(No Model.)

2 Sheets—Sheet 1

# L. SCHUTTE.

## AUTOMATIC JET APPARATUS.

No. 434,997. Patented Aug. 26, 1890.

Fig. 2.
on line 4-4

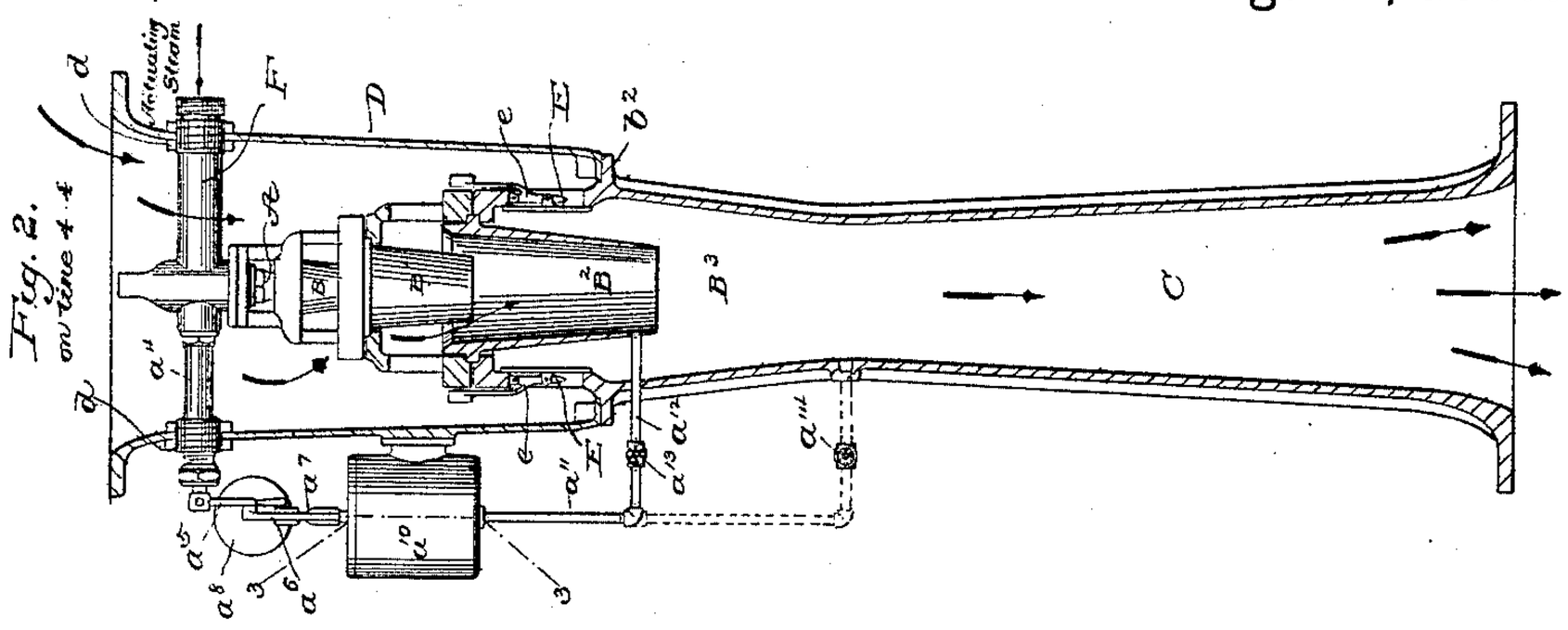



Fig. 3.
on line 3-3

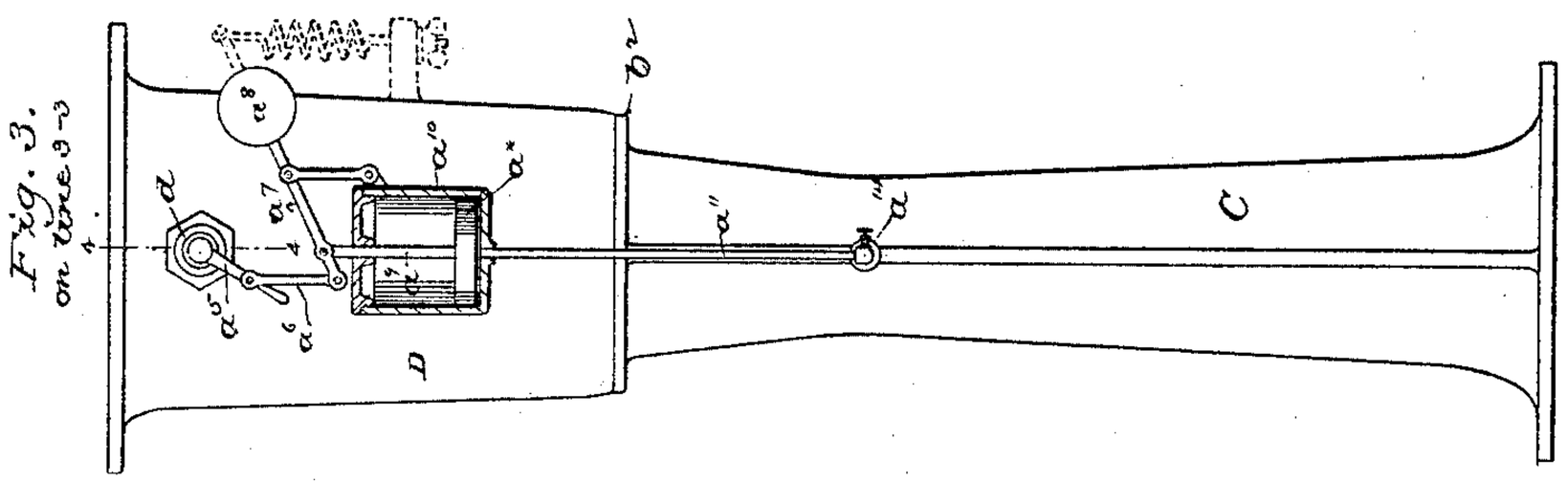
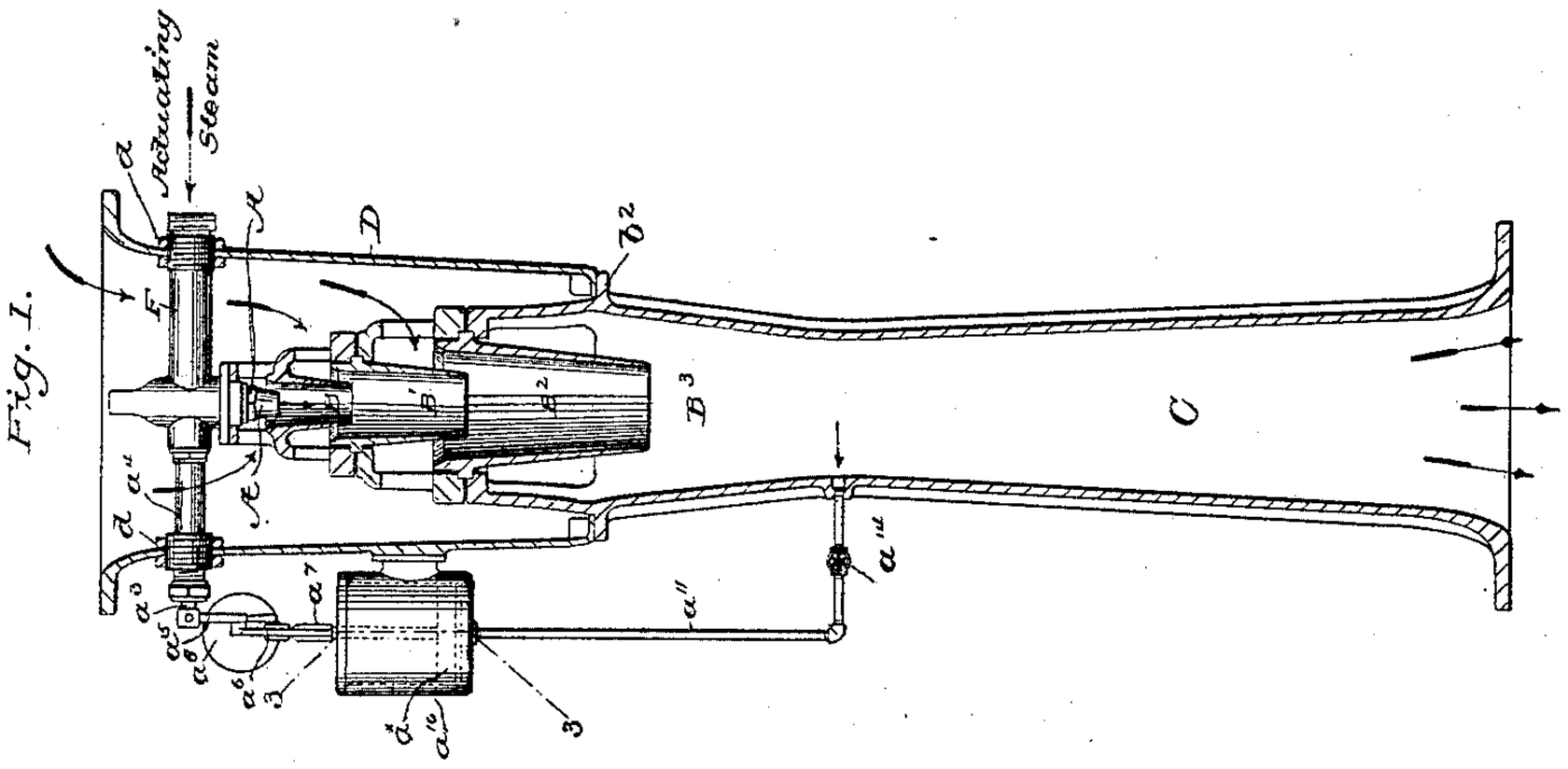



