

M. CLEMENS.

STOP-NOZZLES FOR FIRE EXTINGUISHING APPARATUS.

No. 174,781.

Patented March 14, 1876.

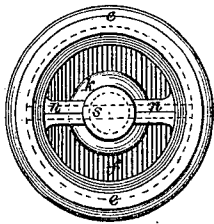


Fig. II.

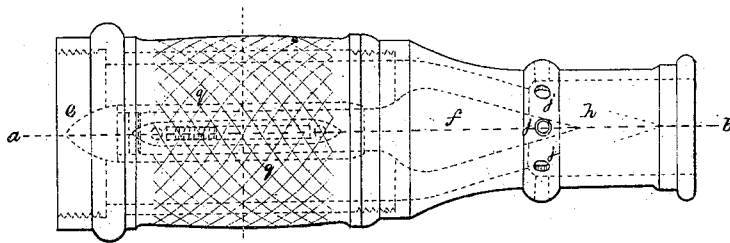


Fig. I.

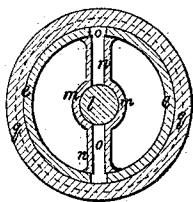


Fig. IV.

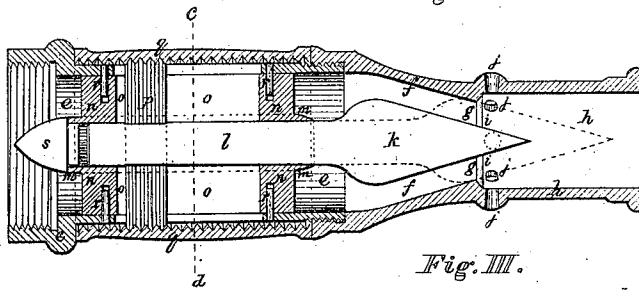


Fig. III.

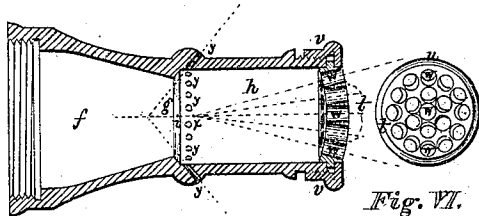


Fig. V.

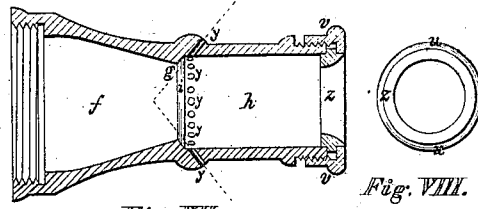


Fig. VII.

Fig. VIII.

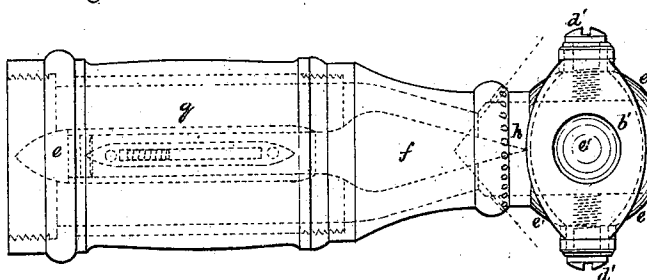


Fig. IX.

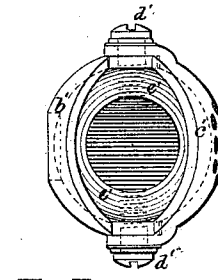


Fig. X.

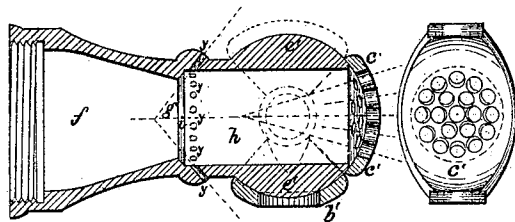


Fig. XI.

Fig. XII.

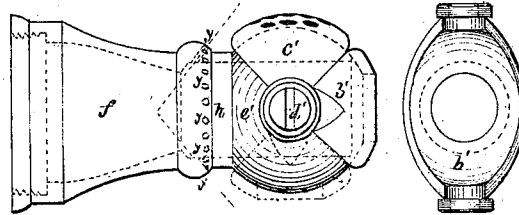


Fig. XIII.

Fig. XIV.

