

S. L. KNEASS.  
INJECTOR.

APPLICATION FILED MAY 10, 1912.

1,069,883.

Patented Aug. 12, 1913.

2 SHEETS—SHEET 1.

Fig-3.

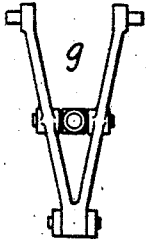


Fig-2.

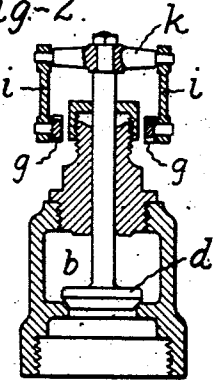
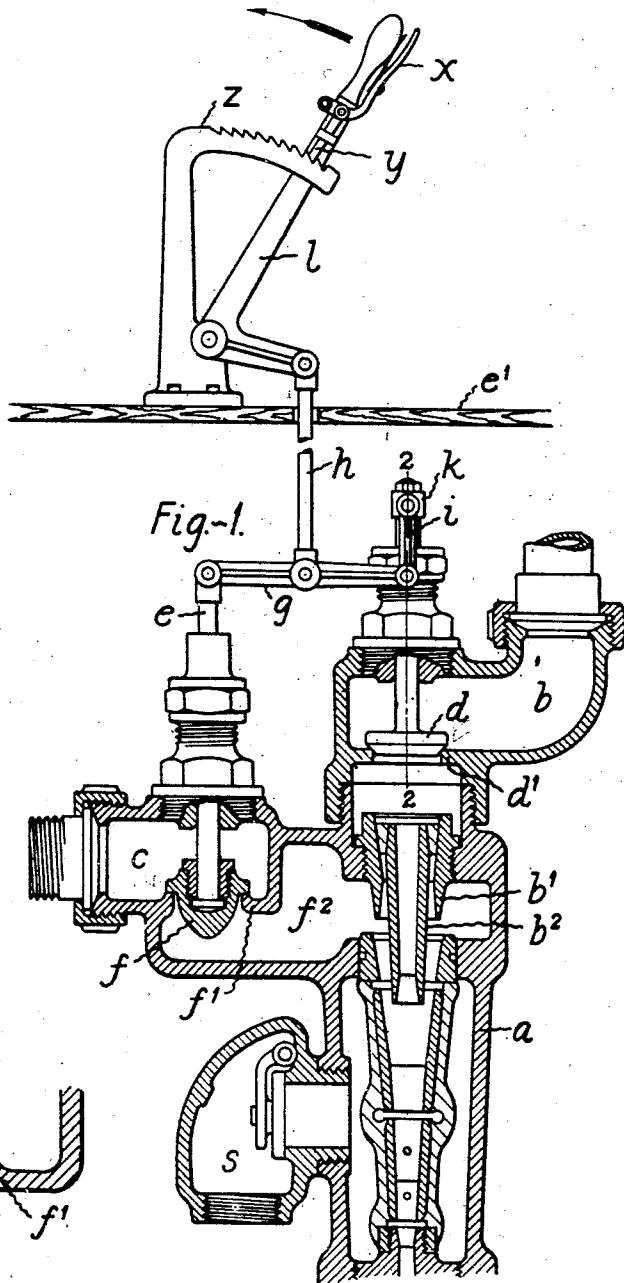
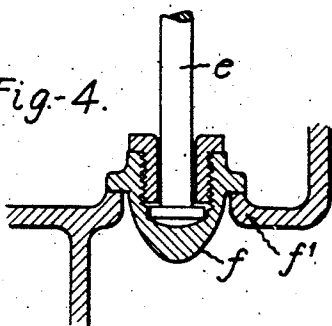


Fig-4.



WITNESSES:  
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# UNITED STATES PATENT OFFICE.

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INJECTOR.

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1,069,883.

Specification of Letters Patent.

Patented Aug. 12, 1913.

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To all whom it may concern:

Be it known that I, STRICKLAND L. KNEASS, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Injectors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

The object of my invention is to simplify the operation of an injector by reducing the number of handles or other devices usually required to admit steam and water thereto and at the same time to control these two supplies by the limits of motion or positions of a single lever.

