No. 640,039. Patented Dec. 26, 1899.

C. T. SMITH & A. J. JOHNSON.

PNEUMATIC DRILL.

(Application filed Mar. 18, 1899.)

(No Model.) 2 Sheets—Sheet 1.

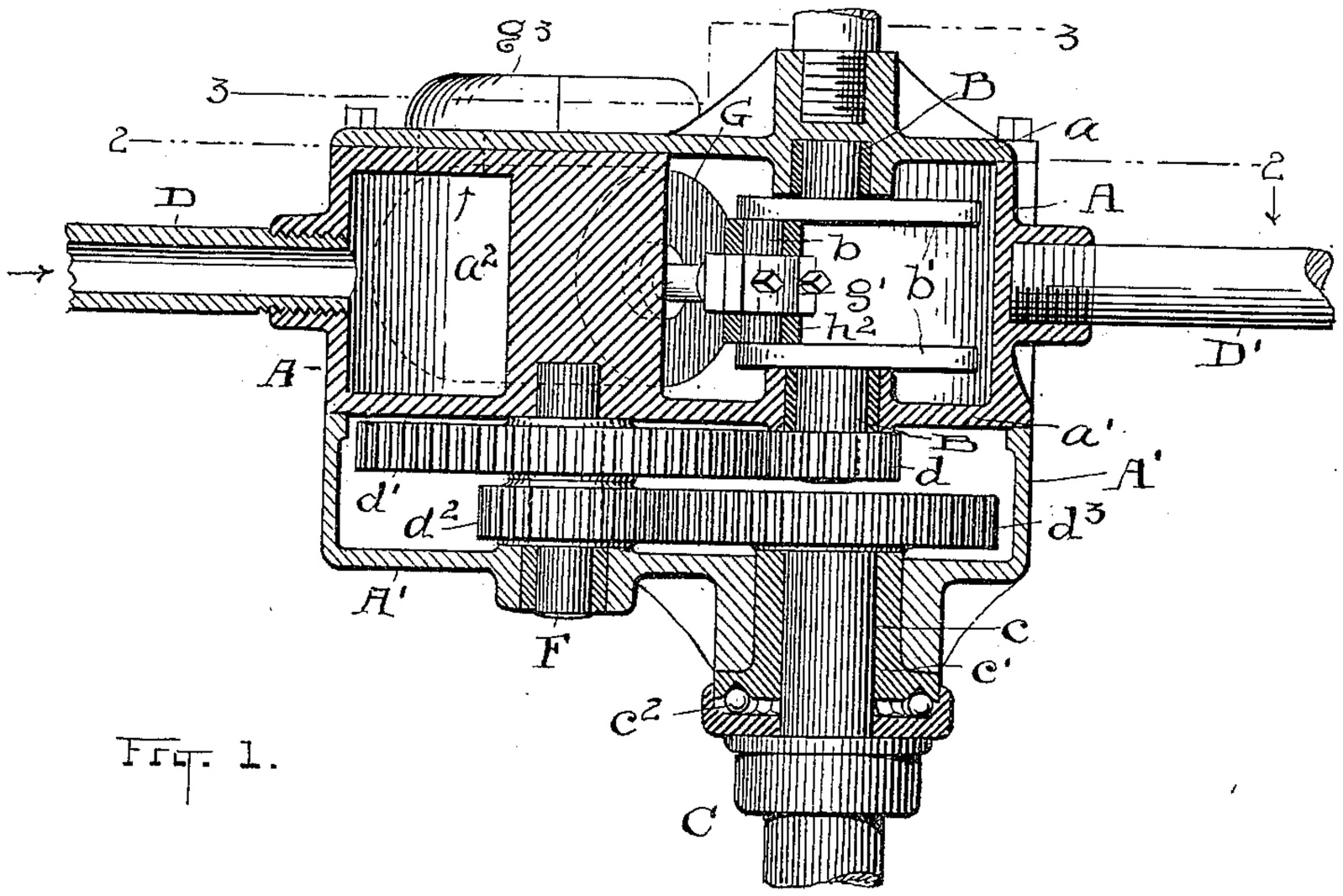

Fig. 1.