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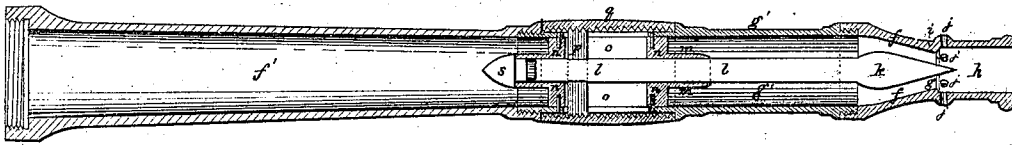


Fig. XV.

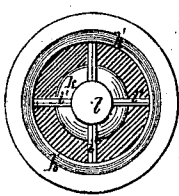


Fig. XVII.

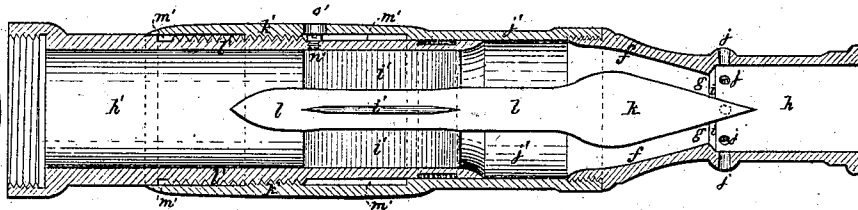


Fig. XVI.

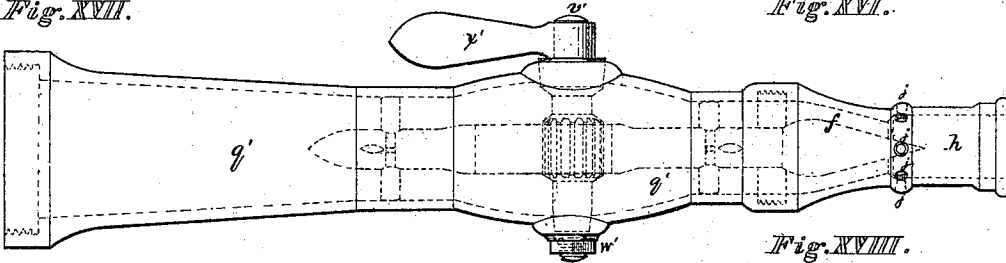


Fig. XVIII.

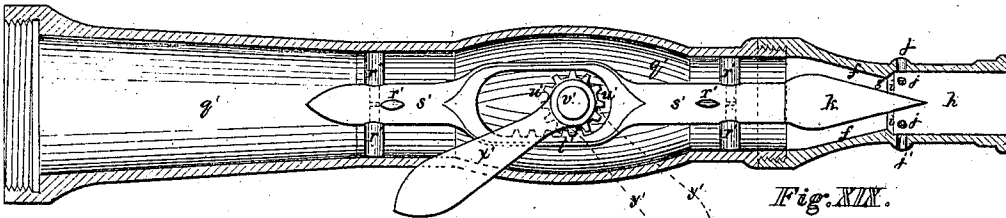


Fig. XIX.

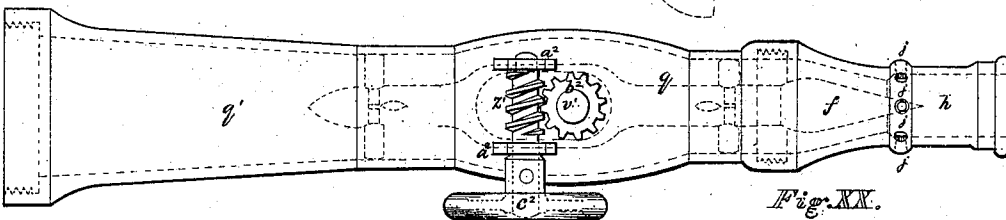


Fig. XX.

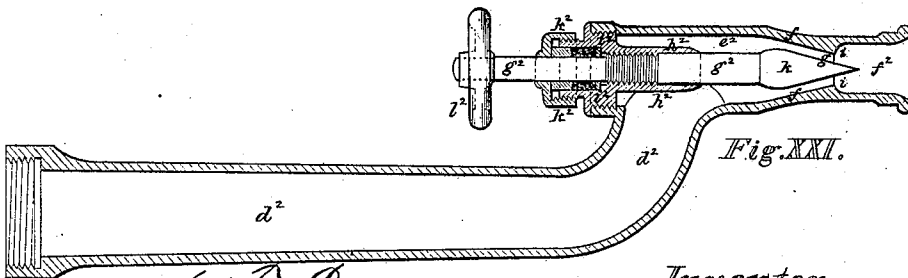


Fig. XXI.

