(Model.)

S. L. KNEASS.

INJECTOR.

No. 541,620. Patented June 25, 1895.

Fig. 2.

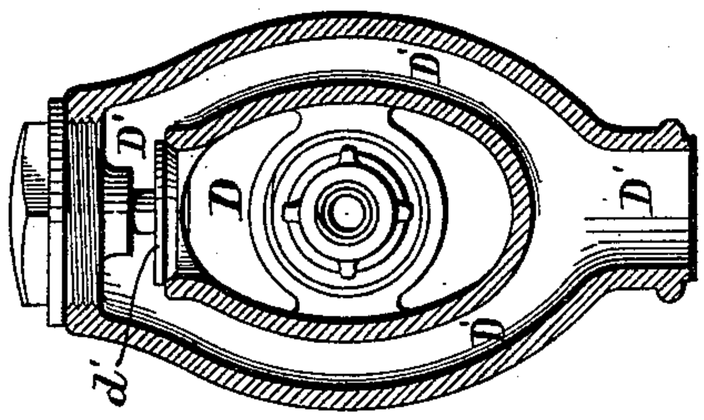
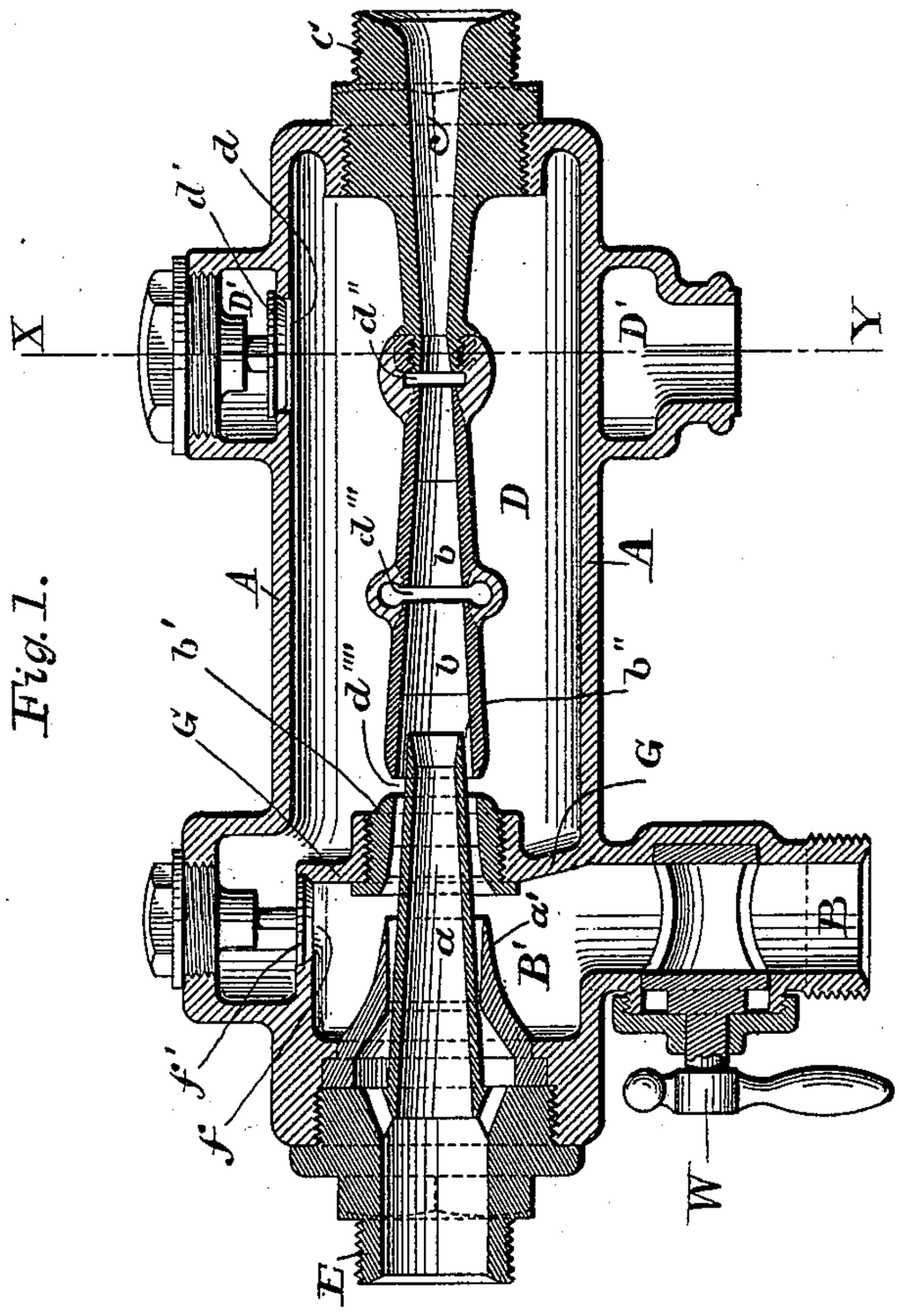