Fig. 2.

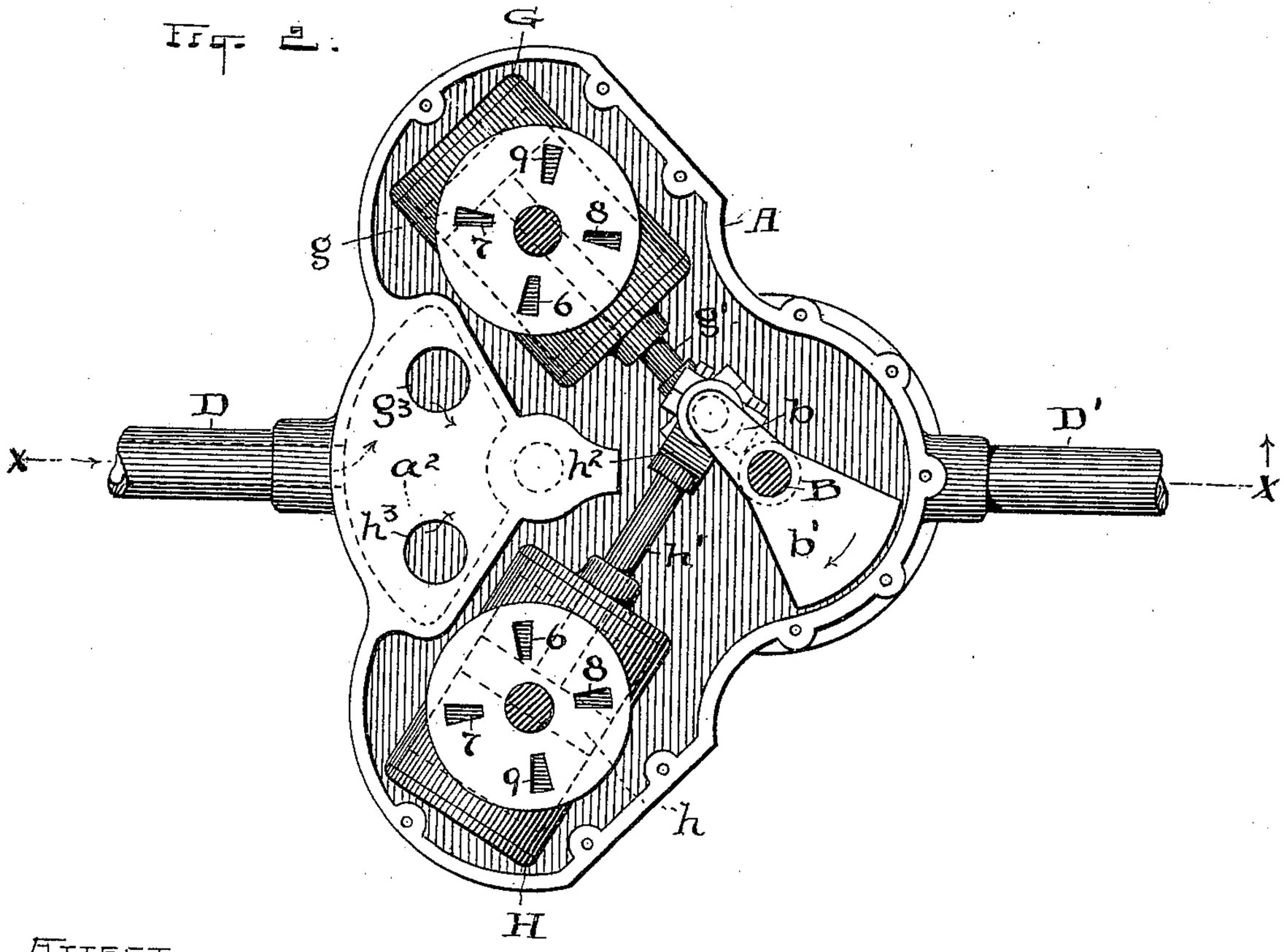

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Fig. 4.