The invention is applicable to injectors of various forms placed either above or below the level of the water supply and as shown in the drawings accompanying this specification is applied to a non-lifting injector having two steam nozzles, in which the steam nozzles are placed in the same axial line and the jet receives a continuous linear acceleration from its entrance into the combining tube until it reaches the minimum diameter of the delivery tube. It can be used with equal advantage in connection with the ordinary form of injector usually denoted as the single jet type.

In order to operate a non-lifting injector it is customary to use separate and independent valves to control the steam and water supplies, and an overflow valve attached to the injector body. In this case, the steam admission valve may be placed in the steam pipe at any desired point or directly at the steam entrance or branch of the injector. The water supply valve is preferably placed at or close to the injector. If the position of the valves is inconvenient to the operator they may be operated by extension handles. The overflow or waste valve is usually similarly controlled. When a non-lifting injector is applied to a locomotive it is advantageous that means be provided so that the manual operations necessary to control the boiler feed be reduced to a minimum in order that the attention of the operators be not drawn unnecessarily from their other duties. It is an object of my invention to

simplify the means of operating a non-lifting injector and to admit both the steam and water by one lever, which has a further function in regulating the amount of water entering the injector and fed to the boiler.

In the embodiment of my invention illustrated in the drawings and hereinafter described Figure 1 is a vertical sectional view of an injector embodying my invention; Fig. 2 is a section on the line 2—2 of part of Fig. 1; Fig. 3 is a plan view of the lever connecting the steam-controlling and water-controlling valves; Fig. 4 is an enlarged vertical sectional view of the water-controlling valve; Fig. 5 is a view, similar to Fig. 1, illustrating a modification; Fig. 6 is a section on the line 6—6 of part of Fig. 5; and Fig. 7 is a detail side view of the water supply controlling valve.

I will first describe the embodiment of my invention shown on Sheet 1, Figs. 1, 2, 3 and 4. *a* is the body or casing of the injector, *b* is the steam inlet, *c* is the water inlet, *d* is the valve controlling the steam supply, *e* is the valve stem operating, and loosely attached to, the valve *f*, which controls the water supply and is seated upon the partition *f'* separating the water inlet *c* from the water chamber *f''* of the injector. The water control valve *f* supports the pressure or head of water in the tank upon its upper face, so that it may act as a check valve, closing the water chamber *f''* of the injector and automatically preventing inflow. *b'* and *b''* are two interacting steam nozzles placed in the same axial line, *b'* a small annular nozzle which gives the initial momentum to the jet and *b''* a larger concentric nozzle which adds sufficient velocity to force a continuous jet of water into the boiler. At the upper end of the steam valve *d* is the crosshead *k* connected by the links *l, i* to the forked lever *g* pivoted at its opposite end to the stem *e* of the water supply valve *f*. *h* is a rod joining the bell crank lever *l* to the connecting lever *g*. *x, y* is a latching mechanism registering with a notched quadrant *z*.

The operation is as follows: When steam and water are admitted to the inlets *b* and *c*, steam pressure and water pressure (respectively) retain the steam valve *d* and the wa-

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ter valve  $f$  to their respective seats  $d'$  and  $f'$ . Drawing the starting lever  $l$  in the direction of the arrow, pulls upward the rod  $h$  and tends to open both the steam valve  $d$  and the water valve  $f$ . The total resistance of the valve  $d$  to the upward pull of the rod  $h$ , due to the pressure of the steam on the valve  $d$ , is in excess of the total resistance of the valve  $f$  to the upward pull of the rod  $h$  due to the pressure of water on the valve  $f$ ; so that motion is first imparted to the stem  $e$ , raising the valve  $f$  and admitting water to the injector. When the upward motion of the stem  $e$  is stopped by reaching the end of its stroke, the pull of the rod  $h$  is exerted upon the steam valve  $d$  which is then opened by the continued motion of the lever  $l$ . Steam is then admitted to the injector, and combining with the entering water forms a continuous jet into the boiler. When it is desired to regulate the volume of water fed to the boiler, the direction of motion of the starting lever  $l$  is reversed. The upward pressure of the steam upon the valve  $d$  and its stem holds the attached end of the connecting lever  $g$  from downward movement, while the downward pressure of the rod  $h$  pushes the stem  $e$  and the water control valve  $f$  toward its seat, proportionally reducing the quantity of water fed to the boiler. By means of the latch  $y$  and the notched quadrant  $z$  the lever  $l$  and the water supply valve  $f$  may be retained in any desired position.

