2 Sheets—Sheet 1.

D. C. GREEN.

Air-Injecting Nozzle.

No. 221,726. Patented Nov. 18, 1879.

FIG-1-

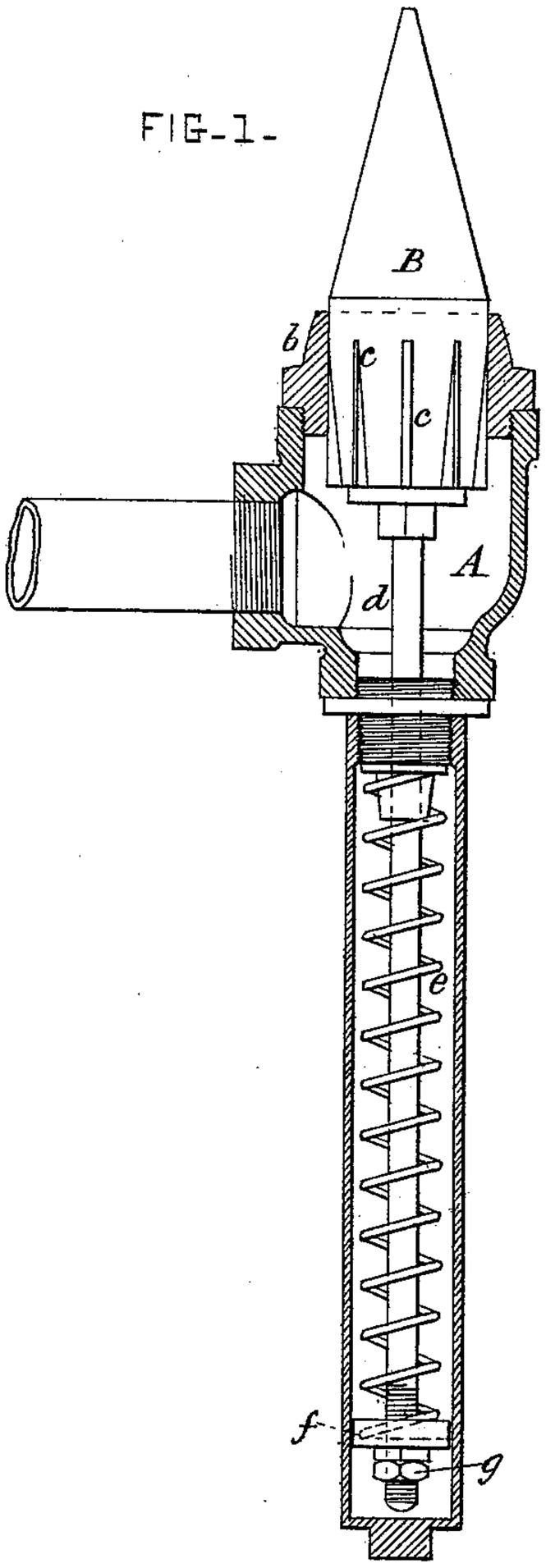


FIG-2-

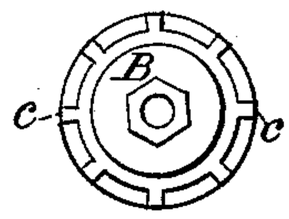
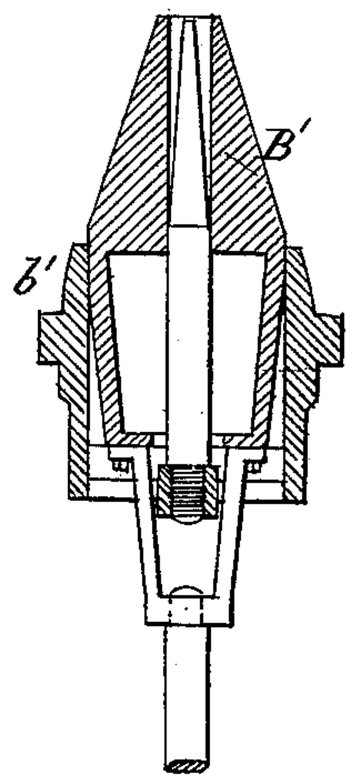


FIG-4-



ATTEST-

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2 Sheets—Sheet 2.