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UNITED STATES PATENT OFFICE

MELVILLE CLEMENS, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN STOP-NOZZLES FOR FIRE-EXTINGUISHING APPARATUS.

Specification forming part of Letters Patent No. **174,781**, dated March 14, 1876; application filed February 15, 1876.

To all whom it may concern:

Be it known that I, MELVILLE CLEMENS, of the city and county of Worcester, State of Massachusetts, have invented Improvements in Stop-Nozzles for Fire-Extinguishing Apparatus; of which the following is a specification:

The characteristic features of my invention are the employment of a pointed cone-valve, placed concentrically in a nozzle ajutage and seating at its discharge-orifice, and adapted to be operated in connection therewith in such a manner that a round and solid stream of water of any required volume, from nearly the full diameter of the discharge-orifice to a small jet, may be formed and projected from the nozzle without cutting off or diminishing the projectory pressure and force of the water at its point of discharge from the nozzle, thus making the nozzle equally efficient in projection of both large and small streams, thereby adapting it for extinguishing large or small fires, as occasion requires, and avoiding the unnecessary damage by water from using inefficiently more water than is required, as is commonly done with the common stop-nozzles in use, which cut off and stop the water back of the discharge-orifice, thereby reducing the projectory pressure of the water at its point of discharge in reducing the stream by them, which renders them inefficient in projection only when fully open.

My invention includes, also, the adaptation of spraying attachments to the nozzle; and it further includes various forms of construction of the nozzle, employing different modes of operating it, in all of which the same characteristic features of forming, regulating, and stopping the stream are employed, as in the original stop-nozzle.

The drawings showing my invention are on two sheets, No. 1 and No. 2, and comprise twenty-one figures, in all of which like letters of reference indicate like parts of the various devices shown.

In the original form of the stop-nozzle shown in Figs. 1, 2, 3 and 4, *e* is the barrel of the nozzle, having a screw-thread cut in its head for attaching it to the discharge-pipe of a hose. To the barrel *e* is screwed fast a nozzle-ajutage, *f*, converging to its discharge-orifice *g*, and

being extended by an enlarged valve-guard tube, *h*, forming an annular shoulder, *i*, at the discharge-orifice, to which air is admitted freely by air-inlet holes *j j*, &c., in the tube *h*.

k is a long-pointed cone-valve, placed and moved concentrically with the axis of the ajutage *f*, and seating at the discharge-orifice *g*, with its pointed end projecting into the guard-tube *h*. The valve *k* is carried and operated by its valve-stem *l*, which is fitted water-tight, but free to be moved in a guide-tube, *m*, supported by wings *n n* in the barrel *e*. A narrow slot, *o*, is formed through the wings *n n* and the barrel *e*, in which slot traverses freely a bar, *p*, which passes through the valve-stem *l* and engages by screw-thread teeth on its ends internal screw-threads of a sleeve, *q*, which is fitted to turn freely on the barrel *e* between projecting flanges of the barrel and the ajutage.

The tube *m* and wings *n n* may be cast in one piece with the barrel *e*, but it is preferable to cast and finish them separately, and to secure the wings in the barrel, as shown, by a driving-fit and steady-pins, *r r*, soldering the joints, if necessary, to make them water-tight.

The wings *n n* are tapered to knife-edges to present least obstruction to the flow of the water over them. The tube *m* is closed water-tight by a pointed plug, *s*.

I make the screw-threads of the sleeve *q* of such a pitch that about three or four revolutions of the sleeve will fully open or close the nozzle, the valve requiring to close slowly to avoid too sudden stopping of the effluxing water-column, and the consequent injurious water-hammering.

To enable holding the sleeve *q* securely in the grasp of the hand in turning it, its exterior surface is milled, grooved, fluted or roughened. Spiral grooves, crossing each other and cutting the surface into checks, as indicated by the parallel and intersecting curved lines in Fig. 1, are most advantageous for the purpose of securely holding the sleeve.