In the other embodiment of my invention, shown on Sheet 2, Figs. 5, 6 and 7, the injector is also of the non-lifting form and of the same type as previously described and the method of steam admission is the same, but the injector is provided with a special form of automatic water supply valve, patented by me and described in United States Patent No. 862,078, dated July 30, 1907. So far as the parts of the two embodiments are the same, they are designated by the same reference letters, and their description will not be repeated. Instead of the manually-controlled check-valve  $f$ , I employ two valves, one an automatically operated check valve  $m$ , normally held closed by the pressure of water in the water inlet  $c$ , and the other a cup-shaped notched valve  $n$  secured to the stem  $e$ , the stem  $e$  being hollow and guiding the upper stem  $m'$  of the valve  $m$ . The lower stem  $m^2$  of the valve  $m$  extends through the wall of the water-chamber  $f^2$  into a steam chamber  $o$  and in line of movement of a steam actuated piston  $p$  in the steam chamber. Each valve acts to control the flow of water from the water inlet to the water chamber of the injector, but the rate of flow is determined by the valve  $n$ , the notches  $n'$  permitting an inflow even when the valve  $n$  is seated, provided the check valve  $m$  is raised when the valve  $m$  is at the

top limit of its stroke, the notched water regulating valve  $n$  can freely seat upon the partition  $f'$ , separating the water inlet  $c$  from the water chamber  $f^2$ , the stroke of the actuating piston  $p$  is limited so that when the water check valve  $m$  is wide open, there is clearance between its upper face and the notched water regulating valve  $n$ .

The operation of the injector is similar to that previously described. Drawing the starting lever  $l$  in the direction of the arrow raises the stem  $e$  and the water regulating valve  $n$  to the upper limits of the stroke, the water check valve  $m$  remaining on its seat. The continued motion of the lever  $l$  lifts the valve  $d$ , admitting steam to the chamber  $d^2$ , and to the steam nozzles  $b'$  and  $b^2$ . Steam also passes down through the small passage-way  $r$  to the chamber  $o$ , where it exerts upward pressure upon the piston  $p$ , forcing upward from its seat the water check valve  $m$  and admitting water to the water chamber of the injector, where it is drawn into the combining tube by the action of the steam flowing from the nozzles  $b'$  and  $b^2$  and is forced into the boiler. If the starting lever  $l$  is moved in the direction opposite that of the arrow, the pressure upon the valve  $d$  and its stem holds it in its extreme upper position so that the stem  $e$  is forced downward, closing toward its seat the notched water regulating valve  $n$ , reducing the quantity of water flowing into the injector and fed into the boiler. So long as steam exerts pressure in the chamber  $o$  the piston  $p$  holds the water check valve  $m$  up from its seat so that water may flow into the injector. If the motion of the starting lever  $l$  be continued, the steam valve  $d$  will be moved toward its seat by the action of the lever  $g$ , because the stem  $e$  is at the lower limit of its stroke. The area of the notches  $n'$  admits sufficient water to condense the entering steam so that the injector will continue to operate until the motion of the starting lever  $l$  forces the valve  $d$  so close to its seat that the pressure of the steam in the chamber  $d'$  is insufficient to force the water in a continuous jet into the boiler. Therefore, as the valve  $d$  closes, the steam will be gradually shut off, but water will continue to flow into the chamber  $f^2$  so long as the check valve  $m$  is raised from its seat. The entering water will condense all of the steam so that the outflow from the waste pipe  $s$  will be water without uncondensed steam. This is due to the notched construction of the water regulating valve  $n$  and the maintained open position of the water check valve  $m$  until the steam admission valve  $d$  is entirely closed, when the supply of steam to the chamber  $o$  will be cut off and the water check valve  $m$  will fall to its seat, stopping the flow of water into the injector.

Having now fully described my invention,

what I claim and desire to protect by Letters Patent is:

1. In an injector, the combination, with means controlling the flow of steam and water respectively to the injector, of mechanism connecting said means and acting against the pressure of the steam upon the steam admission means to control the water supply and upon the water admission means to control the steam supply.