Fig. 1.



WITNESSES:

E. W. Harper

W. F. Coff

INVENTOR

Frederick S. Kneass

UNITED STATES PATENT OFFICE.

STRICKLAND L. KNEASS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE WILLIAM SELLERS & COMPANY, INCORPORATED, OF SAME PLACE.

INJECTOR.

SPECIFICATION forming part of Letters Patent No. 541,620, dated June 25, 1895.

Application filed April 20, 1895. Serial No. 546,528. (Model.)

To all whom it may concern:

Be it known that I, STRICKLAND LANDIS KNEASS, of the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Injectors, of which the following is a specification.

My invention relates to that form of injector in which the receiving end of the combining tube, and one or more of its additional openings, are contained in one chamber, and the description which follows will apply especially to that type in which two jets of steam or other actuating fluid are placed in the same axial line, so that the velocity of the water or other liquid may be constantly accelerated until it has acquired sufficient velocity to enter the boiler.

All injectors in which the nozzles are fixed and the areas of steam discharge and of water entrance to the combining tube are constant, have a steam pressure which is hereinafter called the limiting steam pressure, at which the maximum quantity of water will be delivered to the boiler, and above which, under the same conditions of water supply pressure and temperature, the capacity will decrease as the steam pressure is raised. During the operation of an injector, the absolute pressure within the upper part of the combining tube where the steam jet comes in contact with the cold water supply, is always lower than the pressure in the supply chamber, owing to the partial vacuum caused by the condensation of the steam, and it is this difference in pressure which causes the supply water to flow into the receiving end of the combining tube. As the area of this opening into the combining tube is constant, and the difference in pressure is at its maximum when the limiting steam pressure is reached, any increase in the weight of steam discharged, due to a rise in the steam pressure, will not be met by a corresponding increase of the inflow of the supply water to the combining tube, but, on the contrary, the less complete condensation of the steam in the upper part of this tube will reduce the difference in pressure and the inflow of feed will be lessened. Whenever an insufficient supply of water is provided, immediate condensation of the steam is not effected within the combining tube, and the low internal pressure will be communicated to and maintained in the surrounding overflow chamber, if provided with a suitable valve against the admission of air.

The limiting steam pressure in the form of injector to which my invention chiefly applies, and which is shown and described in United States Patent No. 376,315, granted to me January 10, 1887, is higher than that of other forms of injectors having fixed areas of admission, because its action depends upon certain relations which are non-existent in other types.

In the form of injector to which reference is made, the two actuating jets are placed in the same axial line and the combining tube of the lifting set discharges directly into the receiving end of the forcing combining tube. The capacity of this injector is much greater than that of its lifting set alone, owing to the fact that when the two sets are working in conjunction, the pressure within the receiving end of the forcing combining tube is reduced considerably below that of the atmosphere by the condensation of the forcing steam jet. These conditions obtain as the steam pressure rises, until the increased discharge from the forcing steam nozzle requires a greater supply of water than the lifting set can force through the fixed area of admission of the receiving end of the forcing combining tube, when the jet in this tube, while passing the apertures which open into the overflow chamber, will produce a partial vacuum at those points, and consequently also in the overflow chamber. Some of the water from the lifting set will then be diverted by this partial vacuum from the receiving end of the forcing combining tube into the overflow chamber, through the opening between the combining tubes of the lifting and the forcing sets, and will submerge the apertures in this forcing tube. The jet in this tube will then draw this water in the overflow chamber into the combining tube through its submerged apertures and carry it into the deliv-

ery tube, thus materially increasing the capacity of the injector. These conditions obtain as the steam pressure rises, until the larger area of the lifting combining tube is just sufficient to supply the additional amount of water necessary for the condensation of the increased steam discharge, when the limiting steam pressure of this form of injector is reached, because the jet in the forcing combining tube requires for any increase in the steam pressure, an additional supply of water, which heretofore could not be provided without interfering with the satisfactory performance of the lifting nozzles at the lower pressures it is frequently desirable to use.