Fig. 1.




**WITNESSES**

M. R. Kennedy
F. Stanley Elmore.

**INVENTOR**

Louis Schutte,
By Phil T. Dodge Atty

(No Model.) 2 Sheets—Sheet 2.

# L. SCHUTTE.

## AUTOMATIC JET APPARATUS.

No. 434,997. Patented Aug. 26, 1890.

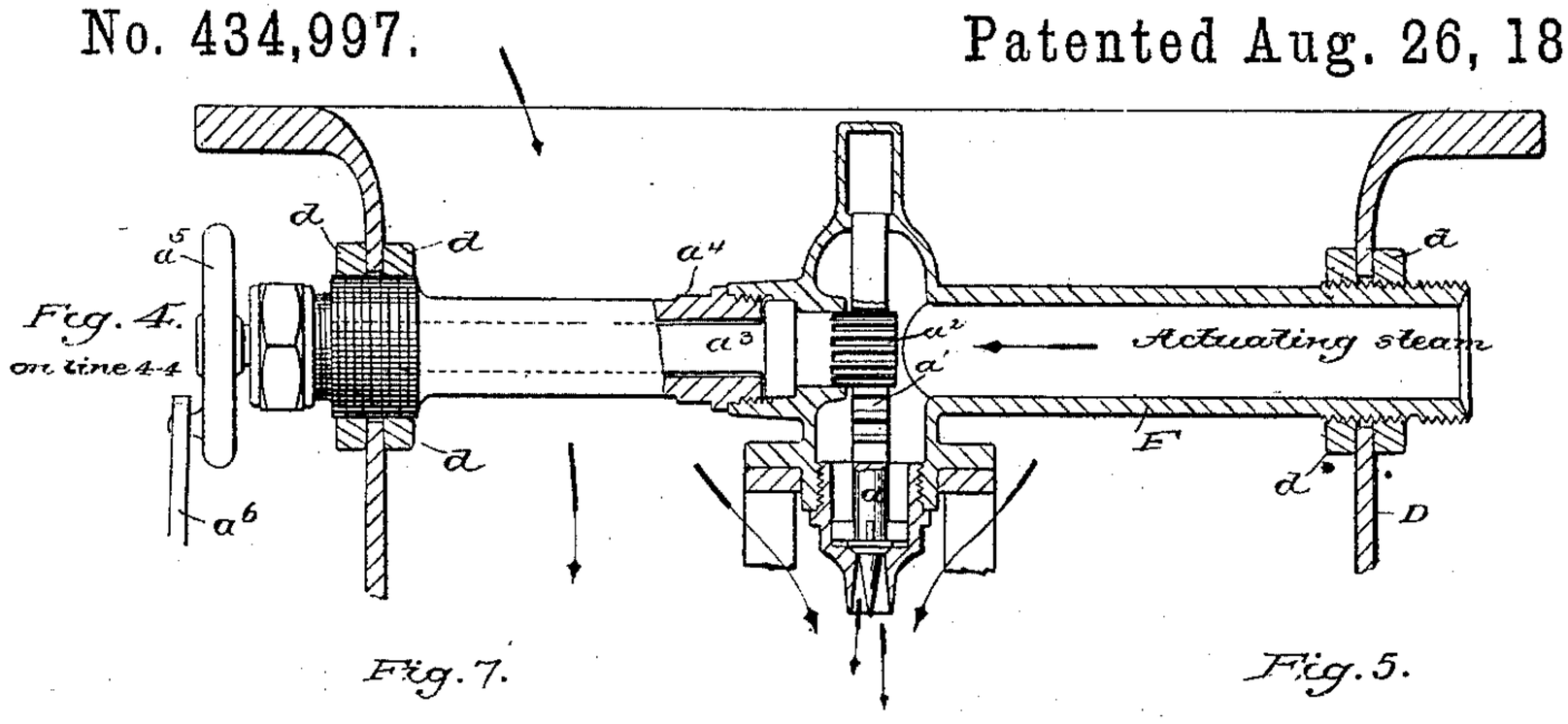



Fig. 4.
on line 4-4

Fig. 7.

Fig. 5.

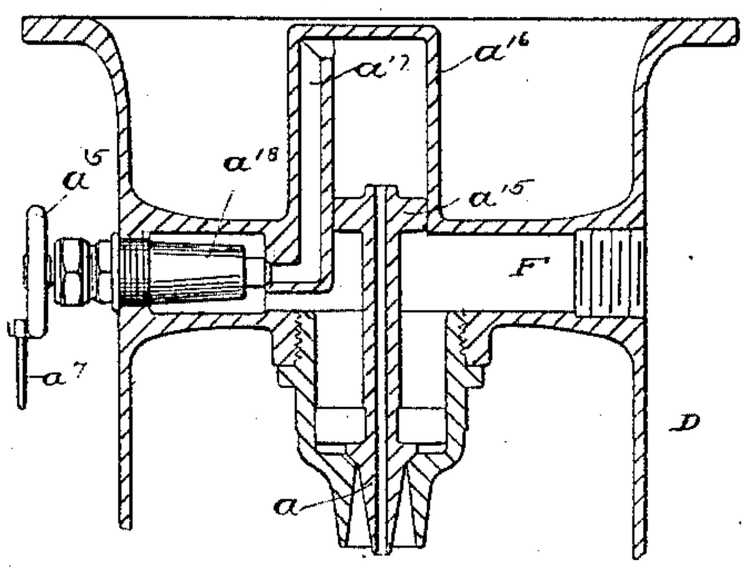



Fig. 8.

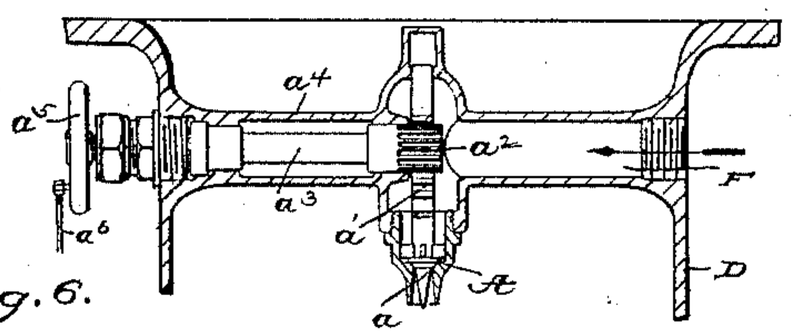
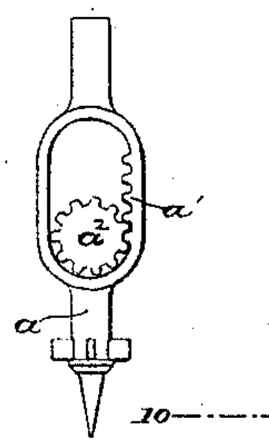



Fig. 6.



