(Model.) 2 Sheets—Sheet 1.

# P. BROWNLEY & F. STICKER.

## STEAM INJECTOR.

No. 571,719. Patented Nov. 17, 1896.

Fig. 2.

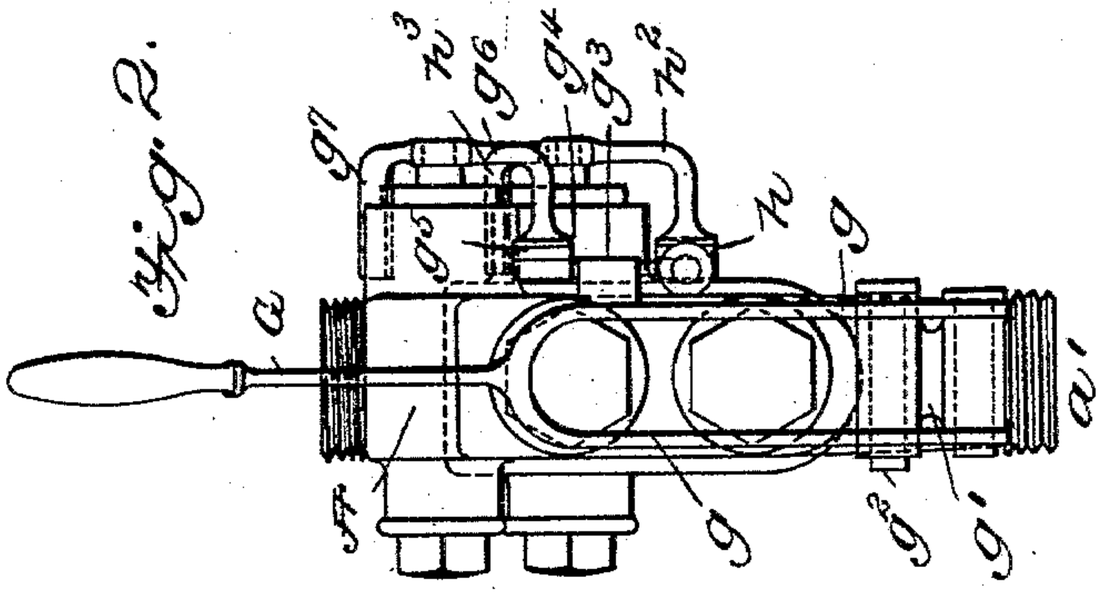
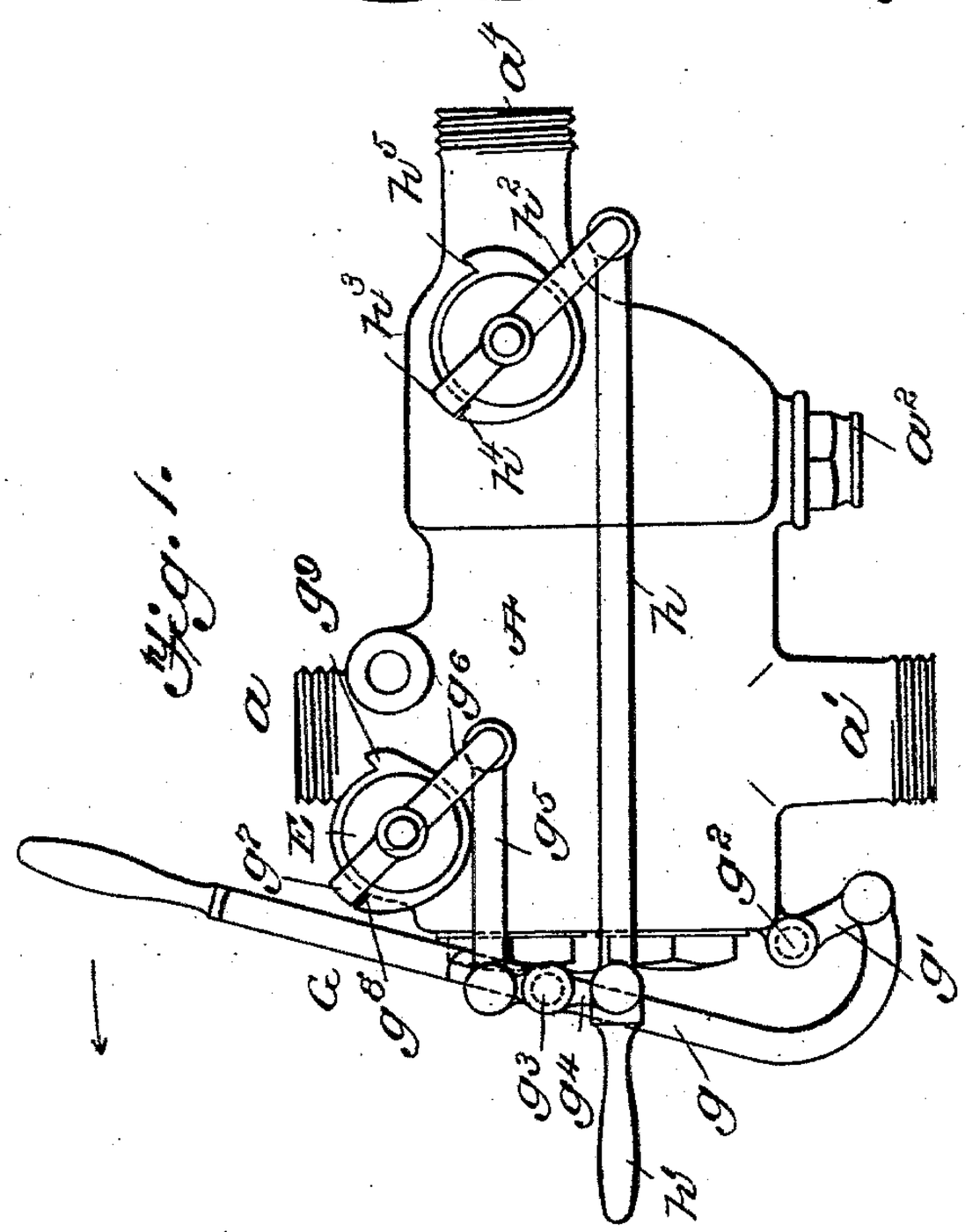