In the drawings, the sides of a portion of the ajutage converge conically to its orifice *g* at angle of about thirty degrees, and the conical convergence of the valve *k* from just above its seating-line to its apex is the same; but

the angle of convergence may be varied in either one or both of them, and they may be converged by either straight or curved lines with less advantageous results.

A sharp edge at the orifice *g*, as shown, is favorable for most efficient forming and projection of the stream; but it may be rounded off or extended straight a short distance to give it a more durable edge.

The discharge-orifice may be made a circular aperture, either straight or convergent, formed in a thin plate or interval projection in the nozzle, but with less favorable results.

The principal office of the tube *h* is to inclose and protect the cone-valve *k* from injury, and the holes *jj* in it serve to admit air freely to the stream at the discharge-orifice *g*, to prevent the stream from exhausting the air from the tube, and creating a vacuum at the shoulder *i*, which would tend to break up the stream, and to cause it to fill the tube in flowing through it.

With a free supply of air at the shoulder *i* the stream, which, at the orifice *g*, is in section a ring, will form into a round and solid stream of smaller diameter upon and at the point of the cone-valve *k*, and it will be projected in that form through and out of the tube *h*, whether the valve is opened to discharge a large or small stream; and to whatever degree the nozzle is closed, the projectory pressure and force of the water is undiminished at the discharge-orifice *g*, so that the nozzle is adapted to form and project efficiently, and with equal force, solid and round streams of all sizes within its range of opening.

It is sometimes desirable, when the nozzle is to be used in connection with fire-engines not equipped with good relief-valves, to prevent the nozzle from being fully closed, which may be readily done by plugging up the slot *o* in front of the bar *p*, thus restraining, as desired, its closing movement. Similarly, by plugging the rear end of the slot, the opening movement is reduced, and the nozzle made of less capacity of opening.

In Fig. 5 is shown by sectional view the ajutage *f*, detached from the nozzle, and having a perforated disk, *t*, (shown in plan view by Fig. 6,) attached to the outer end of the guard-tube *h*, for throwing double sprays from the nozzle. The disk fits into the tube, with its circular flange *u* resting on the end of the tube, to which it is secured by a removable ring-cap, *v*, which screws on the tube, and has an internal flange, which is of the same diameter as the tube, and which bears upon the flange *u* of the disk. The spraying-holes *w*, &c., in the disk all have their axis-lines converging at the point *x* in the axis of the tube *h*, making the body of the spray, which is thrown from them, to spread conically at an angle of about thirty degrees, and the outer and inner surfaces of the spraying portion of the disk are curved in circles centering at the point *x*, which conditions are favorable for efficient formation and projection of the

spray. The total cross-section area of the spray-holes *w* *w* should be about three-fourths of the area of the discharge-orifice *g*, when fully opened, in order that the tube *h* may be maintained filled with water under efficient projectory pressure.

The air-inlet holes *y*, &c., in the tube *h*, at the shoulder *i*, instead of being made large and at right angles to the tube, as before shown, are made small and thickly set and inclined forward, so that when the spraying-piece is attached a fine rear spray will spout from them to protect the pipeman from heat and smoke in close engagement with the fire.

When the sprays are not required, the disk *t* is removed, and the cap *v* screwed down to its seat, which leaves the outlet of the tube *h* smooth and unobstructed; and the holes *y* serve as air-inlet holes, the same as the holes *jj*.

Fig. 7 shows the substitution for the perforated disk *t* of a flat interchangeable disk, *z*, having a single central conical port-hole formed in it of about the same area as the total area of the spray-holes *w* *w*. Its use is to throw a solid stream out of its port-hole for extinguishing fires, and to throw the fine rear spray from the holes *y* *y*. The disk *z* is made so as to be reversed in the tube *h*, in which adjustment of it its port-hole will be convergent instead of divergent, as before, thereby materially increasing the volume of water discharged from it. The disk *v* is also made reversible, like the disk *z*, and when reversed from the position shown, the small jets issuing from its convergent holes will converge and form one stream, similar to that discharged from a single orifice, though not as efficiently projected.

The spraying-pieces *t* and *z* may be of other form, and they may be adapted to screw into or on the tube *h*.