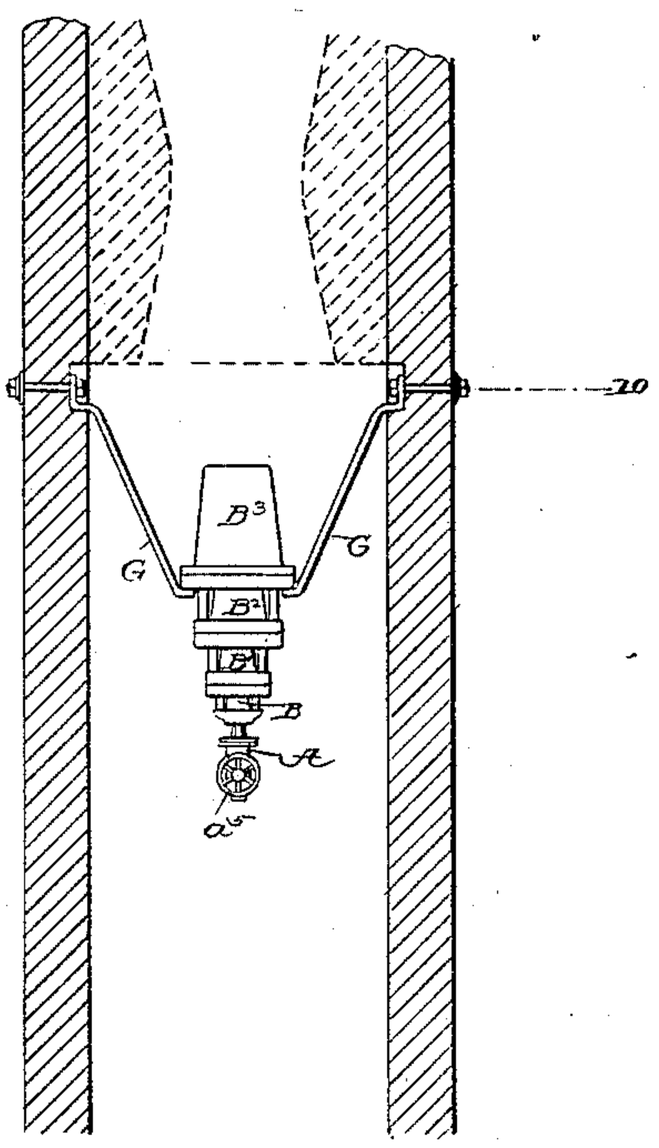




Fig. 9.

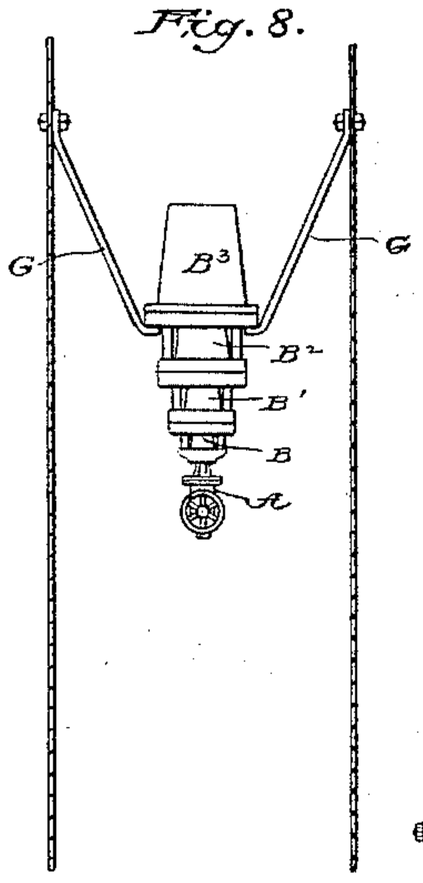
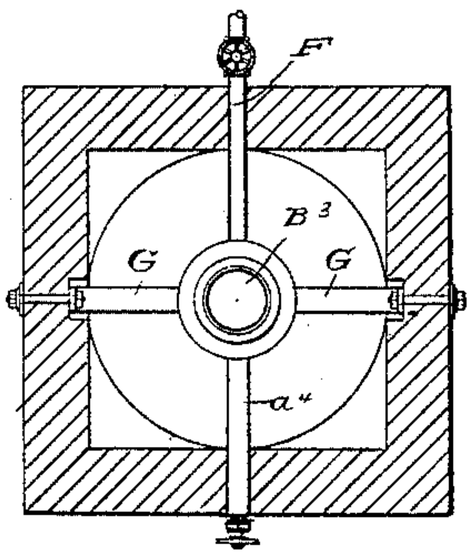



Fig. 10.
on line 10-10.




