(Model.) 2 Sheets—Sheet 1.

F. W. KREMER.

CONVERTIBLE EJECTOR, INSPIRATOR, AND INJECTOR.

No. 282,092. Patented July 31, 1883.

Fig. 2.

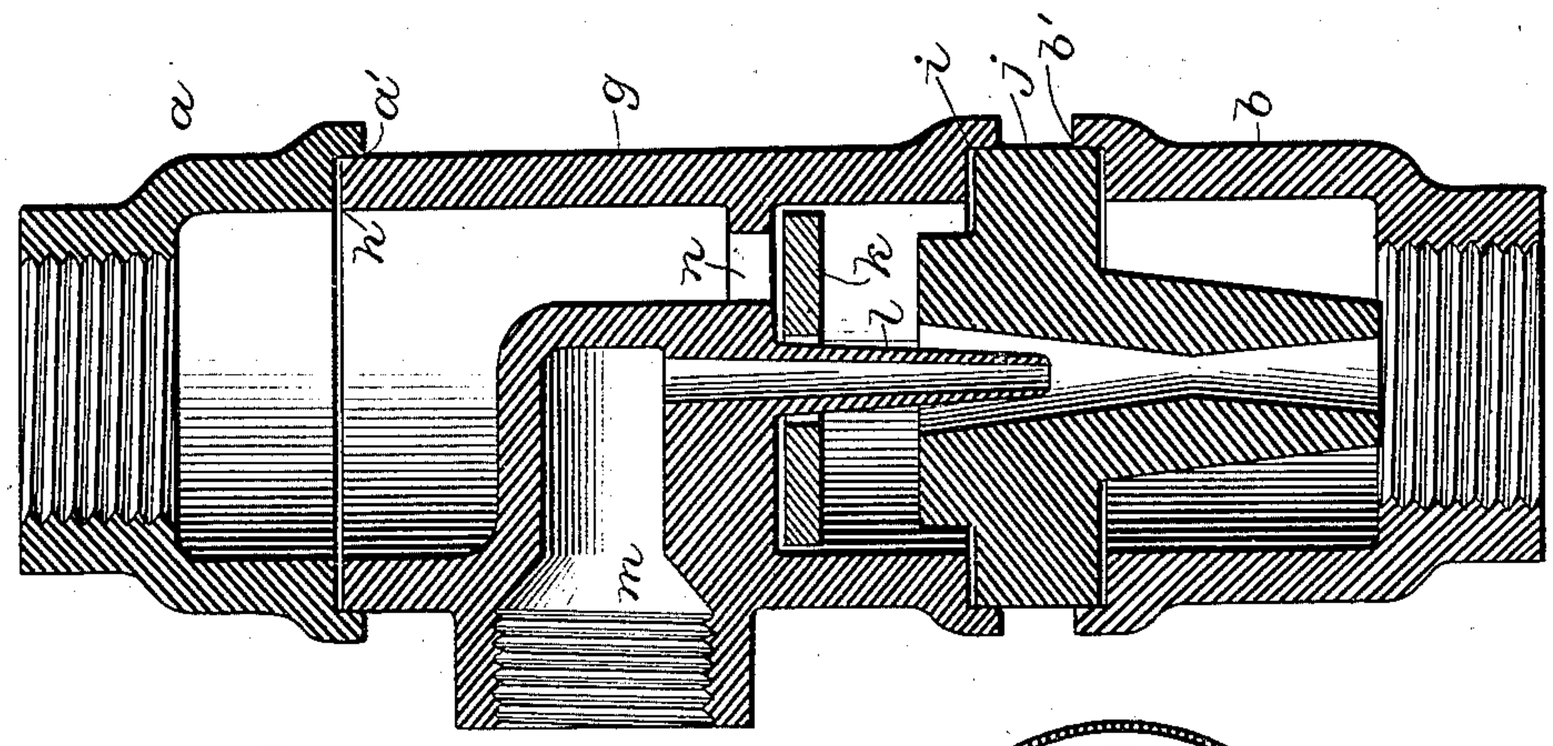


Fig. 5.