Figs. 9 and 10 show, by a plan and an end view, the stop-nozzle, provided with permanently-attached spraying devices, operating similarly to those before described, and consisting of two segmental spherical shell-pieces, *b*¹ and *c*¹, pivoted together at their ends by screw-pins *d*¹ *d*¹, on a spherical enlargement, *e*¹, of the tube *h*, which they fit accurately, but sufficiently free to be swung back and forth upon it, from their position when not in use (shown in Figs. 9 and 10) to their respectively-required positions over the end of the tube *h*, when in use.

Fig. 11 shows, by a sectional view of the ajutage *f*, detached from the nozzle, the perforated shell *c*¹ in position for throwing the double sprays before described, and Fig. 12 is a plan view of the interior of the shell.

Fig. 13 shows, by a plan view of the ajutage *f*, the shell *b*¹, having a single central port-hole in it, the shell being swung into position for throwing a solid stream from it and the fine rear spray from the holes *y* *y*, and Fig. 14 shows an inner plan view of the shell *b*¹.

The ajutage *f*, detached from the stop-noz-

zle and equipped with the described spraying attachments, as shown and described, form complete and original, combined, plane, and spraying nozzles, and they may be so used. In such use of them the ajutage-passage leading to the orifice *g* may be formed like that of any of the common plane nozzles instead of the form shown of it.

Fig. 15 shows, by a sectional view, the stop-nozzle combined with a discharge-pipe. In this combination the discharge-pipe substitutes the barrel *e* of the nozzle and the discharge-pipe to which the originally-described nozzle is designed to be attached. It is made in two sections, *f*¹ and *g*¹, which are screwed fast together, as shown. The nozzle-ajutage *f* is screwed fast to the outer end of the section *g*¹ of the pipe, and the valve-stem *l* is lengthened, but carried in the guide-tube *m* and wings *n n*, and operated by the bar *p* and sleeve *q*, as before described. The wings are fixed in the end of pipe *g*¹, and the sleeve *q* turns on the pipe between flanges of the two pipe-sections, in the same manner as before described, of their connection to the barrel *e*.

In this combination, the operating sleeve *q* is placed farther back on the discharge-pipe, more convenient to be operated by the pipe-man, and also the wings *n n*, being more removed from the ajutage *f*, disturb the water less in forming and projecting the stream than in the before-described nozzle, made to be attached to the end of a discharge-pipe.

Fig. 16 shows by a sectional view, and Fig. 17 by an end view, a modification of the stop-nozzle described, having the same features of forming, regulating, and stopping the stream, but differing therefrom in its having the cone-valve *k* fixed and the adjutage *f* made movable upon it to open and close the nozzle. In this combination *h*¹ is the nozzle-barrel attached, by its screw-head, to a discharge-pipe, (or it may be lengthened to form the discharge-pipe,) and supporting in its outer end concentrically with its axis the cone valve *k* by four wings, *i*¹ *i*¹ *i*¹ *i*¹, on its stem *l*, which are fixedly attached in the barrel. On the barrel *h*¹ is fitted closely, but to turn freely, an operating sleeve, *j*¹, carrying at its outer projecting end concentrically with the barrel *h*¹ the ajutage *f* and valve-guard tube *h*, before described. The sleeve *j*¹ is made to move longitudinally upon the barrel *h*¹ by screw-threads *k*¹ *k*¹, formed on its inner surface, which engage like screw-threads *l*¹ *l*¹ formed on an enlarged portion of the barrel, so that turning the sleeve to the right or left opens or closes the nozzle by moving the ajutage out and in from the cone-valve. The annular recesses *m*¹ *m*¹ between the sleeve and barrel on either side of the threads *k*¹ *k*¹ are to permit unobstructed movement of the sleeve on the barrel, and to protect from external exposure the threads on the barrel. *n*¹ is a screw-pin fixed in the barrel *h*¹ at the edge of its threaded portion in the position shown to form a stop to the outward movement of the sleeve and ajutage.

This pin is inserted in the barrel, and may be removed from it through the hole *o*¹ in the sleeve. Packing may be wound in an annular recess shown in the lower end of the barrel, if the joint between the sleeve and barrel is not otherwise sufficiently water-tight.