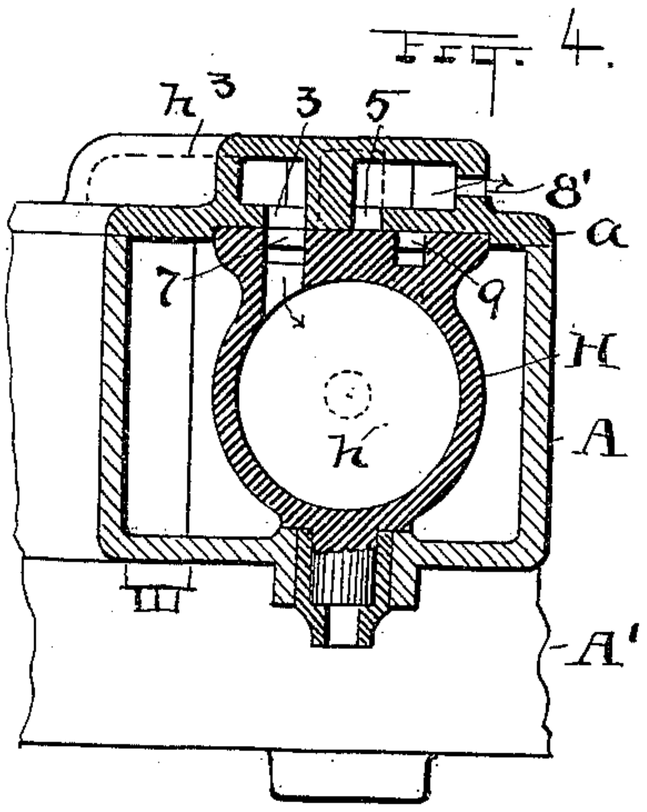

Fig. 5.

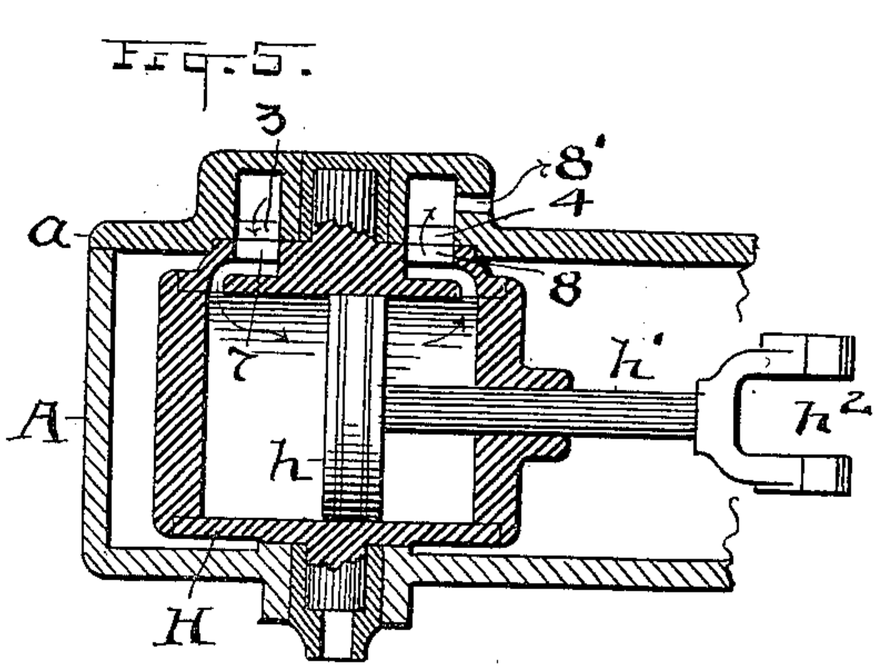

Fig. 6.

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UNITED STATES PATENT OFFICE.

CHARLES T. SMITH AND ANDREW J. JOHNSON, OF CLEVELAND, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE CLEVELAND PNEUMATIC TOOL COMPANY, OF SAME PLACE.

PNEUMATIC DRILL.

