(No Model.) 2 Sheets—Sheet 1.

P. SWENSON.

EXHAUST NOZZLE.

No. 481,334. Patented Aug. 23, 1892.

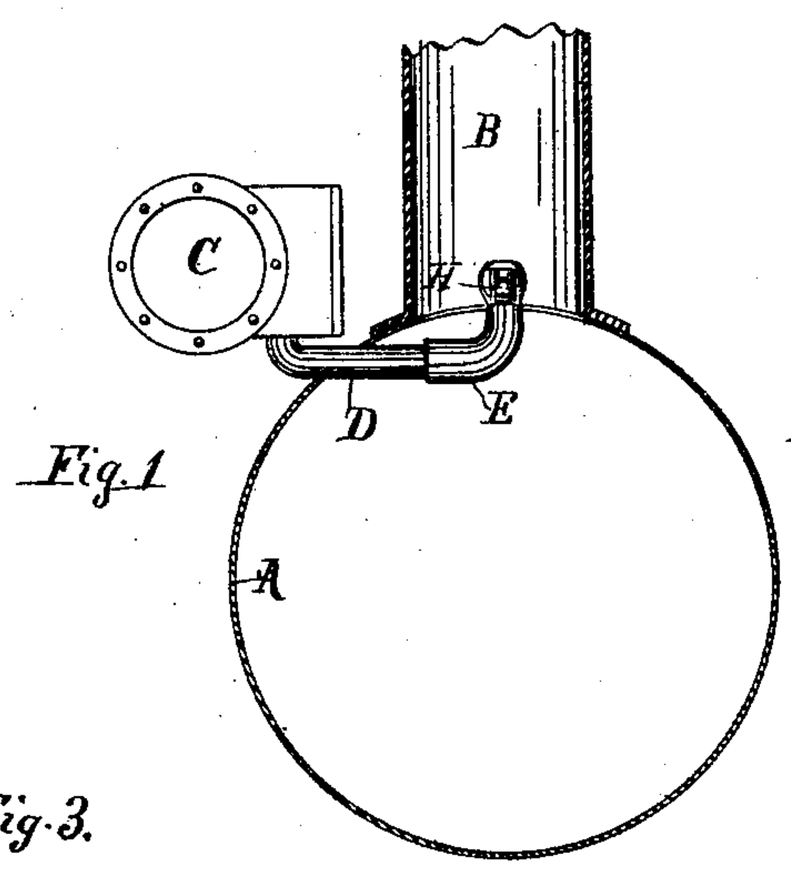


Fig. 1

Fig. 3.

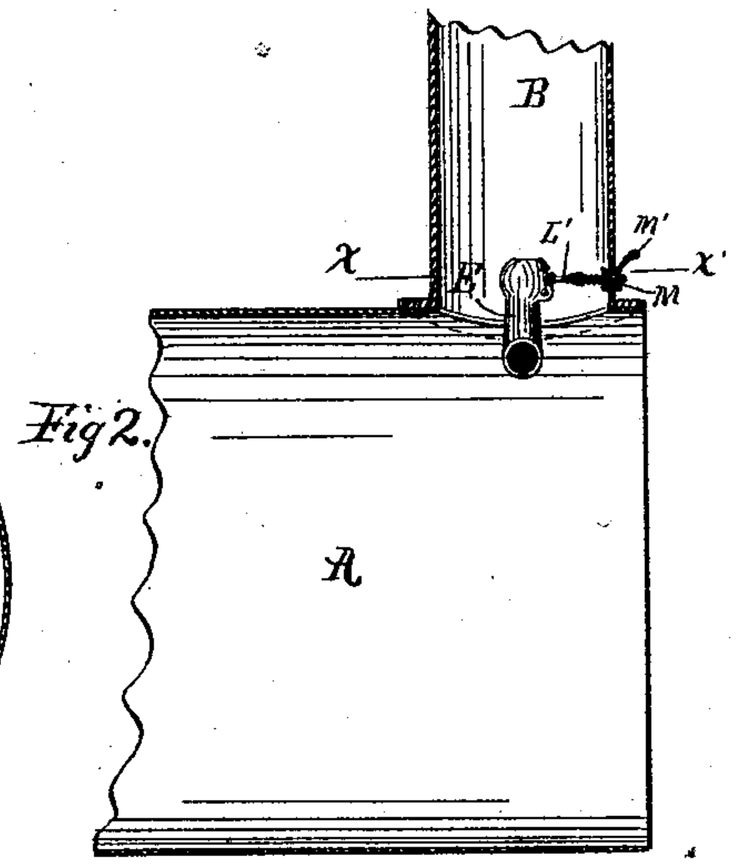
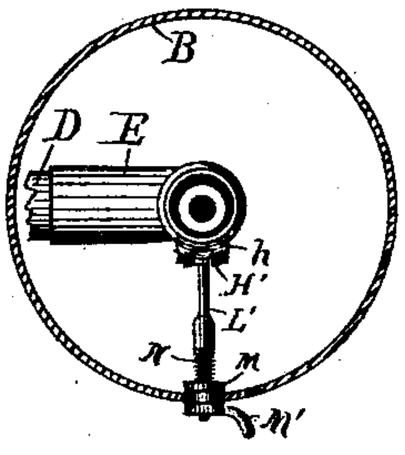