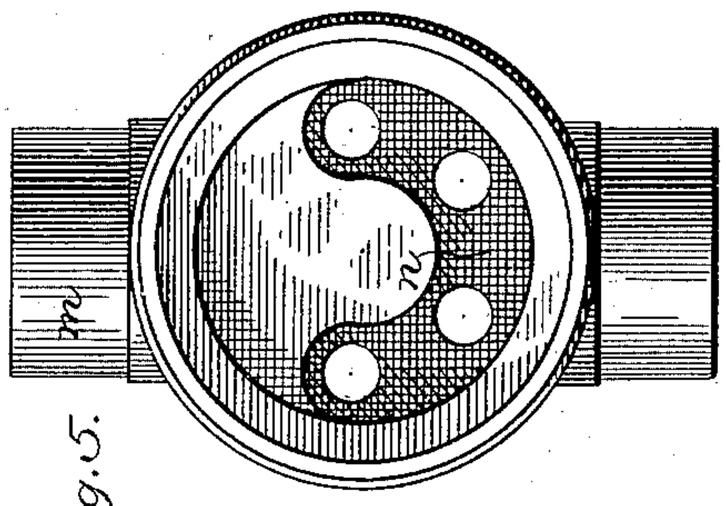


Fig. 6.

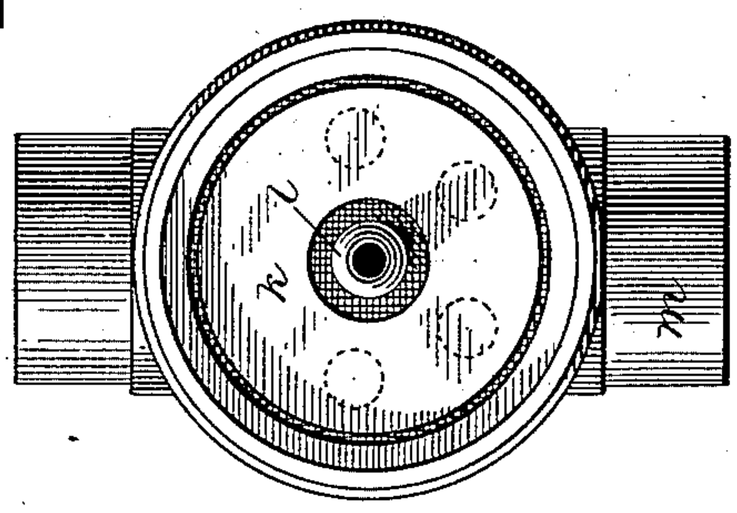
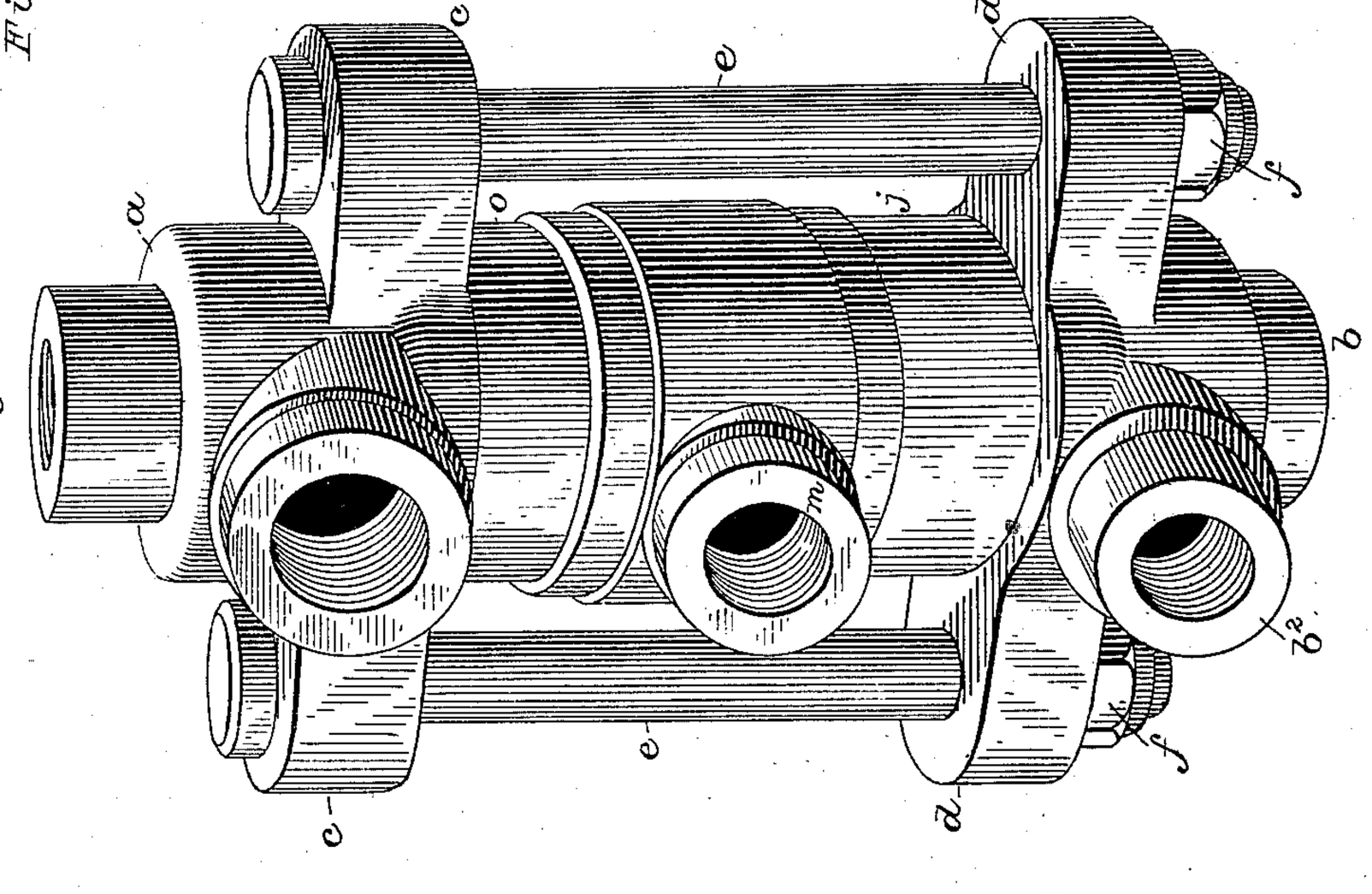


