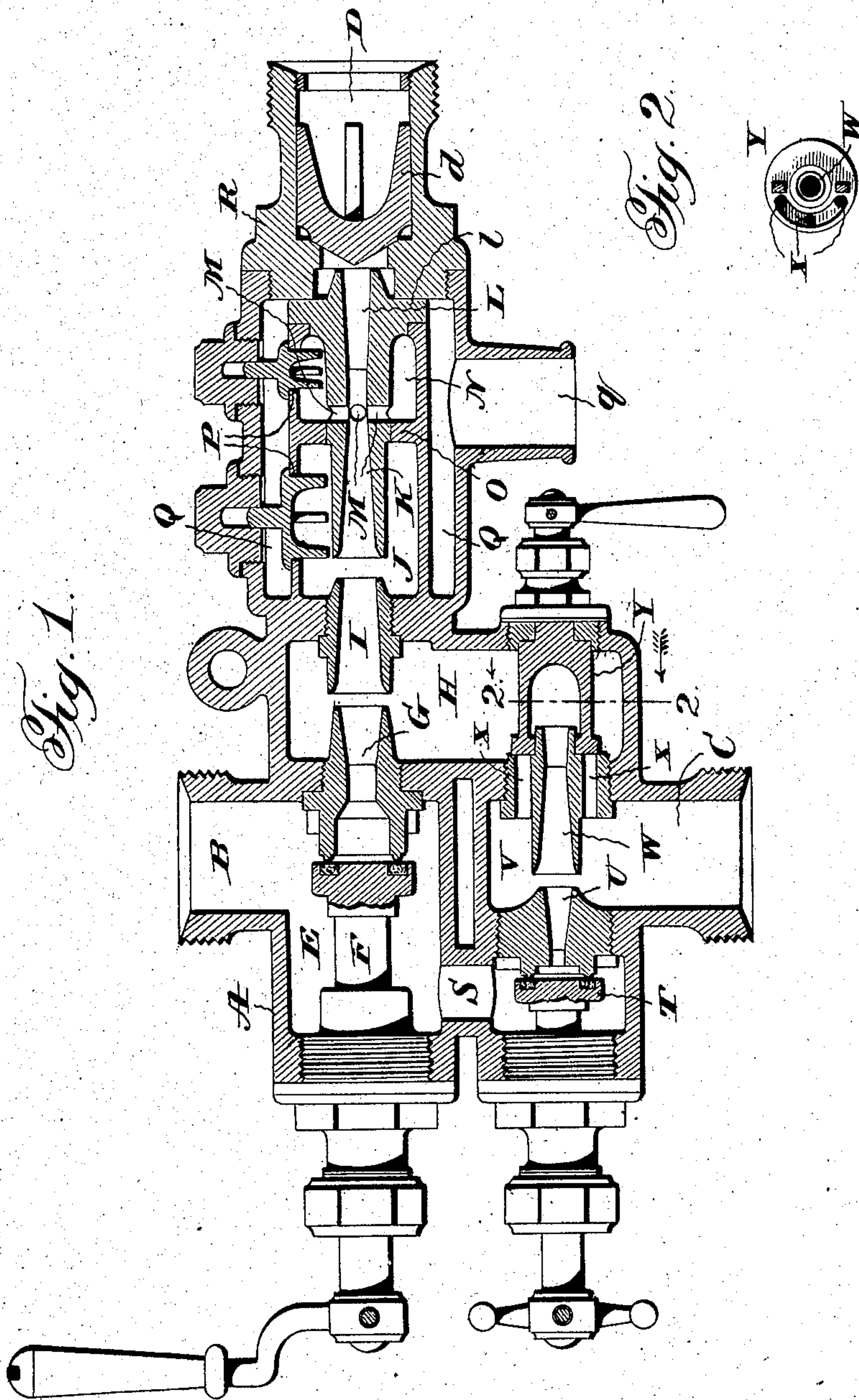


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F. W. KREMER & J. M. ALDERFER.
INJECTOR.

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UNITED STATES PATENT OFFICE.

FRANKLIN WILLIAM KREMER, OF AKRON, AND JOHN M. ALDERFER, OF SHARON CENTER, OHIO.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 786,906, dated April 11, 1905.

