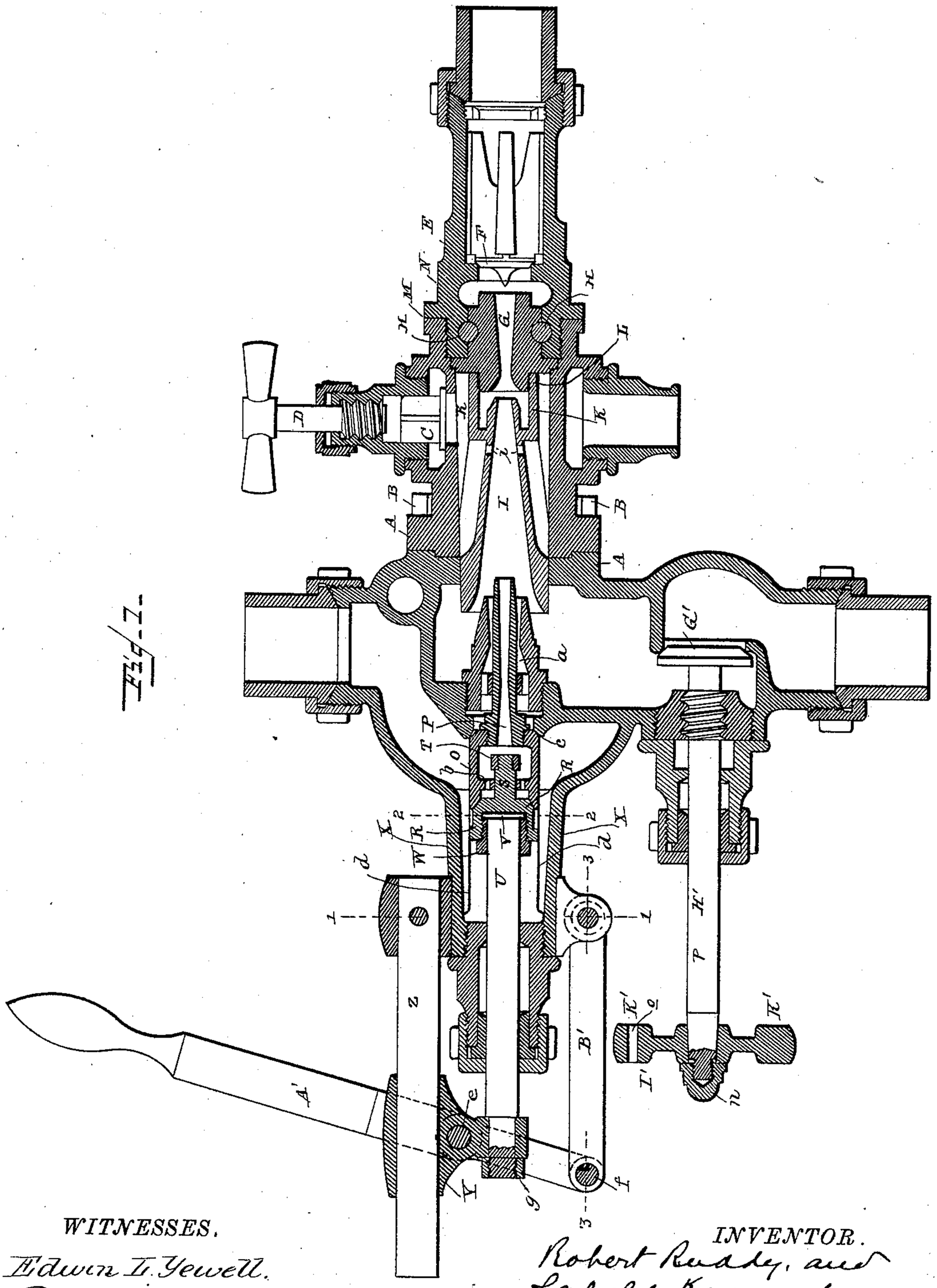
(Model.) 2 Sheets—Sheet 1.