Fig. 1.



Attest:

Geo. M. Finckel

Edwin A. Finckel

Inventor:

Franklin W. Kremer.

by Wm. F. Finckel,

Atty.

(Model.) 2 Sheets—Sheet 2.

F. W. KREMER.

CONVERTIBLE EJECTOR, INSPIRATOR, AND INJECTOR.

No. 282,092. Patented July 31, 1883.

Fig. 4.

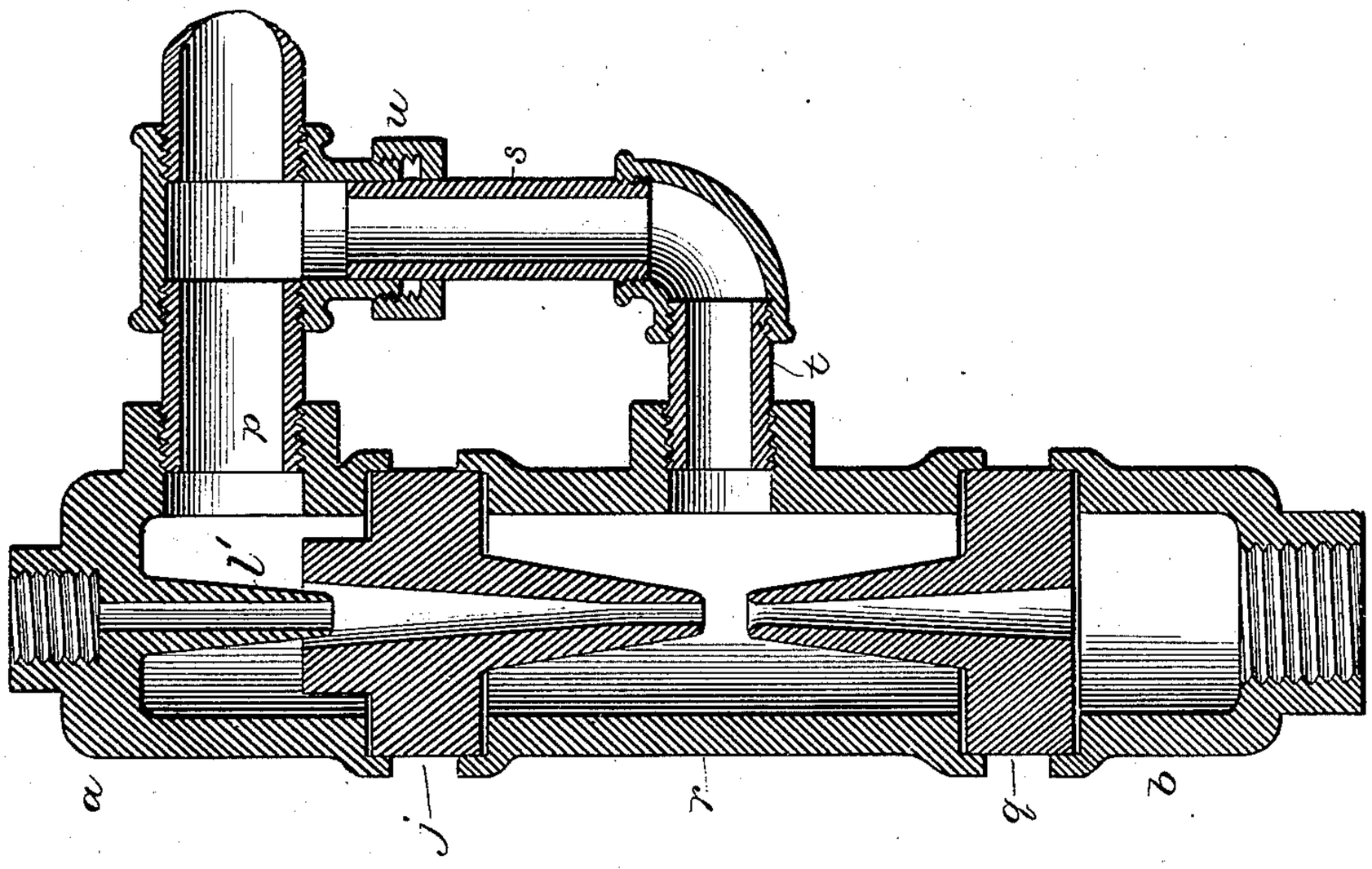
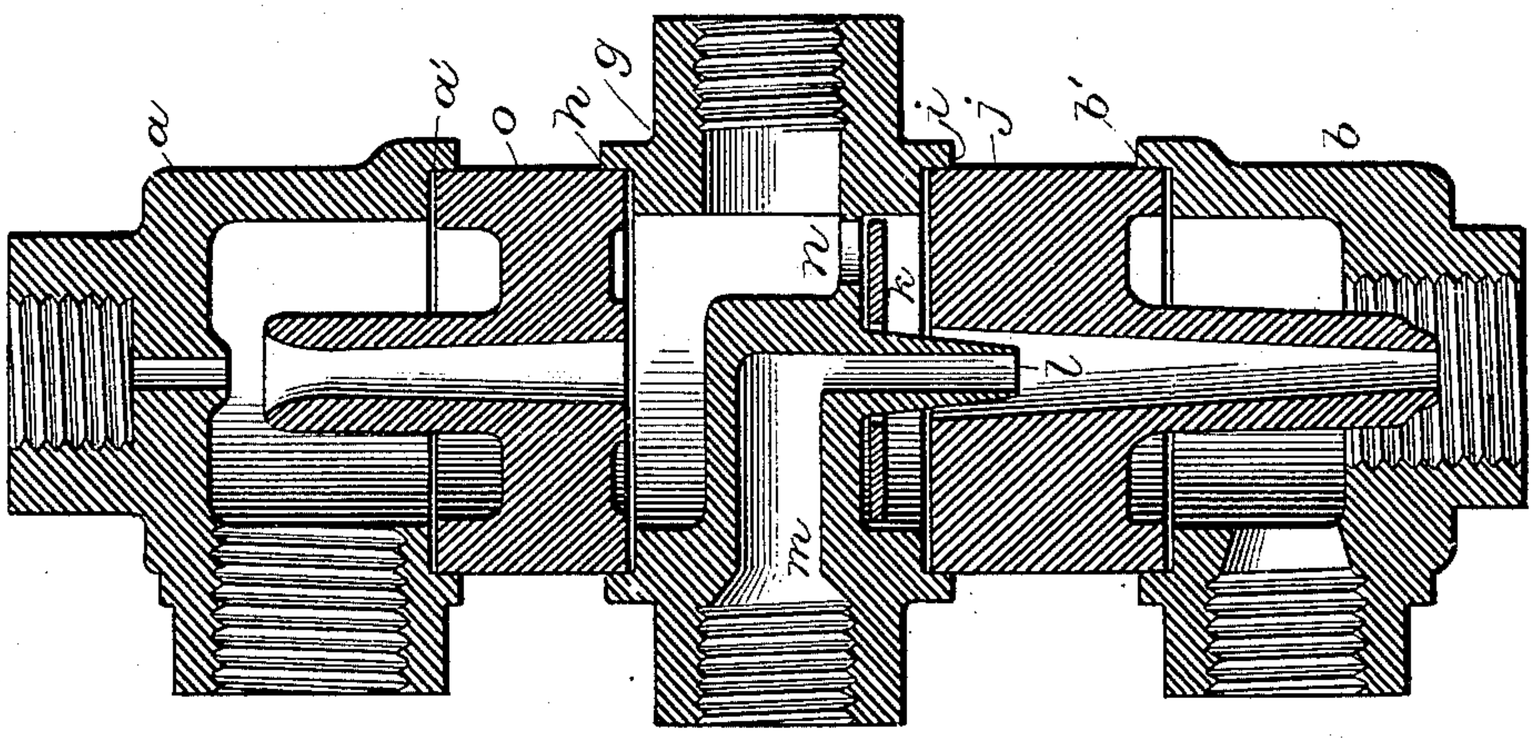