**WITNESSES**

W. R. Kennedy.
F. Stanley Elmore

**INVENTOR**

Louis Schutte
By Phil T. Dodge Atty

# UNITED STATES PATENT OFFICE.

LOUIS SCHUTTE, OF PHILADELPHIA, PENNSYLVANIA.

## AUTOMATIC JET APPARATUS.

SPECIFICATION forming part of Letters Patent No. 434,997, dated August 26, 1890.

Application filed June 5, 1890. Serial No. 354,415. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS SCHUTTE, of Philadelphia, in the county Philadelphia and State of Pennsylvania, have invented certain Improvements in Automatic Jet Apparatus, of which the following is a specification.

My invention relates to that class of apparatus used for exhausting and blowing purposes known under the generic name of "jet apparatus." Such apparatus in its various forms consists, essentially, of a nozzle from which an actuating-jet of steam, air, or gas is projected through a series of so-called "mixing-nozzles" of successively-increasing area, provided with openings through which the air or other fluid to be moved is admitted.

The aims of my invention are, primarily, to effect an automatic regulation of the apparatus and secure a uniform action and rate of delivery under the varying conditions encountered in practice, and consequently to simplify the construction and facilitate access to the interior of the apparatus.

My first improvement is based upon the fact that the volume of the discharge from the apparatus bears a definite relation to the velocity of the current, and this without regard to variations in the counter-pressure or variations against which the discharge is effected. I therefore govern the actuating-jet by the velocity of the current passing through the throat or mixing-nozzle of the apparatus. This I accomplish by utilizing the current to produce a vacuum which will vary in degree according to variations in the velocity and applying the vacuum thus produced through a cylinder and piston or equivalent mechanism to actuate a throttle which controls the actuating-jet. Any change in the velocity of the current from that which gives the proper rate of discharge will be followed by a change in the vacuum, and consequently by an increasing or diminishing discharge from the actuating-nozzle.

I am aware that efforts have been made to control the actuating-jet through mechanism actuated by the pressure at the delivery end of the apparatus; but as this pressure will vary according to variations in the resistance or counter-pressure against which the discharge is effected without reference to the rate or volume of discharge the action is not in all cases satisfactory.

The essence of my invention resides in the fact that I utilize as a means of governing the jet the velocity, as distinguished from the pressure, of the current.

In carrying my invention into effect I may employ as a means of operating the throttle any mechanism adapted to be operated by a vacuum and any device by which the current will produce a vacuum proportioned to the velocity of the current.

In the accompanying drawings, Figure 1 is a longitudinal central section through an apparatus provided with my automatic means for regulating the steam-jet. Fig. 2 is a similar section through the apparatus provided with means for automatically regulating the steam-jet and also with automatic means for changing the area of the air-nozzles. Fig. 3 is a side elevation of the apparatus as shown in the preceding figures, with a portion in section on the line 3 3 of Figs. 1 and 2. Fig. 4 is a vertical central section through the steam-admission device of Figs. 1 and 2, the section being taken on the line 4 4 of Fig. 3. Fig. 5 is a like view showing the same parts in slightly-modified form. Fig. 6 is an elevation of the steam-controlling spindle and its actuating-pinion. Fig. 7 is a vertical section illustrating the steam-controlling spindle and adjacent parts in a modified form, adapted more particularly for apparatus of large size. Figs. 8 and 9 are vertical sections illustrating the mode of suspending my blower in a stack or chimney. Fig. 10 is a cross-section on the line 10 10 of Fig. 9.

Referring to Figs. 1 and 2, A represents the nozzle through which the actuating-jet is delivered, commonly known as the "actuating-nozzle."