D. C. GREEN.

Air-Injecting Nozzle.

No. 221,726. **Patented Nov. 18, 1879.**

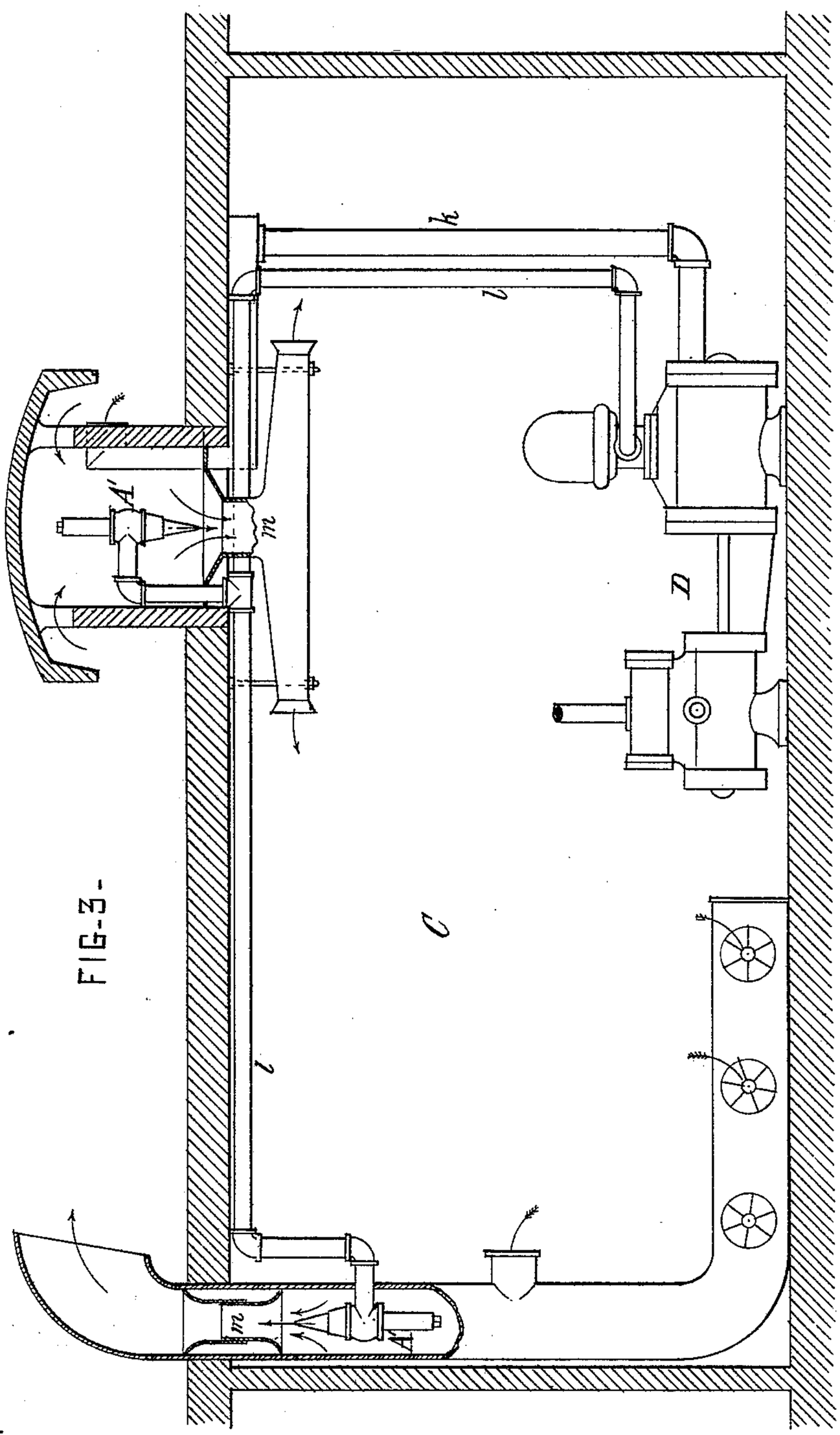

FIG-3-

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UNITED STATES PATENT OFFICE.