Fig 2.



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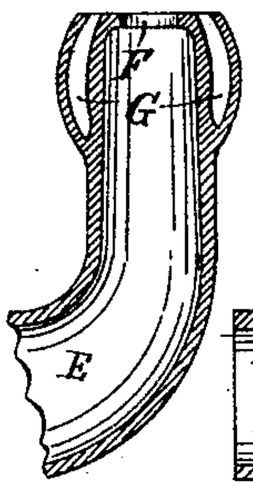
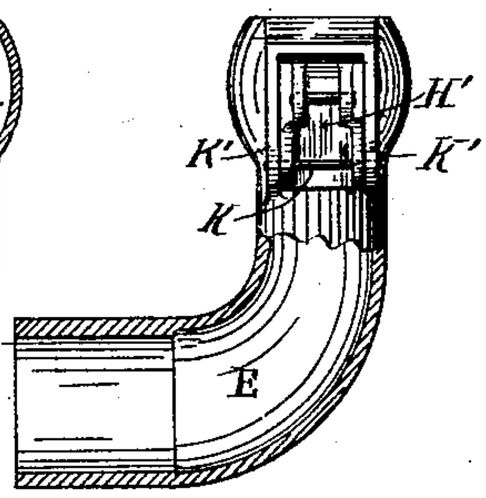


Fig 5.



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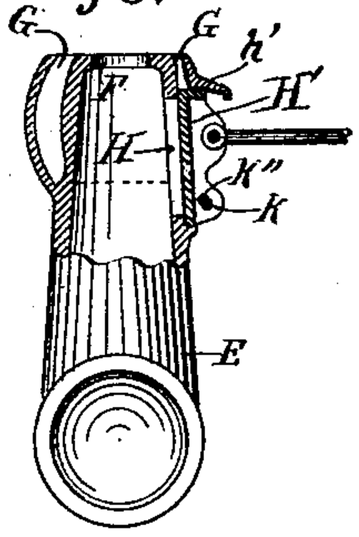


Fig 9.

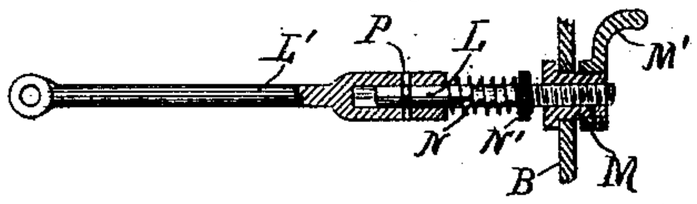


Fig 7.

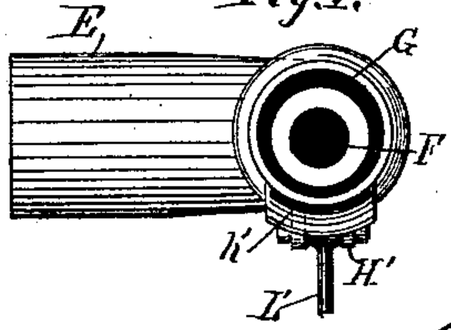
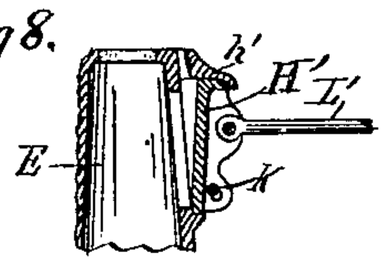


Fig 8.



Witnesses.
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Inventor.
Paul Swenson
By his Attorney.
Jas. F. Williamson

(No Model.)