R. RUDDY & L. KACZANDER.

INJECTOR.

No. 387,599. Patented Aug. 7, 1888.



WITNESSES.

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(Model.)

2 Sheets—Sheet 2.

R. RUDDY & L. KACZANDER.

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Fig. 2.

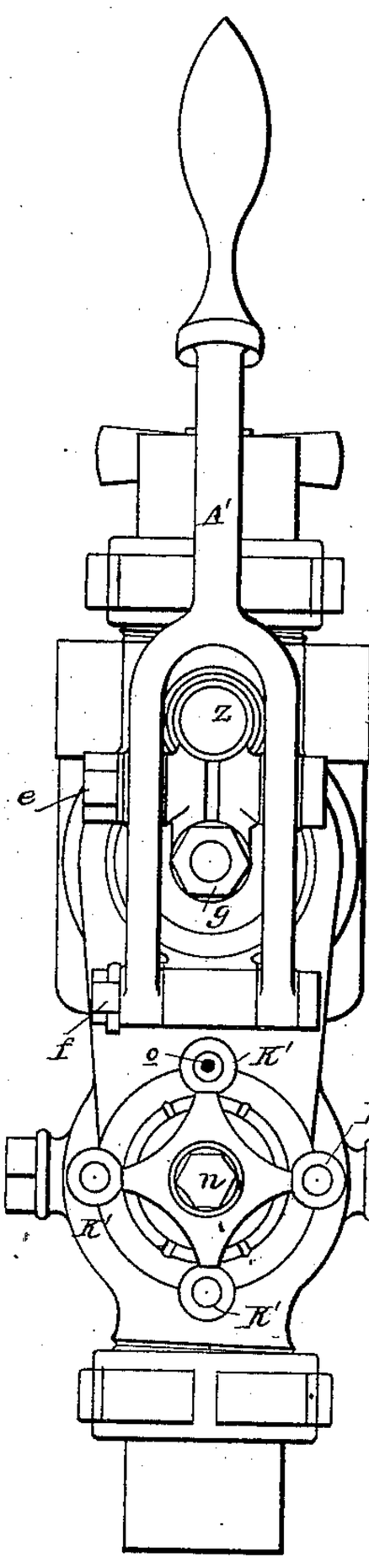


Fig. 3.