SPECIFICATION forming part of Letters Patent No. 640,039, dated December 26, 1899.

Application filed March 18, 1899. Serial No. 709,658. (No model.)

To all whom it may concern:

Be it known that we, CHARLES T. SMITH and ANDREW J. JOHNSON, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Pneumatic Drills; and we do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Our invention has reference to pneumatic drills; and the object of the invention is to provide a drill with a series of associated power mechanism operating in unison to drive the drill and supplementing one another in the application and increase of power, all substantially as shown and described, and particularly pointed out in the claim.

In the accompanying drawings, Figure 1 is a vertical sectional elevation of the drill on a line corresponding in the main to *x x*, Fig. 2, but leaving the gear unbroken. Fig. 2 is a plan view on line 2 2, Fig. 1, the top being removed and disclosing a plan of the cylinders and their four several ports each. Fig. 3 also is a plan on line 3 3 of the whole machine and designed to show the four several ports in the casing matching those in the cylinders, as seen in Fig. 2 and as hereinafter fully described. Fig. 4 is a vertical sectional elevation on line 4 4, Fig. 3, showing one of the cylinders in section and its ports and connections; and Fig. 5 is a vertical section on line 5 5, Fig. 3.

The object of the foregoing construction is to present a drill which while it embodies all the propelling mechanism within itself and is self-equipped in all particulars for work yet is so compact and convenient in the disposition of its parts that it can be placed and used in positions where, at the most, the room is limited and drills as they ordinarily are constructed cannot be used at all.

To these ends we have adopted a form of casing A, which is nearly heart shape as viewed in plan and is just large enough to carry the operating mechanism in the most advantageous arrangement that can be made and not waste room. This mechanism comprises, first of all, a short crank-shaft B, set into suitable bearings in the removable side or top *a* of the casing at one end and in the diaphragm or bottom *a'* at the other end.

C is the tool or drill socket, having a spindle *c* working in the bushing *c'* and arranged directly in line with the axis of shaft B. Anti-friction-balls c^2 are arranged between the head of the drill-socket and the flange of bushing *c'* to take the endwise thrust or pressure of the drill at work. This axial line of shaft and drill is the center of the machine, to which the other parts are built and operate.

The shaft B has a crank *b* at its center, and on the shaft are a couple of counterbalances *b'* opposite the crank *b*. The handles D and D' are arranged axially opposite the center of the casing, so as to balance the machine thereon, and the handle D is a duct for the compressed air to the distributing-chamber a^2 in the casing, Fig. 1, as hereinafter more fully described. Suitable valve mechanism also is connected with this handle, whereby the flow of the air is easily manipulated and governed, as will hereinafter appear.

Power is conveyed from the shaft B to the drill-socket through a system of gears arranged for power and confined in a suitable housing or supplemental casing A', fixed removably to what for convenience is described as the "bottom" of casing A. This gearing consists of the pinion *d* on the lower extremity of shaft B, which meshes with large gear-wheel *d'* on shaft F. On this shaft is a pinion d^2, meshing with large gear d^3 on the inner or upper end of the spindle *c* of tool-socket C. This arrangement of gears enables us to set the shaft B and socket C close together at their ends and at the same time obtain the advantage of multiplying the power on the socket several times.

Now in order to drive the foregoing mechanism pneumatically or with any kindred fluid agent and get power for heavy and rapid work we employ a series of engine-cylinders G and H, arranged substantially at right angles to each other and supported each on trunnions centrally at their sides, on which