The object of my invention therefore, is to provide an adequate supply of water for the forcing combining tube without interfering with the action of the lifting nozzles, and the nature of my invention consists in providing a communication between the water supply and the overflow chamber, which will permit the admission of a supplemental supply of water to the receiving end of the forcing combining tube and its overflow apertures, without passing through any part of the lifting apparatus. This will be more fully understood by referring to the drawings, which form a part of this specification, in which—

Figure 1 is a longitudinal section of an injector embodying my invention, and Fig. 2 a transverse section upon the line X Y.

The tubes are placed in the same axial line, and the combining tube of the lifting set discharges directly into the receiving end of the forcing combining tube, the latter tube being contained with its apertures in one chamber.

A is the body or casing of the injector, provided with a branch B for the water supply, and branches C for the boiler feed connection and E for the steam inlet. The casing A is divided by the septum G G into two chambers B′ for the water supply which communicates with the water branch B, and the overflow chamber D which contains the receiving end b'' of the forcing combining tube b and its apertures.

a is the forcing steam nozzle, and a' is the lifting steam nozzle.

b is the forcing combining tube provided with the apertures d'' and d'''.

b' is the combining tube of the lifting set, and d'''' the aperture between the combining tube of the lifting set and the receiving end of the forcing combining tube.

c is the delivery tube through which the jet passes into the boiler feed pipe.

f is the port connecting the water supply chamber B′ and the overflow chamber D for the admission of the supplemental water supply, and f' is a light check valve placed in this port to prevent cutflow from the overflow chamber.

d is the outlet port from the overflow chamber D which communicates with the air through the cored passage D′. The port d contains the check valve d' to prevent influx of air when the pressure within the chamber D is lower than that of the atmosphere.

W is a water supply regulating valve and is placed in the branch B for the purpose of regulating the capacity of the instrument to suit the requirements of the boiler.

The operation of the injector and of the supplemental water supply valve is as follows: The body of the instrument is intended to be placed horizontally and so that the valves f' and d' will gravitate easily to their seats as soon as the excess of pressure beneath them is relieved, or, if this is impossible, light springs should be placed upon their upper faces, so that under neutral conditions they will be held against their seats. Steam is admitted through the branch C and flows through the forcing nozzle a and the lifting steam nozzle a' into the overflow chamber D, where sufficient pressure is produced to raise the overflow valve d' from its seat, and also to press the supplemental water supply valve firmly upon its seat, which tendency is still further increased by the lowered pressure in the water supply chamber B′. The suction produced by the rapid and free discharge of the steam through the lifting combining tube b', raises the supply water to the lifting nozzles through which it is forced into the receiving end of the forcing combining tube b. It there meets the discharge from the forcing steam nozzle which drives it through the combining and delivery tubes into the boiler. Now if the condition produced by the action of the jet while passing through the forcing combining tube is such that the absolute pressure within the overflow chamber is less than that of the liquid in the water supply chamber, the valve f' will be raised from its seat and an influx of water will occur through the port f from the supply chamber, which will submerge the apertures in the forcing combining tube and will be drawn through them into the tube and be carried by the jet into the boiler.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An injector in which the actuating steam is divided into two or more jets and includes an overflow chamber which contains the receiving end and one or more apertures of a forcing combining tube, an outlet port to the air, and a supplemental inlet port from the water supply, the combination being and operating substantially as and for the purpose set forth.

2. An injector in which the actuating steam is divided into two or more jets and includes an overflow chamber which contains the receiving end and one or more apertures of a forcing combining tube, an outlet valve to the air, and a supplemental inlet port from the

water supply, the combination being and operating substantially as and for the purpose set forth.

3. An injector in which the actuating steam is divided into two or more jets and includes an overflow chamber which contains the receiving end and one or more apertures of a forcing combining tube, an outlet valve to the air, and an inlet valve from the water supply, the combination being and operating substantially as and for the purpose set forth.

STRICKLAND L. KNEASS.

Witnesses:
E. R. HARPER,
W. H. WOLF.