Application filed February 11, 1904. Serial No. 193,072.

To all whom it may concern:

Be it known that we, FRANKLIN WILLIAM KREMER, of Akron, Summit county, and JOHN M. ALDERFER, of Sharon Center, Medina county, in the State of Ohio, have invented a certain new and useful Improvement in Compound Automatic Injectors; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of an injector embodying our invention, and Fig. 2 a cross-section on the line 2 2 of Fig. 1.

The object of our invention is the provision of an injector which will have a much greater range than has been possible heretofore, will be capable of automatically reestablishing the jet should it break, and whose construction will be such as to admit ready access to the overflow-chamber when desirable; and to these ends our invention consists in the injector having the construction substantially as hereinafter specified and claimed.

The type of injector which we have improved is the compound or double-jet type, and in the construction of the machine shown in the drawing a casing or body A is employed, having a steam-inlet B, a water-inlet C, and a water-outlet D. The steam-inlet B communicates with a chamber E, containing the main steam-valve F, and from said chamber leads the tube G for the main steam jet or forcer, the end of the tube in said chamber forming the valve-seat. The other end of the tube G opens into a vacuum-chamber H, and from the latter extends a combining-tube I into a chamber J. Leading from the chamber J is a second combining-tube K, and in one piece with the latter is a delivery-tube L, from which the water passes into the water-outlet D. In the latter is a check-valve *d*. Relief-ports M open from the point where the second combining-tube and the delivery-tube join into a chamber N. The two chambers J and N are separated by a partition O, through which the joined second combining-tube and the delivery-tube pass, and from each of said chambers a valved opening P leads to an overflow-chamber Q, having an exhaust opening or nozzle *q*. The valve

for each opening is a gravity-valve. Near the outer end of the delivery-tube it has a flange *l*, which on the inner side abuts against the end of the chamber N and on its outer side is engaged by a butt or cap R, which contains the water-outlet, and is screwed into the outer end of the overflow-chamber and closes the latter. Besides holding the delivery-tube in position the cap, by reason of its ready removability, affords means of ready access to the overflow-chamber for the removal of any obstructions, such as waste or other material, that may lodge therein.

From the main valve-chamber E a port S leads to a chamber below, which contains a valve T, whose seat is upon and which controls the passage of steam through the tube U of the lifter, which tube opens into a vacuum-chamber V, into which the water-inlet C leads. The lifter combining-tube W leads from the chamber V to the vacuum-chamber H. Besides the passage from the chamber V to the chamber H through the combining-tube W there are several passages or ports X (as shown, three, although the number may be varied, as preferred) for water from the one chamber to the other, which ports are adapted to be wholly closed or wholly opened or partially opened to any degree by means of a rotary valve Y. The injector works at its minimum capacity when the combining-tube W alone is used and at its maximum capacity when the ports X are wholly open, and between this minimum and maximum the machine may be graded within a very great range.

The operation of our injector is as follows: The main steam-valve F being closed, so that no steam can pass through the tube G of the forcer, the lifter-valve T is opened, so that steam passes into the chamber H through the combining-tube W. From the chamber H it passes through the forcer combining-tube I and spilling into the chamber J through the space between the combining-tubes I and H lifts the valve in the nearer opening P and passes through the chamber Q to the atmosphere. By reason of the vacuum thus produced the water will be raised and it will follow the course just described, and when it ap-

appears at the nozzle *g* of the overflow-chamber Q the main steam-valve F is opened and steam then flows through the forcer-jet and encountering the water in the vacuum-chamber H is condensed thereby, and practically instantaneously obtaining a sufficient velocity a jet is established to the boiler.

It will be observed that in the operation of our injector the lifter is used first and it operates on the jet principle, and this is accomplished by providing for the free access of steam passing through the lifter to the atmosphere without any back pressure, such free access being obtained by providing an outlet from the combining tube or tubes into the overflow-chamber Q at a point where the diameter of such combining-tube is greater than the diameter of the steam-jet in the lifter. The combining-tube I is the only means of communication between the chamber H and the chamber J. Though the valves for the openings P are gravity-valves, they are held tightly on their seats when the forcer is operating by the reduction of pressure in the chambers J and N. As has been before stated, the capacity of the machine is variable for a wide range by the grading means that comprises the valve-controlled ports X.