DAVID C. GREEN, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN AIR-INJECTING NOZZLES.

Specification forming part of Letters Patent No. **221,726,** dated November 18, 1879; application filed September 1, 1879.

To all whom it may concern:

Be it known that I, DAVID C. GREEN, of Brooklyn, Kings county, New York, have invented certain new and useful Improvements in Air-Injecting Nozzles, of which the following is a specification.

My invention relates to apparatus for producing blasts or currents of air, for ventilation or other purposes, by the injective action of jets of steam or compressed air discharged from nozzles into suction throats or tubes, through which a large volume of air is thus caused to flow by the inducing action of the jet; and my invention is embodied mainly in an improved form of injection nozzle or jet, whereby the velocity and pressure of the jet are maintained independent of variations in the volume supplied to it from the compressing-pump or other apparatus, thus greatly increasing the effectiveness of the jet, and causing its effectiveness to at all times correspond proportionately with the volume supplied, as hereinafter fully set forth.

Figure 1 of the annexed drawings is a longitudinal section of my improved air-injector nozzle, and Fig. 2 an end view of the inner end of the valve-plug. Fig. 3 represents a ventilating apparatus provided with my improved nozzles.

In producing air currents or blasts by the injective or inducing action of jets it is necessary, as is well known, that the jet be discharged under a positive pressure and at a high velocity in order to obtain an effective inducing action. The pressure, of course, mainly determines the velocity of the jet, and it is found that the best effect is obtained with a jet of a certain pressure and velocity, which, of course, varies in different cases but when this point is determined in each case, it cannot be much departed from without serious loss.

The volume of the jet is, of course, another element in its effectiveness; but if its pressure and velocity be maintained its effectivness will be also maintained, and will correspond with its increase or decrease of volume, while, if its power and velocity be allowed to fall or vary much from the best determined point, the increase in volume will give no corresponding effectiveness, but will be mainly a loss of power. Hence the main defects in air-jet nozzles as heretofore constructed, and which I am to overcome, is that they are formed with a discharge-aperture of a fixed and uniform area, so that to maintain the pressure and velocity of the jet up to its point of greatest efficiency it is necessary that the compressing-pump or other source of supply form a constant volume, corresponding to such pressure and velocity from a jet of that area, and if the volume increase or decrease beyond this point, the area of the jet then, of course, becomes proportionately too small or too large, hence causing the pressure and velocity of the jet to correspondingly decrease or increase, and thus rendering its action inefficient.

Now, the main feature of my invention may be stated to consist in constructing the air-jet nozzle with an automatic valve, arranged to govern its discharge-aperture, and loaded to open at a certain pressure, so that, hence, the jet is discharged uniformly at this pressure; and should the supply to the jet decrease in volume, the valve will partly close to correspondingly reduce the area of the discharge-aperture, and thus maintain the uniform pressure and velocity of the jet; and should the volume increase, the valve will open wider, thus discharging a jet of greater volume, yet at practically the same pressure, thus maintaining the efficiency of the jet under a varying supply, causing the volume of the induced current to increase proportionately as the volume of the inducing-jet increases.

In Fig. 1, A indicates the casing or body of my improved injector valve or nozzle, and *b* the nozzle end thereof, in the aperture of which, as illustrated, is arranged a valve-plug, B, which, when quiescent, fully closes said aperture, preventing any discharge from the nozzle.

The outer extremity of the valve-plug is preferably of an elongated tapering form, as illustrated; its middle, or that part which fills and closes the aperture of the nozzle, is cylindrical, to form a close fit for the nozzle-aperture, while its inner part is also tapering, to form, as the valve is pressed out of the nozzle, an annular outlet, which increases in area in proportion to the distance it is pressed out, as will be readily understood. From this inner tapering part of the valve-plug short radial

ribs *c c* project, as shown in Figs. 1 and 2, but extend only to the same diameter as the cylindrical or plain part of the valve, as illustrated, thus forming grooves between each other, through which the air escapes, while the ribs serve to guide the plug centrally in the nozzle aperture.