Fig. 1.

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(Model.) 2 Sheets—Sheet 2.

# P. BROWNLEY & F. STICKER.

## STEAM INJECTOR.

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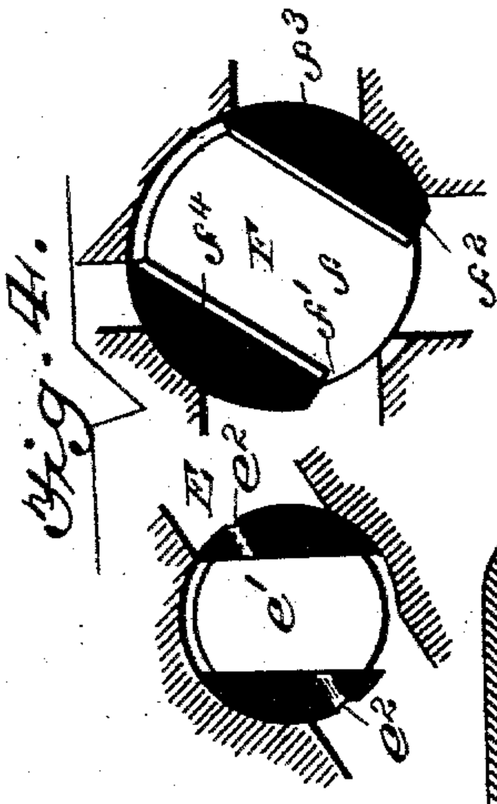

Fig. 4.



Fig. 3.



Fig. 5.

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# UNITED STATES PATENT OFFICE

PATRICK BROWNLEY AND FRANCIS STICKER, OF NEW YORK, N. Y., ASSIGNORS TO THE BROWNLEY MANUFACTURING COMPANY, OF NEW JERSEY.

## STEAM-INJECTOR.

SPECIFICATION forming part of Letters Patent No. 571,719, dated November 17, 1896.

