chamber E, and a small jet allowed to escape from the steam-nozzle by opening the plug *g*, which jet is condensed by the feed-water of the ejector; but the overflow-valve is instantly opened, and the steam-jet will force its way through the combining-tube, thereby sealing the communication between the overflow-chamber and the ejector. The steam-plug *g* is then opened until a sufficient quantity of water appears at the overflow, and the operation of the ejector may cease. The further operation of the device is as hereinbefore stated.

By the use of my improvement the feed-water may be raised from a great depth, since an almost perfect vacuum is formed by effectually excluding air from the feed-water chamber by means of the valve *h*, and heating of the injector and feed-water is avoided, since steam is not admitted until the feed-water has been raised. The highest temperature at which water can be raised by the device being about 60° Fahrenheit, were the injector to become heated, the degree of the water at which it could be injected would decrease in proportion to the increase of the temperature of the injector.

Though the foregoing description of my improvement has been confined to its operation in connection with the Sellers device, it is not necessarily limited to this connection, but may be adapted, as hereinbefore stated, to injectors of various constructions. The ejector may also be constructed to form one casing with an injector; but in the form of a separate device it possesses the advantage of being capable of location at the most convenient situation. When the feed-water reservoir is situated above the level of the injector, the device may be successfully operated by keeping the valve *l* of the ejector closed.

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

1. The combination, with an injector, of an ejector communicating directly with the overflow and water-supply passages of the said injector, whereby the air is drawn from the overflow-chamber through the combining-tube, and also from the water-supply pipe, substantially as described, and for the purpose set forth.

2. The combination, with an ejector, of an injector, with the overflow and water-supply passages of which the said ejector has direct communication, to draw the air from the overflow-chamber through the combining-tube and also from the water-supply pipe, said injector being constructed to effect the sealing of the communication between the overflow-chamber

of the said injector and the said ejector by the passage of a jet of steam from the receiving tube or nozzle of the said injector through the combining-tube of the same, substantially as described.

3. The combination, with an injector, of an ejector communicating with the overflow and water-supply passages of the said injector, and comprising, in combination, the following elements, viz: a casing having a steam-chamber, *p*, and vacuum-chamber *g*, steam-pipe E, connecting the ejector with the boiler, nozzle *o*, pipe *t*, to afford communication between the injector and feed-water supply, T-branch *s*, for connecting the ejector to the injector, chambers *x* and *f* within the T-branch *s*, valve *l* between the said chambers, and valve-stem *c*, all being constructed and arranged to operate substantially as described.

JOSEPH REICHMANN.

In presence of—
C. C. LINTHICUM,
DOUGLAS DYRENFORTH.