B B′ $B^2$ $B^3$ are the series of mixing-nozzles, of successively-increasing area, arranged to discharge each into the next, with annular openings between them for the admission of the air or other fluid to be moved.

C is a discharge-nozzle joined at its smaller end to the smaller or delivery end of the last mixing-nozzle $B^3$.

D is a casing surrounding the series of nozzles.

The foregoing parts, as regards their general construction, arrangement, and operation, are the same as those now in general use.

In order to secure an automatic governing action, I provide the actuating-nozzle A with a tapered controlling-spindle $a$, formed with a rack $a'$, engaging the pinion $a^2$ on the end of a horizontal shaft $a^3$, which is projected outward through a surrounding tube $a^4$, and provided at its outer end with a crank wheel or arm $a^5$, connected, as shown in Figs. 1 and 3, by a link $a^6$ to one end of a link $a^7$, which is mounted on a central fulcrum, and provided at its opposite end with an adjustable weight $a^8$, which tends to open the throttle and increase the volume of the actuating-jet. This lever is connected at its unweighted end to the rod by a piston $a^9$, mounted in a fixed cylinder $a^{10}$, the lower end of which is closed and connected to a tube $a^{11}$, which leads into the apparatus at or near the throat—that is to say, at or near the smaller end of the last mixing-nozzle—where the current passing through the apparatus travels with its greatest velocity.

When the apparatus is operating in a proper manner, there is no pressure at the throat. The current passing the mouth of the pipe $a^{11}$ with a high velocity has an exhausting effect and produces a vacuum therein, causing the piston to descend and, overcoming the weight, hold the throttle of the actuating-nozzle in a nearly-closed position. This condition of affairs continues as long as the jet is sufficient to maintain the proper rate of discharge. If, however, by reason of an increased counter-pressure or other cause the jet becomes insufficient to maintain the discharge, the velocity of the current through the throat will be diminished accordingly, and the vacuum produced by the current will be diminished in degree, and as a consequence the weight will act to open the throttle. The extent of this opening movement will bear an exact relation to the degree of the vacuum, which will in turn bear a definite relation to the velocity of the current. The opening of the throttle will be continued until the velocity of the current through the throat of the apparatus is raised to the proper limit. By adjusting the weight so that it offers more or less resistance the discharge apparatus may be regulated as required.

A pipe tapped into the side of the throat so that the current passes across its nozzle is the most simple contrivance within my knowledge for producing a vacuum by means of the current; but it is to be understood that any of the contrivances known in the art for producing a vacuum or suction by means of a rapidly-moving current may be employed in place of this pipe.

While I prefer to employ the weight as a means of opening the valve, it will of course be understood that a spring may be substituted in the manner shown in dotted lines in Fig. 3, or in any other appropriate manner.

As the connections for operating the throttle are operated by means of a vacuum, they are, for convenience of reference, hereinafter designated simply as the "vacuum mechanism."

Referring to the apparatus represented in Fig. 2, the throttle for the actuating-jet and the vacuum mechanism connected therewith are identical with those represented in the preceding figures. As an additional means, however, of governing the action of the apparatus, I provide the inlet-openings to the last mixing-nozzle $B^3$ with balanced inwardly-opening valves E, which may be of any appropriate construction, and which in the form shown are sustained by weighted links $e$. When the apparatus is working effectively and to the best advantage, these valves are opened by the inflowing air. When, however, the velocity of the current is diminished so that the suction through the openings ceases, the valves close automatically and the end of the nozzle $B^2$ becomes in effect the throat of the apparatus. In order to maintain the proper vacuum when the valves are thus closed, the branch of the vacuum-pipe $a^{12}$ is tapped into the nozzle $B^2$ near its delivery end. This branch and also the main pipe are provided with stop-valves $a^{13}$ and $a^{14}$.