Application filed April 17, 1896. Serial No. 287,926. (Model.)

*To all whom it may concern:*

Be it known that we, PATRICK BROWNLEY and FRANCIS STICKER, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Steam-Injectors; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to steam-injectors, having reference to the class known as "double-jet" or "lifting and forcing" machines.

In a concurrent application for patent of Patrick Brownley filed April 17, 1896, Serial No. 587,928, it has been fully set forth how the starting and working capacity of a double-tube injector is increased by supplying steam simultaneously to both the "lifter" and the "forcer," the latter serving, in conjunction with the former, to lift the water in starting the injector. In said application it is also pointed out that this result is capable of successful accomplishment by reason of the fact that no check-valve for the overflow is employed, the only pressure to be overcome being that of the atmosphere.

In the present invention it is sought to control the working capacity of the injector by regulating the quantity of steam supplied to the machine, making the supply of water commensurate therewith, the action of the lifter and forcer being uniform. This we accomplish by means of a steam-inlet cock having ports of different capacity, said cock being under the control of a single lever. By the employment of a cock in lieu of a valve the injector can be easily started and controlled, as there is but little pressure to overcome in turning the cock, the latter presenting substantially no resistance.

A further object is to so connect the steam-inlet cock with the overflow-cock that both cocks will work in unison, or said steam-inlet cock may be adjusted without affecting the position of the overflow-cock. The latter is substantially like the form shown in Letters Patent No. 513,378, granted to Patrick Brownley January 23, 1894, and exactly like the cock described in the before-mentioned application for patent. This cock is connected to the operating-lever by a rod which can be moved with or independently of said lever, or the latter may be moved independent of said rod, as when it is desired to change the position of the steam-inlet cock without adjusting the overflow-cock or to turn the latter without moving the former. In this way the head or supply of steam is readily and easily regulated, or by means of said rod the overflow-cock can be held stationary and the inlet-cock opened to its full capacity, thereby causing the steam to heat the water in the suction-pipe.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation of our improved injector. Fig. 2 is an end view thereof. Fig. 3 is a central vertical longitudinal sectional view. Fig. 4 shows the relative positions of the steam and overflow cocks after lifting water. Fig. 5 shows the positions of said cocks when the injector is working.

Referring to the drawings, A designates a casing or casting; $a$, the steam-inlet; $a'$, the water-inlet; $a^2$, the overflow-opening; $a^3$, the channel leading to the latter, and $a^4$ the outlet-opening leading to the boiler.

B designates the forcer, composed of the usual steam-tube $b$, combining-tube $b'$, and delivery-tube $b^2$, and C is the lifter, comprising the steam-tube $d$, combining-tube $d'$, and delivery-tube $d^2$. The two steam-tubes are mounted in one of the walls $d^3$ of a steam-chamber D, into which latter extends the steam-inlet $a$.

E is the steam-inlet cock, located at the top of steam-chamber D and extending transversely through the casing, said cock fitting and rotatable on an interior curved seat $e$ of said casing. This cock is formed with a transverse port or opening $e'$, the walls of which are slightly tapered, said opening being designed when the cock is so turned to its full extent to coincide with the branches of the steam-chamber intercepted by said cock. A second very small port is also formed in this cock, said port consisting of two correspond-

ing small holes $e^2$, in line with one another, formed in the solid sides $e^3$ $e^4$ of the cock. The seat $e^5$ of the latter is such that by giving to the cock a slight turn, as in starting the injector, only this small port will be brought into line with the branches of the steam-chamber, thus allowing but a small quantity of steam to pass to the injector; but by giving a further turn to said cock the large port or opening $e'$ is caused to coincide with said branches, thus permitting the full head of steam to pass to the machine. This quantity, however, can be controlled by giving a reverse movement to the cock sufficient to cover up or close portions of the port or opening $e'$ thereof. It will be noted that no valve is used for controlling the admission of steam to the forcer independently of the supply to the lifter. Hence the supply to both sets of jets is always uniform. It follows, therefore, that by controlling this steam supply the effect upon the forcer and lifter is equal, thereby regulating the lifting capacity of the injector by the power of the forcer.