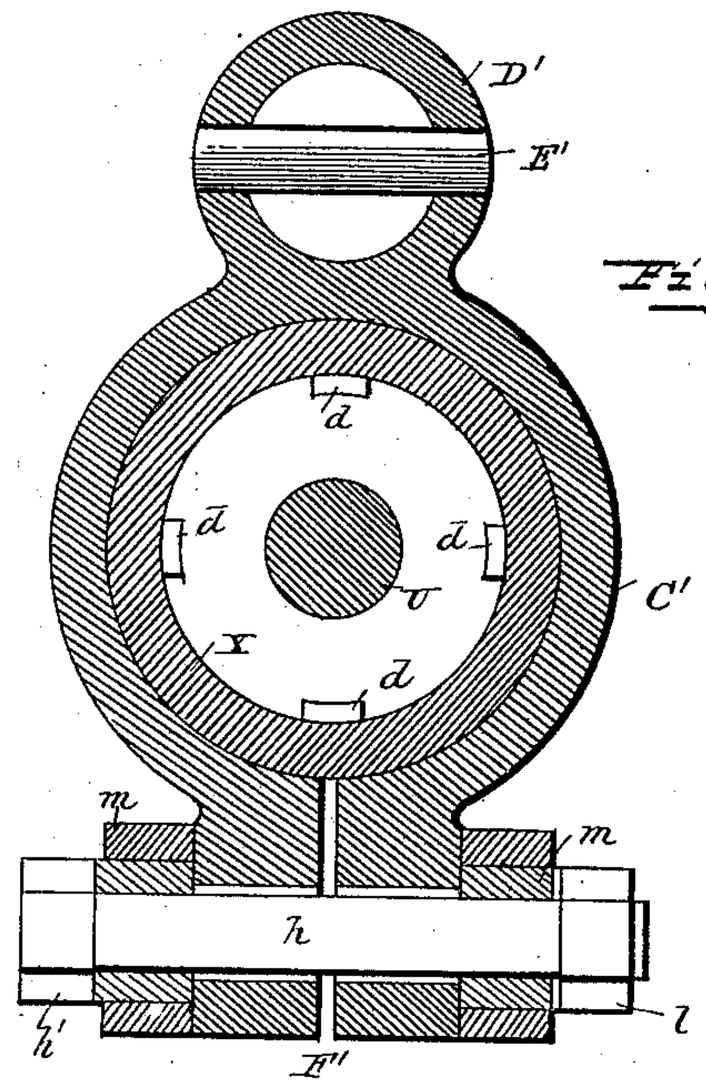
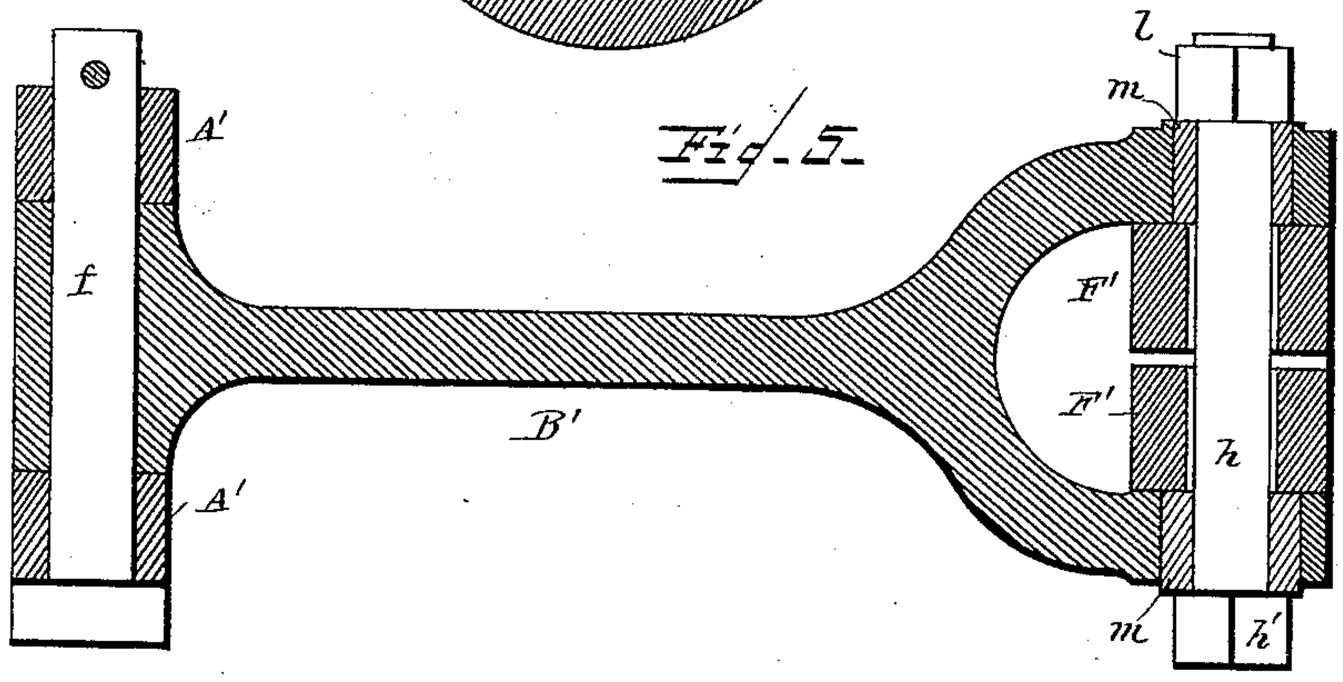


Fig. 4.