they are adapted to rock or oscillate as they operate together in driving the shaft B. Each cylinder has a sliding piston g and h, respectively, connected by their rods g' and h' with the crank b, the rod h' having a yoke h^2, Fig. 5, adapted to engage crank b at either side of rod g'. By this arrangement of the power or motor cylinders G and H they follow each other in succession, and as one reaches the dead-center at either side of the stroke the other will be at its best in the stroke. Thus in Fig. 2 the dead-center is reached by the motor-cylinder G and its piston and rod, with piston g at the end of its stroke to the rear, while the cylinder H is half-way in its stroke and in the place of greatest power on the crank-shaft B. Now following the parts a quarter-turn farther the cylinder H will be at the outer dead-center and cylinder G will be at its best, with its piston g on the half-stroke. This change occurs four times, or at every quarter-turn, in every revolution of shaft B, and it is push and pull alternately in each cylinder, the inlet and exhaust for each being so arranged that the motive agent enters first on one and then on the other side of the pistons. How this occurs may now be traced in the drawings. Assuming that we are operating compressed air, though any expansible fluid may be used that will do the work, the said fluid or air enters through tubular handle D into distributing-chamber a^2, Fig. 1, common to both motor-cylinders. From this chamber ducts g^3 and h^3 lead to the two cylinders G and H, respectively, and enter the cylinders through two separate ports 2 and 3 and exhaust through two like ports 4 and 5. The cylinders each have inlet-ports 6 and 7 to match 2 and 3 and outlet-ports 8 and 9 to match 4 and 5. The oscillation of the cylinders is utilized as a medium for opening and closing the said ports, and in the disposition of the ports as shown 2 and 6, 3 and 7, 4 and 8, and 5 and 9 go together. Hence it occurs that when one set of inlets is open one of the exhausts also is open and the other set of inlets and exhausts is closed. This is demonstrated in Fig. 3 and the cross-section, Fig. 5. The motive fluid enters through ports 3 7, behind piston h, and exhausts through ports 4 8. When the piston reaches the farther limit of its stroke, both these sets of ports will be closed and the opposite sets 2 6 and 5 9 will be opened, and so on alternately. For simplicity we use the same reference-figures for the ports connected with both cylinders, because the operation is identical in both.

It will be noticed as a feature peculiar to this construction that the exhaust-ports have their exit at the series of openings 8′, to which both exhaust-ports for each power-cylinder lead. Hitherto all discharges have been internally, where all the dust and dirt in the air would naturally accumulate and foul the operating mechanism. Our discharges are outside, and the interior of the machine is atmospherically closed against the admission of dust from any source.

An important office of the housing A′ is its affording a perpetual lubricating-chamber for the contained gearing, thus preventing overheating under the excessive friction a tool of this kind is subject to when under the usual strain. For example, the present tool weighs twenty-one pounds, and yet will bore an inch-and-a-half hole over an inch in depth in solid steel in less than a minute. The tool has to be crowded to do this, and hence will heat at once if no precaution be taken to prevent it. The housing A′ is designed to be so tight that the usual grade of lubricant will be sealed up therein and in such quantity that the gearing cannot do more than get warm and never heats; but such rapid work would be impossible with this tool without these lubricating facilities. The same condition as to lubricants holds true of the mechanism within the casing A, and in both chambers the mechanism is constantly flooded with oil.

It will be noticed that the cylinders have each on their top a flat surface or portion matching the corresponding surface of the main casing and the respective ports or ducts for the power fluid are through these flat closely-matched surfaces or portions for both inlet and exhaust. The casing is shown as somewhat recessed to receive the flat portion of the cylinder, so as to make a very close fit at this point and avoid perceptible leakage. It will also be observed that the ports are so arranged and the cylinders so constructed as to themselves control the ports, thus avoiding all necessity for valve mechanism for either inlet or exhaust passages.

What we claim is—

In an oscillating engine, in combination with a main casing, and a fluid-pressure-supply chamber, a pair of oscillating cylinders, two series of inlet and exhaust ports in each cylinder, corresponding inlet-ports in said supply-chamber, ducts leading from said cylinder inlet-ports to opposite sides of the piston, means to simultaneously open one series of ports and close the other by the oscillation of the cylinder, an independent exhaust-chamber common to both of said cylinder exhaust-ports, ducts leading from said exhaust-ports to said chamber, and ducts leading from said chamber and having exits exterior the casing, substantially as described.

Witness our hands to the foregoing specification this 27th day of February, 1898.

CHARLES T. SMITH.
ANDREW J. JOHNSON.

Witnesses:
H. T. FISHER,
R. B. MOSER.