Our injector is automatic or restarting, and to make it operate automatically the lifter-controlling valve T is closed, the ports X from the vacuum-chamber V to the vacuum-chamber H are opened to their full extent, and the main steam-valve F is opened. The steam passing through the forcer will produce a vacuum that will result in the lifting of the water, which will spill through the space between the combining-tubes I and K into the chamber J and through the relief-ports M into the chamber N and lifting the valves of the openings P will escape into the chamber Q and from thence to the atmosphere through the nozzle *g*. The spilling is but momentary and the jet to the boiler quickly established. Should the jet be broken, it will be automatically reestablished through a similar operation.

While certain details of construction have been described by us, it is to be understood that the scope of our invention is not limited to these; but changes in construction may be resorted to which will not involve any departure from the scope of our invention.

Having thus described our invention, what we claim is—

1. An injector having chambers from one to the other of which water flows, a tube establishing communication between said chambers, and variable means supplementing said tube for the passage of water from one chamber to the other.

2. An injector having chambers from one to the other of which water flows, a tube establishing communication between said chambers, said tube fixing the minimum capacity

of the injector, and variable means supplementing said tube for the passage of water from one chamber to the other.

3. An injector having chambers from one to the other of which water flows, a combining-tube between such chambers, and a valve-controlled port or ports leading from one chamber to the other.

4. An injector having a lifter and a forcer, and vacuum-chambers in communication through the combining-tube of the lifter, and variable means supplementing said tube for the passage of water from one chamber to the other.

5. An injector having chambers, from one to the other of which water flows, a tube establishing connection between said chambers, and hand-operated, variable means supplementing said tube for the passage of water from one chamber to the other.

6. An injector having chambers, from one to the other of which water flows, a combining-tube between such chambers, a valve-controlled port or ports leading from one chamber to the other, and a handle for operating said valve.

7. An injector having a lifter and a forcer, means for placing the lifter in and out of operation, the forcer also acting as a lifter when the lifter is out of operation, means whereby water is delivered through the lifter-tube to the forcer, and means for increasing the supply of water from this source to the forcer when the forcer is acting both as a lifter and forcer.

8. An injector having a lifter and a forcer, means for each of the latter for placing it in and out of operation, the forcer also acting as a lifter when the lifter is out of operation, vacuum-chambers, the combining-tube of the lifter establishing communication between said chambers, a port or ports leading from one chamber to the other, and means for opening and closing said port or ports.

9. An injector having a lifter and a forcer, a chamber into which both lifter and forcer open, means to vary the water-supply to said chamber, a tube leading from said chamber, a chamber in communication with said tube and with the atmosphere, the connection between said chamber and said tube being at a point in the latter where its diameter is not less than the diameter of the lifter-jet, and means for placing both the lifter and the forcer in and out of operation, the forcer acting as a lifter when the lifter is out of operation.

10. An injector, having a lifter and a forcer, a chamber into which both lifter and forcer open, means to vary the water-supply to said chamber, a tube common to both, a chamber in connection with said tube and with the atmosphere, the connection between said chamber and said tube being at a point in the latter where its diameter is not less than the di-

ameter of the lifter-jet, and means for placing both the lifter and the forcer in and out of operation, the forcer acting as a lifter when the lifter is out of operation.

5 11. An injector having a lifter and a forcer, a chamber into which both lifter and forcer open, means to vary the water-supply to said chamber, a second chamber in communication with the atmosphere and with the combining-tube of the forcer, the connection between said chamber and said tube being at a point in the latter where its diameter is not less than the diameter of the lifter-jet, and means for placing both the lifter and the
10 forcer in and out of operation, the forcer acting as a lifter when the lifter is out of operation.

12. An injector, having a lifter and a forcer, and two chambers, communication between which exists only through the combining-tube 20 of the forcer, one of said chambers being in communication with the lifter and the other with the atmosphere.

In testimony that we claim the foregoing we have hereunto set our hands.

FRANKLIN WILLIAM KREMER.

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