Fig. 5.



WITNESSES,

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UNITED STATES PATENT OFFICE.

ROBERT RUDDY, OF MOUNT VERNON, AND LEOPOLD KACZANDER, OF NEW YORK, ASSIGNORS TO THE NATHAN MANUFACTURING COMPANY, OF NEW YORK, N. Y.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 387,599, dated August 7, 1888.

Application filed June 13, 1888. Serial No. 276,915. (Model.)

To all whom it may concern:

Be it known that we, ROBERT RUDDY, of Mount Vernon, Westchester county, New York, and LEOPOLD KACZANDER, of the city, county, and State of New York, have invented certain new and useful Improvements in Injectors, of which the following is a specification.

These improvements relate to that class of injectors in which the water receives successive impulses from two or more jets of steam arranged in the same axial line, the velocity of the water being continually accelerated until velocity requisite to enable the water to enter the boiler has been acquired.

The improvements more particularly refer, first, to the specific construction of the steam-admission valves in that class of lifting-injectors in which are employed a central steam-jet which lifts or draws up the water and an annular forcing-jet which, in conjunction with the central lifting-jet, imparts to the water the necessary velocity to enable it to enter the boiler, the construction being such that the valves are raised from their seats in succession, first the valve governing the admission of steam to the lifter, and then the valve admitting steam to the forcing-nozzle, both valves, after they have once been opened, remaining open during the operation of the injector; second, to the construction of the support for the fulcrum and guide-bar of the operating-lever; third, to the means for regulating the water-supply.

These improvements are illustrated by the accompanying drawings, in which—

Figure 1 is a longitudinal section of the injector. Fig. 2 is an elevation from the lever end of the injector; Fig. 3, a cross-section on line 1 1, Fig. 1; Fig. 4, a cross-section on line 2 2, Fig. 1; Fig. 5, a cross-section on line 3 3, Fig. 1.

The body of the injector is, for convenience sake, made in two parts bolted together by means of the flanges A A and four bolts, B. It is provided with the common inlet-passages for steam and water and with a delivery-connection, to which the pipe is attached that leads the fluid to the boiler. It is, furthermore, provided with the usual overflow-passage and a check-valve, C, in the overflow-chamber, which prevents the admission of air after the injector has been started. This check-valve can be pressed down on its seat by means of the screw-spindle D when it is desired to use the injector as a feed-water heater, as is frequently done in ordinary locomotive practice.

The casing E, which contains the usual check-valve, F, for preventing the backflow of the water from the boiler, is secured to the delivery-nozzle G by means of the swivel-joint H. The condensing-nozzle I, which is provided with one or more overflow-openings, *i i*, at a short distance from its mouth, is screwed to the delivery-nozzle by means of the arms K, ending in a screw-threaded ring, L. The casing E screws into the body of the injector at M, and by means of the described construction the delivery and condensing nozzles can be removed for inspection or cleansing purposes by simply applying a wrench to the squared part N of casing E.

The steam-admission valves, which form the first part of these improvements, are constructed in the following manner: Valve O, which will be called the "main valve" and which admits the steam into the annular space *a*, is formed in the shape of a hollow cylinder, provided with a circular perforated diaphragm-plate, *b*. This valve seats on the body of the injector at *c*, and to it is screwed the lifting steam-nozzle P, this latter being centrally guided in the forcing steam-nozzle Q, as clearly shown in Fig. 1 of the drawings.

Valve R, which will be called the "jet-valve" and which admits the steam into nozzle P, is a cylindrical valve seated on main valve O, and is provided with a stem or cylindrical prolongation, S, protruding through the diaphragm-plate and having nut T screwed on its end. The connection between the spindle U and the jet-valve is established by means of the collar V and lock-nut W.