F is the overflow-cock located transversely of the casing at the interception of the delivery-chamber of the forcer and outlet to the boiler and the overflow passage-way of the lifter and overflow-opening $a^2$, said cock being provided with a main port or opening $f$ and two cut-aways $f'$ $f^2$, forming additional ports for the overflow from the forcer. When positioned as shown in Fig. 3, the wall $f^3$ of this cock closes the outlet to the boiler, rendering the use of a check-valve unnecessary, and after the water is lifted and the cock partly turned the other wall $f^4$ of said cock instantly cuts off the overflow from the lifter, (see Figs. 4 and 5,) while the ports $f'$ and $f^2$ permit of gradually cutting off the overflow from the forcer, all as fully set forth in the above-noted application for patent. The movement of this overflow-cock is designed to be uniform with that of the steam-inlet cock, and the latter is also capable of being moved independently of the overflow-cock either for the purpose of regulating the supply of steam or of heating the water in the suction-pipe.

G designates a hand-lever having a lower forked end $g$, fulcrumed by links $g'$ to the lower portion of the casing at $g^2$. On a side stud $g^3$ of this lever is loosely mounted a bar $g^4$, to the upper end of which is connected one end of a pitman $g^5$, the other end of the latter being connected to an arm $g^6$, carried by the steam-inlet cock E. The other end of this arm is bent to form a finger $g^7$, designed to engage stops $g^8$ and $g^9$ to limit the movements of the cock. To the lower end of this pivoted bar $g^4$ is pivotally connected a long rod $h$, having a handled end $h'$, the other end of said rod being connected to an arm $h^2$, carried by the overflow-cock F. The free end of this arm is also bent to form a finger $h^3$ to limit the movement of the cock by engaging stops $h^4$ and $h^5$. In drawing outward on the lever G the two cocks E and F are caused to rotate, the former in advance of the latter, and after the lever has reached the outer limit of its movement or before being moved the operator can, by grasping and holding the handled end of rod $h$, hold the overflow-cock as against turning and move the steam-inlet cock independently, the bar $g^4$ turning on its pivotal connection to said rod.

In practice when the machine is not in use the two cocks occupy the positions shown in Fig. 3, the lever and its connections to said cocks being as shown in Fig. 1. It is obvious that any movement of the lever will first affect the steam-inlet cock before moving the overflow-cock. Hence in operation the operator just pulls outward on the lever to a slight extent, causing the rotation of the steam-cock sufficient to throw the small port in line with the branches of the steam-chamber, thus admitting but a small head of steam to the two sets of tubes. The steam passing through the latter and through the respective overflow-outlets of the lifter and forcer to the overflow-opening overcoming atmospheric pressure a vacuum is created within the machine, causing the water to be lifted thereinto. As this is accomplished the lever is further moved outward, throwing the two cocks into the positions shown in Fig. 4, the overflow-cock instantly cutting off the overflow of the lifter and gradually closing that of the forcer, and upon further moving said lever the main port of the steam-inlet cock is brought into position with the branches of the steam-chamber, allowing a full head of steam to pass to the machine, and at the same time the overflow-cock is brought into the position shown in Fig. 5, opening up direct communication between the delivery-chamber of the forcer and the boiler-outlet, the overflow-openings being entirely closed by the solid sides of said valve. There being no valve to unseat and the steam having to overcome only the atmospheric pressure, both sets of tubes will act conjunctively in lifting the water. The overflow-cock works in unison with the steam-inlet cock, and the latter effects the positive and certain cutting off of the overflow from the lifter, and after that of the machine in general, concurrent with the opening of the steam-inlet cock. Hence the injector will work as a non-lifter as well as a lifter, the supply of steam to both sets of tubes being equal.

In order to reduce the capacity of the machine, the operator grasps the handled end of rod $h$, so as to prevent movement of the overflow-cock, and then moves the lever inward to close the port of the steam-inlet cock to the desired extent, thus curtailing the steam supply. This is very important, as it not only results in the reduction of the steam to the lifter and thereby reduces the capacity of the machine, but acts at the same time as a governor and steam-saver for the

forcer, the latter needing less steam commensurate with the decreased supply of water. In this way we are enabled to adjust the steam-inlet cock independent of the overflow-cock and thereby regulate the steam supply and consequently the working of the injector.