Fig. 3.



Attest:

Geo. N. Finckel

Edwin A. Finckel

Inventor:

Franklin W. Kremer

by Wm. H. Finckel, Atty.

UNITED STATES PATENT OFFICE.

FRANKLIN W. KREMER, OF WADSWORTH, OHIO.

CONVERTIBLE EJECTOR, INSPIRATOR, AND INJECTOR.

SPECIFICATION forming part of Letters Patent No. 282,092, dated July 31, 1883.

Application filed January 2, 1883. (Model.)

To all whom it may concern:

Be it known that I, FRANKLIN W. KREMER, a citizen of the United States, residing at Wadsworth, in the county of Medina and State of Ohio, have invented a certain new and useful Convertible Ejector, Inspirator, and Injector, of which the following is a full, clear, and exact description.

The objects of my invention are to simplify, strengthen, and increase the durability of the construction of water-feeding devices for steam-boilers, and to adapt such devices for interconversion into inspirators or lifting-injectors, ejectors, and non-lifting injectors, by change or substitution or addition of parts.

To these ends my invention consists in fitting the parts together by ground or ground and packed joints, the several parts being held together as a whole by connecting-bolts and nuts, whereby parts are easily removed and renewed, danger of sticking and corrosion incident to the usual screw-threaded joints avoided, and the construction largely simplified and strengthened and greater durability secured.

The invention also consists in providing parts for such an inspirator whereby it may be converted into an ejector or injector at pleasure, in accordance with the work to be done by it.

The invention further consists in providing an ejector or inspirator with a check-valve, whereby the dangers and difficulties incident to the backflow of steam and the breaking of the steam-jet, respectively, are obviated; and the invention finally consists in the details of construction, all as hereinafter specifically set forth and claimed.