It will be observed that neither of the valves is firmly secured to the spindle, but each of them can freely revolve around its horizontal axle, and the connection by means of the lock-nut W provides for the necessary allowance for expansion and contraction on the spindle

when the injector is charged with steam or cut off from it. Both valves are centrally guided by four wings, *d*, dropping from neck *x*, formed in one with the body of the injector.

The spindle U is secured to the sliding sleeve Y, and this latter is guided by the rod Z and secured to the U-shaped lever A′, and this latter to the fulcrum-bar B′ by the usual mechanical appliances—viz., bolt and nut *e e′*, pin *f*, and lock-nut *g*.

The guide-rod Z and fulcrum-bar B′ are supported by a peculiarly-constructed friction-clamp. This consists of the ring shaped part C′, slipped over the neck *x* of the body and provided with neck D′, in which rod Z is held by the pin E′. The lower part of ring C′ ends in a slotted flange, F′, which permits the ring C′ to be drawn tightly around neck *x* of the body by means of the bolt *h* and nut *l*; but in order to not interfere with the free oscillation of the fulcrum-bar the nut *l* and bolt-head *h′*, when tightened, press on flanges F′ through the intermediary of the bushings *m*, the fulcrum-bar thus oscillating around the bushing *m* independently of the tightening-bolt *h*. The water-regulator consists of a common disk valve, G′, made solid with the spindle H′. The end of this spindle is conical and receives a star wheel or handle, I′, held by friction on the conical end of the spindle by means of the screw-cap *n*. The star-wheel consists of four knobs, K′, connected by wings with each other and with the hub of the wheel, and one of them is formed with a hole, *o*. The proportion between the required lift of valve G′ and the pitch of the screw-thread on spindle H′ is so chosen that just one turn of the wheel I′ will entirely open or entirely close the water-passage. The position of the perforated knob on the wheel therefore forms a most simple and reliable indicator for the position of the water-valve. The knob being flattened, the recess naturally formed by the hole can be easily felt with the fingers, and by this means the position of the water-valve is readily discernible even at night, which is of great value in locomotive practice.

The operation of the injector is as follows: The lever is moved a short distance in the direction of the arrow, which opens the jet-valve, the main valve being kept closed by the steam-pressure. The steam thus admitted into the hollow main valve rushes through the perforations in the diaphragm-plate *b* into the lifting-nozzle P. This steam, finding a ready outlet through the overflow-space between delivery and condensing nozzle and through perforations *i* in the condensing-nozzle into the atmosphere, creates the necessary vacuum in the water-chamber and the water will be drawn into the injector. As soon as water appears at the overflow, the lever is pulled out to its full stroke, the nut T on the cylindrical prolongation of the jet-valve will strike the diaphragm-plate in the main valve, and this latter valve will be lifted from its seat, allowing the steam to enter the annular space *a* in the forcing steam-nozzle Q. The combined effect of both steam-jets will be to force the water through the condensing and delivery nozzle with sufficient velocity to enter the boiler. The quantity of water to be delivered in proportion to the steam-pressure in the boiler can be regulated by the water-valve G′.

The proportions of the different nozzles and their shape will be readily determined by those skilled in the art.

Injectors with a central lifting-jet, annular forcing-jet, and successively-opened jet and main valves have been made and used before this; but in all of them the lifting-nozzle has either been attached to the jet-valve and the main valve has been made to slide on the lifting-nozzle, or, when the lifting-nozzle has been attached to the main valve, as in these improvements, the jet-valve was formed in one with the spindle, no allowance being made for the expansion and contraction of the spindle. In the former case, as soon as the jet-valve opened an inevitable leak took place through the annular space between the lifting-nozzle and sliding main valve, the effect of which was to materially lessen and eventually to totally destroy the proper lift of the injector. In the second case the steam valves could not be kept tight for any reasonable length of time. These defects are successfully overcome by the herein-described construction of the valves.