Figs. 18 and 19 show, by a plan view and a sectional view, a combined discharge-pipe and stop-nozzle, having the same features or principles of forming, regulating, and stopping the stream, as before described, of the original stop-nozzle, but differing therefrom in its form of construction, and in its mode of carrying and operating the cone-valve, and in its being more especially designed for use on hose for stand-pipes, and in buildings. In this combination the nozzle-ajutage *f* is screwed fast to the outer end of a discharge-pipe, *q*¹, and the valve *k* is supported concentrically with the axis of the pipe and the ajutage by knife-edged wings *r*¹ *r*¹, attached near the ends of its long valve-stem *s*¹, which wings fit accurately, but free to slide back and forth, in straight portions formed in the pipe, as shown. The valve-stem *s*¹ is enlarged and slotted with rack-teeth formed in one side, *t*¹, of the slot, as shown. A pinion, *w*¹, working in the slot and engaging the rack *t*¹, is formed on a spindle, *v*¹, which passes transversely through the middle of the pipe *q*¹ at its swelled portion, and is made water-tight therein by tapering joints and the set-nut *w*¹. A lever, *x*¹, fixed to the spindle *v*¹, affords external means of operating the pinion *w*¹ and valve *k*. In the position shown by the full lines the nozzle is nearly opened, and when the lever *x*¹ is swung to the position shown by the dotted lines *y*¹ the nozzle is closed.

Fig. 20 shows, by plan view, the same combination as in Figs. 18 and 19, excepting in the substitution for the lever *x*¹ of a worm and gear for operating with greater leverage the valve *k*. The worm *z*¹ is mounted on the pipe *q*¹ by its spindle being supported in posts *a*² *a*², and its screw-threads engage a worm-gear, *b*², fixed on the spindle *v*¹, the whole being operated by a small hand-wheel, *c*².

Fig. 21 shows, by a sectional view, a combined pipe and stop-nozzle, having the same features of forming, regulating, and stopping the stream as the stop-nozzles before described, but differing from them in its form of construction, and in its mode of carrying and operating the cone-valve, and in its being more especially adapted for use on garden-hose and small hose in buildings. In this combination the discharge-pipe *d*², the barrel *e*², the ajutage *f*, and valve-guard tube *f*² are formed as shown, and may be cast in one piece. In the guard-tube *f*² the before-described air-inlet holes are not required, the tube *f*² being so short and the space being so great in the tube around the small stream which is projected through it that air will be supplied freely to the shoulder *i* from the tube's outer end. The pipe *d*² is connected to the barrel *e*² by an elbow to enable passing the

valve-stem g^2 straight through and out of the barrel, for convenience and simplicity of carrying and operating it. The valve-stem g of the cone-valve k works concentrically to the barrel e^2 and ajutage f in a projecting tube, h^2 , of the barrel-head i^2 , there being matching screw-threads formed on the stem and in the tube, and an external stuffing-box, k^2 , to make the stem-joint water-tight. A small hand-wheel, l^2 , fixed on the outer end of the valve-stem, serves to turn the stem and open and close the nozzle. A stop in opening the valve to its required limits is made by forming the threads on the valve-stem, as shown, and cutting away the threads in the tube, as shown.

I am aware that various devices are commonly in use for the discharge of fluids, such as water, steam, gas, and air valves, and pumping and condensing injectors, in which valves both pointed cones and frusta of cones open and close them and seat at or near their discharge-orifices, but none of them have been adapted or are suitable for the purposes required of a regulating stop-nozzle for fire-extinguishing apparatus.

I claim as my invention—

1. In combination with a hose-nozzle, a cone-valve placed within the nozzle concentrically with and seating at its discharge-orifice, and arranged to form, regulate, and stop the

stream thrown by the nozzle, substantially as and for the purposes set forth.

2. The stop-nozzle, consisting of the barrel e , ajutage f , valve-guard tube h , and the cone-valve k , carried by its valve-stem l in the tube m of the fixed wings $n n$, and operated by the reciprocating bar p , which engages the screw-threaded operating sleeve q , all substantially as and for the purposes set forth.

3. The central tube m carrying the valve-stem l , supported and fixed by the wings $n n$ in the barrel e , and having the slot o through the barrel and wings for operating the valve k externally, substantially as described.

4. The valve-guard tube h , in combination with a stop-nozzle, substantially as and for the purposes set forth.

5. The air-inlet holes $j j$ or $y y$, in combination with the guard-tube h and ajutage f , substantially as and for the purposes set forth.

6. In combination with a hose-nozzle, the removable and reversible disk t , having divergent holes $w w$, to form a spray or solid stream, substantially as and for the purposes set forth.

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Witnesses:

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