In the accompanying drawings, illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a perspective view of my inspirator. Fig. 2 is a central vertical cross-section of the same when converted into an ejector. Fig. 3 is a similar view of the inspirator of Fig. 1. Fig. 4 is a central vertical cross-section of a non-lifting injector. Fig. 5 is a top plan view of the forcing-tube section, and Fig. 6 is a bottom plan view thereof, with the check-valve pertaining thereto shown in dotted lines.

The suction or inlet section *a* and the discharge or boiler section *b* of my device are provided with lateral horizontal ears *c c* and *d d*, respectively, which ears are perforated. These sections receive between themselves the various sections going to make up the device, and the whole number of sections are securely united by bolts *e e*, passed through the perforated ears *c c d d*, and fastened therein by nuts *f f*.

Instead of jointing the several sections by screw-threads, as heretofore, I ream out or counterbore the edges of alternate sections, so as to receive within them the adjacent sections, making the fitting or joint tight and accurate, and insuring them against leakage by packing where necessary.

Experience has demonstrated that the old screw-thread joint is wholly unreliable, for in removing a section its threads will be injured to such an extent as to prevent further accurate fitting, and this is particularly true where sediment or corrosion incident to some kinds of water has accumulated. Lime-water is especially injurious, as the lime is precipitated by the steam and hardens into an almost unremovable scale throughout the joints. Now, my unthreaded joints and bolt-connected sections obviate any danger from this source.

In illustration of my mode of joining the sections of an ejector, referring to Fig. 2, the section *a* has its end *a'* counterbored and ground, so as to leave an external flange. The section *g* has a straight end, *h*, of a diameter to fit the counterbore in section *a* within the flange, while the end *i* of said section *g* is counterbored, as in the case of the end *a'* of section *a*. Within this counterbored end *i* is received the upper edge of the section *j*, the lower end of such section *j* being received within the counterbored end *b'* of the section *b*.

If desired, any suitable packing—in the nature, for example, of a rubber compound or soft-metal gasket or annulus—may be laid in the counterbores to insure a steam-tight joint; but ordinarily the fitting together of the sections accurately will obviate any necessity for the employment of packing. The sections so put together are united securely and tightly under a regulated compression by the connecting-bolts *e e* and nuts *f f* engaging the ears *c c d d*, as before stated; and the device

can be very readily taken apart for renewals, repairs, changes, or conversions of parts by simply taking out the bolts, any sticking of the parts by corrosion or incrustation being overcome by a slight blow without damage to the part struck and without impairing the accuracy of the newly-formed or renewed joint.

In all ejectors to me known the steam-pressure is liable to vary, and where water is to be elevated to a certain height and the steam falls below the required pressure the jet is broken and the machine ceases or fails to work, the steam being thereby forced back through the suction or inlet pipe to the well or reservoir. If this mishap is not discovered in time, and of its nature it rarely is, the steam heats the water to such a degree that the machine will not start when the pressure is increased; and where liquids are conveyed with an ejector this difficulty is very objectionable, if not serious. I provide for and overcome this trouble by applying a disk, *k*, in the water-chamber, acting as a check-valve just above the forcing-tube. In Fig. 2 the forcing-tube *l* has its steam-inlet *m* in the section *g*, and a perforated diaphragm, *n*, separates the water-inlet from the forcing-tube. The disk *k* is perforated centrally to slip over the forcing-tube, and plays between the mixing or directing section or tube *j* and said diaphragm *n*. Now, so soon as the jet is broken, the disk is forced to its seat against the diaphragm, as shown in the drawings, by the back-pressure, thus closing the water-way through the openings in said diaphragm and preventing the steam from blowing back.

In Fig. 3 the device is arranged as an inspirator or lifting-injector, with the forcing-section and its diaphragm and check-valve substantially as in Fig. 2, but for another purpose, to wit: In starting a lifting-injector the steam is turned on the lifting-jet, and when the water appears at the overflow the lift-overflow is closed and the water will issue from the overflow below the combining-tube. At this stage the steam is turned on the forcing-jet. In other machines, if the steam is admitted too rapidly, the jet will be broken and the steam must be shut off and the whole operation gone over again, whereas in my machine the trouble is avoided by the check-valve, for if the steam be turned on too rapidly this check-valve will rise against the diaphragm, closing the water-way and preventing the breaking of the lifting-jet. It thus makes the forcing-jet positive in its action, which is very desirable, especially in locomotive-engine-boiler injectors.