In order to heat the water in the suction pipe or tank, the operator while the machine is working grasps the lever so as to hold it firm and pushes inward on rod *h*, causing the cock F to break the column of steam and water, resulting in the steam passing down into the suction-pipe, heating the water therein.

The advantages of our present invention are apparent. It will be observed that we use but two cocks, one for controlling the steam-inlet and the other for the overflow and supply to the boiler. These cocks are easily operated, having substantially no resistance to their turning, and are movable in unison and independently. It is well known with what difficulty injectors are started when full pressure of steam is against the series of valves; but this we avoid by using cocks which can be turned in either direction without difficulty. The lifting of the water is effected by but a small head of steam supplied through the small port of the inlet-cock, the steam passing to both the lifter and the forcer, and as the water is lifted the overflows are closed and a full head of steam is supplied through the main port of the inlet-cock.

A steam-injector constructed as herein described is simple and inexpensive and not liable to readily get out of order.

We claim as our invention—

1. A double-tube injector having a single steam-chamber common to both the lifter and forcer and a steam-inlet cock having two steam-ports of different sizes, both of said ports being designed to open into said steam-chamber, and means for turning said cock, substantially as set forth.

2. A double-tube injector having a single steam-chamber common to both the lifter and forcer and a steam-inlet cock having a wide transverse port or opening and a smaller port arranged diagonally to said former port or opening, both of said ports being designed to open into said steam-chamber, and a lever for turning said cock, as set forth.

3. A double-tube injector having a single steam-chamber common to both the lifter and the forcer, a steam-inlet cock located in the top of said steam-chamber, a second cock for controlling the overflow and the passage to the boiler, and connections between said cocks, substantially as set forth.

4. A double-tube injector having a steam-chamber common to both the lifter and forcer, a steam-inlet cock located in the top of said steam-chamber, a second cock for controlling the overflow and the passage to the boiler, an operating-lever and connections between said lever and said cocks, whereby the latter may be moved in unison, or independently, as set forth.

5. A double-tube injector having a steam-chamber common to both the lifter and forcer, a steam-inlet cock located in the top of said steam-chamber, a second cock for controlling the overflow and the passage to the boiler, an operating-lever, a rocking bar mounted thereon, and connections between the ends of said rocking bar and said cocks, substantially as set forth.

6. A double-tube injector having a steam-chamber common to both the lifter and forcer, a steam-inlet cock located in the top of said steam-chamber, a second cock for controlling the overflow and the passage to the boiler, an operating-lever, a rocking bar mounted thereon, arms carried by said cocks, a pitman connecting the arm of the steam-inlet cock to one end of said rocking bar, and the handled rod connecting the other end of said rocking bar to the arm of said overflow-cock, substantially as set forth.

7. In a lifting and forcing injector having a single cock for controlling the overflow and the passage to the boiler, a steam-inlet cock having ports of different capacities, and means for moving said cocks in unison and independently, as set forth.

8. In a lifting and forcing injector having a single cock for instantly cutting off the overflow of the lifter and gradually that of the forcer, a steam-inlet cock having ports of different capacities, and a lever connected to both of said cocks, substantially as set forth.

9. In a lifting and forcing injector having a single cock for instantly cutting off the overflow of the lifter and gradually that of the forcer, a steam-inlet cock having ports of different capacities, a lever, connections between said lever and both of said cocks the connection between said lever and said steam-inlet cock permitting the latter to be moved independently of the other cock, substantially as set forth.

10. A lifting and forcing injector having steam-inlet and overflow cocks extended transversely through the machine, arms carried by said cocks having bent ends, stops designed to be engaged by said ends, and an operating-lever connected to both of said arms, substantially as set forth.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

PATRICK BROWNLEY.
FRANCIS STICKER.

Witnesses:
LOUIS O. VAN DOREN,
WILLIAM SMITH.