2. In an injector, the combination with means controlling the flow of steam and water respectively to the injector, of lever mechanism fulcrumed on the steam admission means, and acting against the pressure of the steam on the steam admission means to control the water supply and fulcrumed on the water admission means to control the steam supply.

3. In an injector, the combination with valves controlling the supply of steam and water respectively to the injector, of lever mechanism fulcrumed on the steam supply valve to operate the water supply valve and fulcrumed on the water supply valve to operate the steam supply valve.

4. In an injector, the combination of a valve controlling the steam supply, a valve controlling the water supply and lever mechanism connecting and operating said valves independently by the difference of pressure on or resistance to the motion of said valves.

5. In an injector, the combination with valves, controlling the flow of steam and water respectively to the injector, of lever mechanism fulcrumed on both valves, manually operable devices connected with and adapted to operate the lever mechanism in the direction to actuate both valves, and means limiting the stroke of the water valve, thereby enabling the difference in pressure upon said valves to cooperate with said limiting means to cause the successive operation of the valves in the desired sequence.

6. In an injector, the combination with valve mechanism controlling the flow of steam to the injector and valve mechanism controlling the flow of water to the injector and having a limited stroke, of means connecting said valve mechanisms and enabling the steam pressure upon the steam-control valve mechanism to permit the operation of the water-supply valve mechanism and enabling the water-control valve mechanism upon reaching its limit of stroke to permit the operation of the steam supply valve mechanism.

7. In an injector, the combination with the steam and water inlets, of valve-mechanism adapted to control the flow of steam from the steam inlet to the injector, valve mechanism adapted to control the flow of water from the water inlet to the injector, means connecting said valve-mechanisms and adapted to

permit the pressure of steam upon the steam control valve mechanism to control the operation of the water control valve mechanism and adapted to permit the water-control valve mechanism to control the operation of the steam-control valve mechanism, and a manually operated device connected with and adapted to operate said means.

8. In an injector, the combination with the steam and water inlets, of valve-mechanism adapted to control the flow of steam from the steam inlet to the injector, valve mechanism having a limited stroke adapted to control the flow of water from the water inlet to the injector, means connecting said valve-mechanisms and adapted to permit the pressure of steam upon the steam control valve mechanism to control the operations of the water-control valve mechanism and adapted to permit the water-control valve-mechanism upon reaching the limit of its stroke to control the operation of the steam-control valve mechanism, and a manually operated device connected with and adapted to operate said means.

9. In an injector, the combination with a valve-mechanism adapted to control the flow of steam to the injector and normally held at its limits of stroke by steam pressure, of valve-mechanism having a limited stroke adapted to control the flow of water to the injector, lever mechanism fulcrumed on both valve-mechanisms, and a single manually controlled device connected with the lever mechanism and adapted when operated to move the lever mechanism successively on its two fulcrums by reason of the same being successively held stationary by steam pressure upon the steam-valve-mechanism and by the locking of the water-valve-mechanism at the limit of its stroke.

10. In an injector, the combination with a valve adapted to control the flow of steam to the injector and normally held at its limits of stroke by the steam pressure, of a normally-closed valve adapted to control the flow of water to the injector and having a limited stroke, lever mechanism having fulcrum connections with both valves, and a manually controlled device operatively connected with the lever-mechanism, whereby when the latter is moved in a direction tending to unseat both valves, the water-valve and steam valve will operate successively.

11. In an injector, the combination with a valve adapted to control the flow of steam to the injector and normally held at its limits of stroke by steam pressure, of water-valve mechanism comprising two valves both adapted to control the flow of water to the injector, the first of which is normally held closed by water pressure and the second of which has a limited stroke, lever mechanism having fulcrum connections

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with both the second water-valve and the steam valve, a manually controlled device operatively connected with the lever mechanism, and independent steam actuated means controlled by the steam-valve in its opening movement to open the first water-valve.

In testimony of which invention, I have

hereunto set my hand, at Philadelphia, on this 3rd day of May, 1912.

STRICKLAND L. KNEASS.

Witnesses:

I. P. PEDRICK,

F. C. BLAIR.