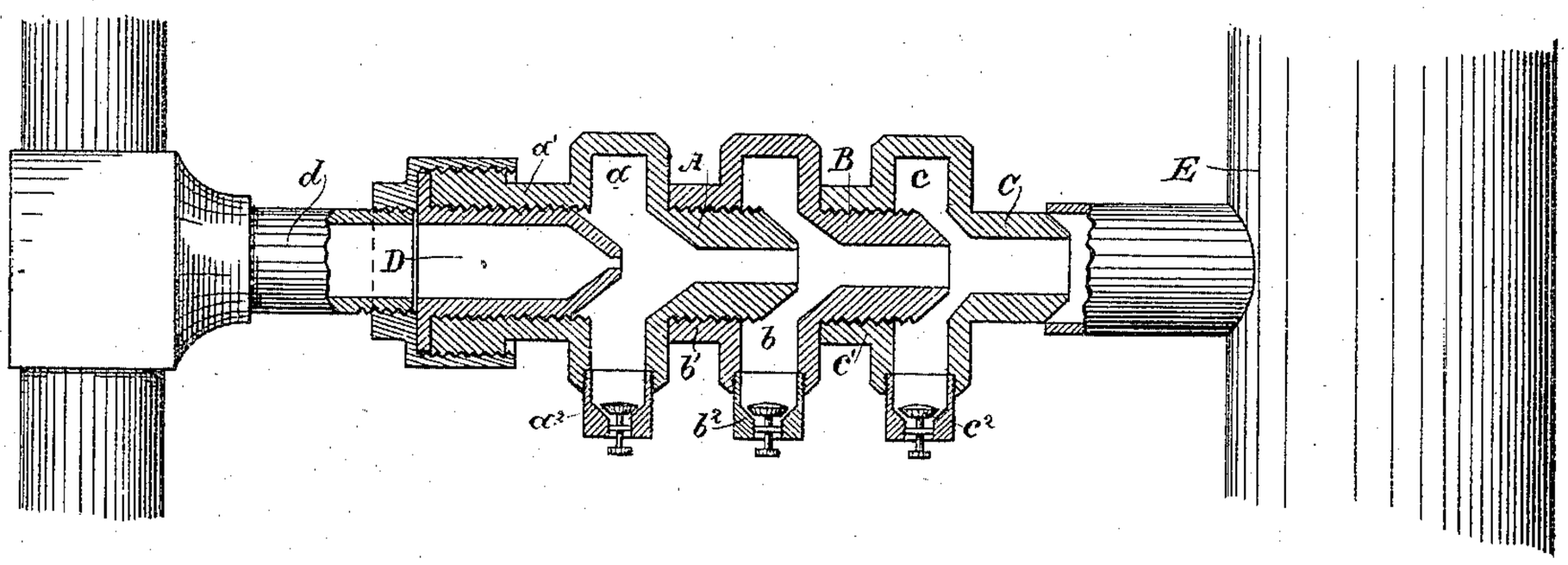
(Model.)

# J. W. STANLEY.

## INJECTOR.

No. 500,677. Patented July 4, 1893.

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# UNITED STATES PATENT OFFICE.

JAMES W. STANLEY, OF OAKLAND, CALIFORNIA.

## INJECTOR.

SPECIFICATION forming part of Letters Patent No. 500,677, dated July 4, 1893.

Application filed January 19, 1893. Serial No. 458,955. (Model.)

*To all whom it may concern:*

Be it known that I, JAMES W. STANLEY, a citizen of the United States, residing at Oakland, Alameda county, State of California, have invented an Improvement in Injectors; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of injectors formed in graduated series, and it consists essentially in a series of removably connected nozzles with air chambers, said nozzles increasing in capacity of opening from the one which connects with the source of supply to the one which connects with the discharge.

It further consists in the novel construction of said nozzles, as I shall hereinafter fully describe and specifically claim.

The general object of my invention is to provide an injector capable of regulation, according to the necessities of the case, and the particular object is to provide such an injector as will regulate itself automatically in accordance with the power required.

Referring to the accompanying drawing for a more complete explanation of my invention,—the figure is a longitudinal section of my injector.

A is a nozzle having at its base a suitable air chamber *a* with an air inlet or inlets, and a rearward projection *a'* adapted to receive the nozzle D connected with the pipe *d*, which represents the communication from the source of steam or other medium under pressure.

B is a second nozzle, having a capacity of opening greater than that of nozzle A. This nozzle has also a suitable air chamber *b* with air inlet, and a rearward projection *b'* adapted to receive nozzle A.