It will be observed that the devices for moving the throttle may be modified in the details of construction at will. In Figs. 1 and 4 the actuating-nozzle is screwed into the end of the steam-supply pipe F, cast integral with the case or shell which incloses the throttle and its actuating-pinions. The tube $a^4$, surrounding the pinion shaft, is screwed into the shell just mentioned. The steam-pipe and the tube are threaded at their outer ends, passed through holes in the surrounding shell D, and secured by nuts or collars $d$. In Fig. 5 I have shown the steam-supply pipe, the shell to inclose the throttle, and the tube to inclose the pinion-shaft as cast integral with the outer shell or casing D. When the apparatus is of large size, it is found advisable to utilize the steam-pressure for moving the throttle, and in Fig. 7 I have represented a construction to this end. The throttle or spindle has an axial opening therethrough, and is provided at the upper end with a piston $a^{15}$, mounted in a cylinder $a^{16}$, which receives steam at its upper end through a port $a^{17}$ from the steam-supply pipe. This port or passage $a^{17}$ is controlled by a secondary throttle $a^{18}$, which has its operating spindle or handle connected to link $a^7$, which is in turn connected with a weighted lever and piston of a vacuum apparatus in the form and manner shown in Figs. 2 and 3. When the velocity of the current through the apparatus diminishes, lessening the vacuum, the secondary throttle $a^{18}$ is closed, and the steam in the cylinder, escaping through the central opening in the main throttle, permits the latter to be opened by the pressure of the steam on the under side of the piston $a^{15}$. On the contrary, an in-

crease in the vacuum due to an increased velocity of the current through the apparatus will cause the secondary throttle $a^{18}$ to open, allowing live steam to pass into the cylinder above the piston $a^{15}$. Whenever this inflow of steam is greater than the discharge through the central opening of the main throttle, the latter ceases. It will be observed that this piston mechanism is simply an equivalent for the rack and pinion shown in the preceding figures for moving the throttle.

In constructing my apparatus I propose to cast the discharge-nozzle C, the last mixing-nozzle $B^3$, and the support for the next mixing-nozzle $B^2$, as shown in Fig. 1, complete in one piece, with an external flange $b^2$, to receive and sustain the casing D. This construction greatly simplifies the apparatus, avoids numerous joints attending the ordinary construction, and admits of the parts being quickly separated to give access to the interior.

In making use of my apparatus in furnace-stacks and chimneys I propose to suspend the same in position to discharge vertically by means of arms or stays G, (see Fig. 8,) extended upward and outward and secured to the inner walls of the stack. These arms stand in vertical planes at right angles to the steam-pipe and throttle inclosing the tube, which are extended through the walls of the stack or chimney, as shown in Fig. 10. By this simple arrangement of parts the apparatus is held firmly in position and slight obstruction offered to the passage of the ascending currents around the same.

In the apparatus as shown in Fig. 8 the discharge-nozzle C is omitted.

Fig. 9 shows the apparatus sustained in a chimney in essentially the same manner as in Fig. 8, but with a contracted throat above the same to serve the purpose of the discharge-nozzle.

Having thus described my invention, what I claim is—

1. In a jet apparatus, and in combination with its actuating-nozzle and one or more mixing-nozzles, a throttle to control the delivery from the actuating-nozzle, and a vacuum mechanism to control the throttle communicating with the interior of the apparatus and exhausted by the current passing therethrough.

2. In a jet apparatus, a throttle to control its actuating-jet, a pipe leading into the interior of the apparatus in position to be exhausted by the outgoing current, and an intermediate mechanism, substantially as shown, through which the vacuum is applied to operate the throttle.

3. In a jet apparatus comprising the actuating and mixing nozzles, the throttle, the weight or its equivalent tending to close the throttle, and the vacuum mechanism to open the throttle, constructed and arranged to be exhausted by the current passing from the nozzles.

4. In a jet apparatus, the throttle to control the actuating-jet, its rack-bar, the pinion, pinion-shaft, and crank on the shaft, in combination with the weighted lever, the cylinder and piston, and the pipe connected at one end to the cylinder and exposed at the other end to the passing current in the apparatus.

5. In a jet apparatus, the exhausting-nozzle, the final mixing-nozzle, the support for a second nozzle, and the support for the external casing, all cast in one piece, as described and shown.

In testimony whereof I hereunto set my hand, this 3d day of May, 1890, in the presence of two attesting witnesses.

LOUIS SCHUTTE.

Witnesses:

DANIEL W. HILDRETH,

MAURICE F. SPILLIN.