The stem *d* of the valve is provided either with adjustable weights or a strong spring, *e*, as illustrated, which constantly tends to keep the plug drawn in, and thus close the nozzle-aperture, and which may be adjusted so as to place any desired pressure on the valve, so that the jet will be discharged from the nozzle at this pressure only.

Where the jet is so arranged as to discharge upwardly, weights may be used to load the stem instead of a spring; but for all other situations I prefer to use a strong spring, as shown in Fig. 1, of such length that its tension will not vary much with a slight compression or extension thereof.

The spring may be adjusted to place the required pressure on the valve by the adjusting and jam nuts *f g*, as will be readily understood, and the spring and stem may be inclosed in an air-tight tube projecting from the neck of the valve-casing, thus enabling the packing of the stem to be dispensed with, and therefore securing a more sensitive action of the valve; but, if desired, the inclosing-tube may be omitted, and the stem passed through a gland in the neck of the valve-casing, leaving the spring and stem exposed.

The nozzle is connected to the air-supply pipe, preferably, by a branch or coupling on the side of the casing A, as shown in Figs. 1 and 3, and for ordinary ventilating purposes the air is supplied to the nozzle under a pressure of about five pounds to the square inch.

In Fig. 3 is illustrated the manner in which my improved nozzles are arranged in a ventilating apparatus. C indicates the apartment to be ventilated, which may be in a war or passenger vessel, building, mine, or elsewhere. D is an air-compressing pump, which draws in the atmospheric air through pipe *k*, and discharges the compressed air through the pipe *l*, which terminates with several of the improved nozzles A′, arranged in ventilating-passages leading into and out of the apartment. These nozzles are arranged to discharge into contracted suction-throats *m m*, through which a large volume of atmospheric air is thus induced to flow into and out of the apartment by the injecting action of the jet, as will be readily understood, and these throats are preferably made adjustable toward the nozzle, so as to obtain the best relative position thereof. If the valves of the injector-nozzles be now set to the required pressure, and the air-pump D put in motion, the nozzle-valves will confine the air till it attains the desired pressure, when the valve will open, allowing the discharge of an energetic jet from the nozzle, having the required velocity and pressure to produce an effective inducing action, and thus cause a strong induced current to flow through the suction-throats with the inducing-jet. Should, however, the speed of the pump decrease, rendering the supply to the nozzle less, or should it increase, rendering the supply greater, the nozzle-valve will partly close or open correspondingly, thus causing the volume of the jet to always correspond to the volume of its supply, while its pressure and velocity are maintained practically uniform, thus causing the jet to act to its greatest efficiency under the different variations in volume, and producing, under different volumes, a corresponding and full efficiency.

By means of these automatically-acting nozzles, it is found that the volume of the inducing jet being one, the volume of the induced current will be thirty-five, thus practically obtaining from one pump the capacity of thirty-five pumps.

The improved nozzle may, of course, be used for producing air blasts or currents for other purposes than ventilation, and it will also be understood that in some cases the nozzle may be supplied with live steam instead of compressed air; but the use of the latter is more generally contemplated.

I sometimes prefer to construct the valve-plug of the nozzle so as to discharge a central jet as well as an annular one, the center of the plug in this case being provided with a bore arranged to embrace and slide over a tapering plug fixed in the center of the nozzle, as shown in Fig. 4; but this is optional.

What I claim as my invention is—

An injector-nozzle for producing blasts or currents of air, constructed with an automatic valve arranged to govern its discharge-aperture, and adjustable by spring or weights to open and discharge the jet at a certain determined pressure, whereby the pressure and velocity of the jet are maintained practically uniform under varying volumes, and its efficiency thus rendered constant and proportional to the volume supplied, substantially as herein set forth.

DAVID C. GREEN.

Witnesses:
CHAS. M. HIGGINS,
JOHN E. GAVIN.