The several sections making up this inspirator are jointed and connected as described of Fig. 2, and said joints need not be further specified. *j* is the forcing or discharging jet tube or section, and *o* is the lifting-jet tube or section. The overflow in the section *b* may be dispensed with.

In Fig. 4 the section *a* is provided with the steam-jet tube *l'* and the water-inlet *p*. The section *j* and a similar but reversed section, *q*, with their conical tubes adjacent, form a steam and water combining tube for a non-lifting injector. These sections are held separated and in position by a section, *r*, the section *a*, and the usual discharge-section, *b*. The section *a* receives the water through the pipe *p*, and this pipe is connected by a T with a pipe, *s*, leading by pipe *t* to the plane between the combining-tubes. The pipe *s* is connected with the T by a slip-joint, *u*, suitably arranged—as, for example, a packing-gland.

Now, this device is specially designed for use where the water to be fed to the boiler is higher than or on a level with the machine; and, although the figure (4) illustrating it is on a different scale from the other figures of the drawings, I wish it to be understood that this injector embodies all the elements of the others, in so far as they are applicable.

In machines heretofore used, so far as I am aware, where the water-supply is higher than on a level with the boiler, the injector failed to work, owing to the varying steam-pressure, unless the overflow were left open. When the steam is low water will escape at the overflow, and when it is high air will be drawn in, each very undesirable. Some injectors have a valve arranged to allow the escape of the water and prevent air being drawn in. In my non-lifting injector, Fig. 4, when the steam is high, water will be drawn in through the pipe *t* instead of air, and the capacity of the machine thus greatly augmented. With low pressure of steam, instead of wasting, the water is returned to the feed-pipe. Thus, it will be seen, my machine becomes practically automatic and the working perfect with varying steam-pressure.

The slip-joint for connecting pipes *p* and *s* is provided in order to permit the ready separation of the parts and prevent cramping the joints of the pipes when the parts are drawn up by the clamping-bolts.

While I have not shown any one device containing all the parts necessary to make up each or either of the others, I have yet shown such device easily separable for the removal and substitution of parts to change the character or operation of the machine, and have shown one or more such parts applicable in two or more different kinds of machines.

What I claim is—

1. The sections or parts of an ejector or equivalent feeder fitted together with ground or ground and packed joints, and bolts engaging perforated ears on the uppermost and lowermost sections or parts for clamping together as a whole all such sections or parts, substantially as and for the several purposes specified.

2. The combination, with the steam inlet or forcing tube and the water-way, of an annulus, *k*, and a perforated diaphragm, *n*, adapted to operate as a check-valve to prevent the back-flow of steam, substantially as shown and described.

3. In an injector, the combination of the lifting-jet, the forcing-tube, counterbored ground joint therefor, and clamping-bolts, the said lifting-jet being arranged directly over the forcing-tube and clamped by said bolts in direct line with the same, substantially as and for the purpose described.

4. In a non-lifting injector, the sections thereof fitted together with ground or ground and packed joints, and clamp-bolts, combined with pipes *p*, *s*, and *t*, having a slip-joint, *u*, and constituting an automatic regulating device, substantially as shown and described.

5. In an ejector, a forcing-section provided with a perforated diaphragm and a check-valve seated thereon by backflow, removable at pleasure, and combinable with other suitable sections by means of counterbored joints and clamp-bolts to form an inspirator or an ejector, substantially as shown and described.

6. The several sections of an ejector or equivalent water-feeding device fitted together with counterbored joints made without screw-threads, combined with the external bolts and nuts common to all, engaging the end sections only, and clamping them and the intermediate sections together, substantially as and for the purpose described.

In testimony whereof I have hereunto set my hand this 19th day of December, A. D. 1882.

FRANKLIN W. KREMER.

Witnesses:

JACOB S. OBERHOLTZER,

JOHN C. KREMER.