C is a third nozzle having a capacity of opening greater than that of nozzle B. It has also a suitable air chamber *c* with air inlet and a rearward projection *c'* adapted to receive nozzle B. The series of nozzles of gradually increasing capacity may be multiplied indefinitely, but three are sufficient for the purposes of illustration. The nozzle C connects with the delivery pipe E. The connection between the several nozzles of the series is a removable one of any suitable character, whereby the nozzles may be made independent and may be connected together in varying series to suit particular needs. A good form of connection is here shown, wherein the nozzles screw into the rearward projections. From this separability of these nozzles of varying capacities flow the following advantages: When they are united in maximum number, a series is formed having a capacity for a maximum volume of air drawn in, but the pressure is in inverse ratio, being the minimum pressure. By diminishing the number of nozzles and forming a series of a minimum number, a minimum volume of air is obtained, but with a maximum pressure. Between these limits, by forming series of a greater or less number of nozzles, the volume and pressure can be varied as needs may be. There can also be formed a series having the increase in nozzle capacity more or less pronounced or gradual, thereby still further regulating the volume of pressure. The separability of the nozzles is also of advantage in permitting them to be readily cleaned and kept clean on the inside, thereby avoiding friction. The best construction of these nozzles is that here shown, in which a capacious air chamber is formed by an annular enlargement at the base of the nozzle, and in a plane at right angles to the line of projection of the nozzle, and back of this chamber is formed the projection which serves as a seat for the next nozzle. This form of air chamber enlarged, and in a plane at right angles, gives sufficient room for the valve controlling the air inlet, and yet allows the nozzle of the steam pipe to be set up close enough to the first section to admit the quantity of air which the momentum of the steam is capable of carrying through said first section, whose nozzle is a little larger than the steam nozzle. The air chamber being at a point back of the steam nozzle allows the air to enter all around that nozzle. This applies to all the sections, and the momentum of the steam carries the air with it through the series of sections. The air chamber being in the rear of the nozzles and each nozzle being close enough to perform its work, the steam has not a chance to expand much and as a result it keeps up a better momentum and carries with it a greater volume and greater pressure of air. These results could not be obtained were the nozzles fitted directly into chambers no larger than their

seats, for in such case the nozzles would have to be a greater distance from each other, to give room for the air inlets. This would throw the chambers in front of the nozzles, and the steam expanding would lose its momentum, and would necessitate larger nozzles, nor would the air be in the best position to be carried along, being rather forced than drawn. The air-inlets to these air chambers may be of any suitable character, one or more in number, and suitably located, but for the automatic regulation of the injector, it is sufficient to have one inlet for each chamber, as shown, and to control this inlet by an inwardly opening check valve. These valves are here shown and designated by the letters $a^2$, $b^2$ and $c^2$. The discharge from the steam nozzle D passing through nozzle A, causes the valve $a^2$ to open and thus to admit air. The combined steam and air are forced through nozzle B, and the valve $b^2$ opening, the volume of air is increased. Likewise in nozzle C. If, from any cause, the pressure in the delivery pipe E should increase, then to overcome the resistance in nozzle C, caused by this pressure, the check valve in said nozzle which, being the largest, has the least resistance, will close. If the pressure in delivery pipe should further increase, the resistance in nozzle B being the next smaller in size is overcome by the closing of its check valve $b^2$. Then if there should be a further increase in pressure, the valve of nozzle A will close. The reverse is also true. When the pressure in the delivery pipe decreases the valve $a^2$ of nozzle A will first open, and as the pressure continues to decrease the valves $b^2$ and $c^2$ will successively open. Thus the volume and pressure are automatically varied according to the necessities of the case.

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

1. An injector composed of a series of independent separable nozzles, each having at its base an enlargement in a plane at right angles to the line of projection of the nozzle, forming an air chamber, said chamber having suitable valved air inlets, and a rearward projection forming a bearing or seat for the next nozzle, substantially as herein described.

2. An injector composed of a series of independent separable nozzles, increasing in capacity of aperture from the receiving nozzle of the series to the discharging nozzle, each nozzle having at its base an enlargement in a plane at right angles to the line of projection of the nozzle forming an air chamber, said chamber having suitable valved air inlets, and a rearward projection forming a bearing or seat for the next nozzle, substantially as herein described.

3. An injector composed of a series of independent separable nozzles having suitable air chambers with an air inlet and a check valve controlling said inlet, the apertures of the several nozzles increasing in capacity from the receiving nozzle of the series to the discharging nozzle, substantially as herein described.

4. An injector composed of a series of independent separable nozzles increasing in capacity of aperture from the receiving nozzle of the series to the discharging nozzle, each nozzle having at its base an enlargement in a plane at right angles to the line of projection of the nozzle forming an air chamber, said chamber having an air inlet and a check valve controlling said inlet, and a rearward projection forming a bearing or seat for the next nozzle, substantially as herein described.

In witness whereof I have hereunto set my hand.

JAMES W. STANLEY.

Witnesses:
JAS. T. NORTON,
WM. F. STANLEY.