The clamp for the support of the guide-rod and fulcrum-bar as used and made before these improvements consisted of a plain ring slipped over neck *x* and held down to a shoulder by a lock-nut, or the ring itself was screw-threaded, screwing over a screw-threaded neck of the injector-body. Both these constructions were defective in that it was impossible to keep the clamp, and with it the lever, in the desired position, the lock-nut or screw-threaded ring being loosened by the vibration of the pipings or of the locomotive. The herein-described friction-clamp totally overcomes this difficulty.

In view of the prior state of the art, what herein is considered new, and desired to be secured by Letters Patent, is—

1. In an injector, the combination of a delivery-nozzle, perforated condensing-nozzle, and an annular forcing steam-nozzle with a jet-valve and a hollow cylindrical double-seated main valve provided with a perforated diaphragm-plate through which a cylindrical prolongation of the jet-valve protrudes, as and for the purpose set forth.

2. In an injector, the combination of a delivery-nozzle, perforated condensing-nozzle, annular forcing steam-nozzle, and central lifting steam-nozzle with a jet-valve and a hollow cylindrical main valve provided with a perforated diaphragm-plate through which a cylindrical prolongation of the jet-valve protrudes, as and for the purpose set forth.

3. In an injector, the combination of an annular forcing steam-nozzle, central lifting

steam-nozzle, hollow cylindrical main valve, and diaphragm-plate with a jet-valve provided with a cylindrical stem or prolongation protruding through the diaphragm-plate of the main valve, and with nut T, determining the stroke of the jet-valve, as and for the purpose specified.

4. In an injector, the combination of an annular forcing steam-nozzle, central lifting steam-nozzle, hollow cylindrical main valve and perforated diaphragm, jet-valve R, with cylindrical prolongation protruding through the diaphragm of the main valve, with spindle U, and lock-nut W, the valves opening successively and none of them having rigid connection with the spindle, as and for the purpose set forth.

5. The friction-clamp consisting of ring C′, with neck D′ to receive the guide-rod Z′ and the slotted flange F′, pressed together by means of bolt *h*, bolt-head *h′*, and nut *l*, bushings *m*, interposed between flanges F′ and nut *l* and bolt-head *h′*, the two arms of the fulcrum-bar oscillating around the bushings *m* without interfering with the tightening of the clamp, as and for the purpose set forth.

6. In an injector, the combination of an annular forcing steam-nozzle, central lifting steam-nozzle, hollow cylindrical main valve and perforated diaphragm, jet-valve R, with cylindrical prolongation protruding through the diaphragm of the main valve, spindle U, and lock-nut W, with the fulcrum-bar and friction-clamp, as specified.

7. In an injector, the combination of an annular forcing steam-nozzle, central lifting steam-nozzle, hollow cylindrical main valve and perforated diaphragm, jet-valve R, with cylindrical prolongation protruding through the diaphragm of the main valve, spindle U, and lock-nut W, with fulcrum-bar, guide-rod, and friction-clamp, as and for the purpose set forth.

8. In an injector, the combination of an annular forcing steam-nozzle, central lifting steam-nozzle, hollow cylindrical main valve and perforated diaphragm, jet-valve R, with cylindrical prolongation protruding through the diaphragm of the main valve, spindle U, lock-nut W, fulcrum-bar, guide-rod, and friction-clamp, with sliding sleeve Y and operating-lever A′, all constructed and operating as and for the purpose specified.

9. The star-wheel I′, consisting of four knobs, hub, and connecting-wings, one of the knobs being perforated and serving as an indicator for the position of the water-valve, as and for the purposes set forth.

In testimony whereof we have hereunto set our hands this 8th day of June, 1888.

ROBERT RUDDY.
LEOPOLD KACZANDER.

Witnesses:
CHARLES JUDGE,
ADOLPH BARGEBUHR.