2 Sheets—Sheet 2.

P. SWENSON.

EXHAUST NOZZLE.

No. 481,334. Patented Aug. 23, 1892.

Fig 11.

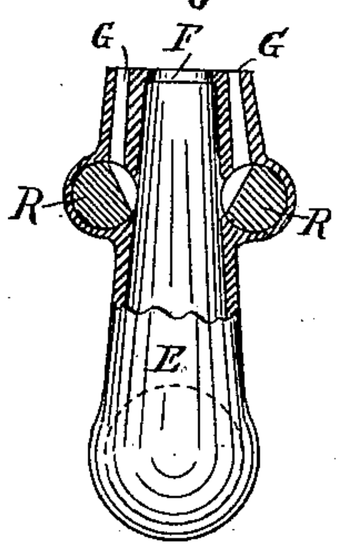


Fig 10.

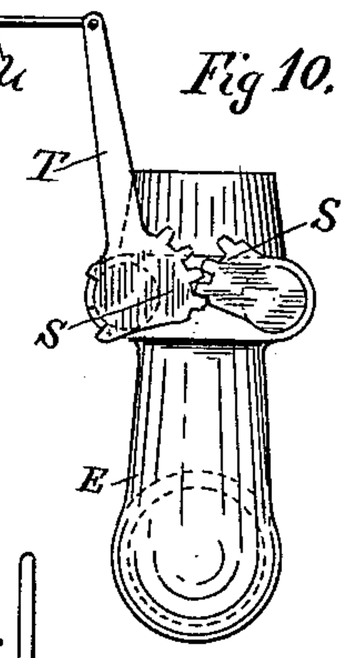
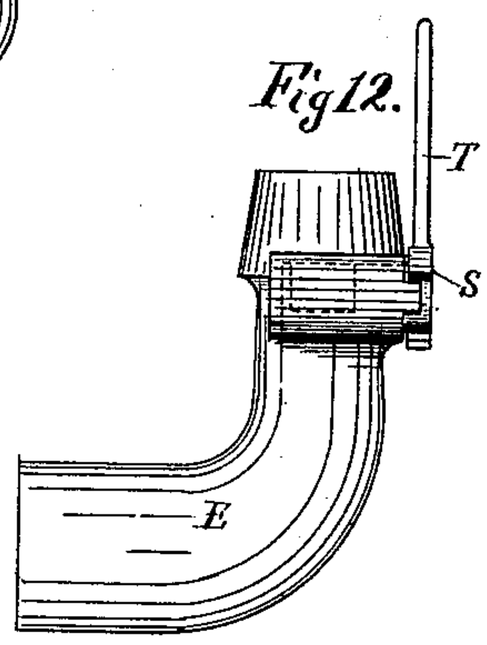


Fig 12.



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UNITED STATES PATENT OFFICE.

PAUL SWENSON, OF MINNEAPOLIS, MINNESOTA.

EXHAUST-NOZZLE.

SPECIFICATION forming part of Letters Patent No. 481,334, dated August 23, 1892.

Application filed February 13, 1892. Serial No. 421,448. (No model.)

To all whom it may concern:

Be it known that I, PAUL SWENSON, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Exhaust-Nozzles; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to exhaust-nozzles, and has for its object to provide a nozzle which will permit a comparatively free exhaust to the engine under all conditions of variable load and cut-off. It was especially designed for use on steam-engines.

As is well known, it is desirable to have as little back-pressure as possible in the exhaust-pipe. On the other hand, the nozzle must be sufficiently contracted to give the requisite draft on the fire. A better draft is also obtained from a single column discharged central of the stack than from two or more columns discharged from different points. To these ends, as is well known in the ordinary construction, the nozzle is located central of the stack and its discharge-orifice is contracted sufficiently to best adapt it to the discharge of the steam under the ordinary or average working conditions of the engine, which would be at a medium cut-off. As is obvious, however, when the engine is laboring under hervy work and the cut-off is increased to the maximum a greater amount of steam must be exhausted at each stroke of the piston, increasing the back-pressure to an objectionable degree. Again, when the load is light and the engine is cutting off short, the volume of steam to be exhausted is decreased and will not be discharged under sufficient contraction to create the desired draft. In my invention I remove these objections by constructing the nozzle with two or more concentric or practically concentric discharge-orifices provided with a valve or gate for opening and closing certain of said orifices to increase or decrease the total amount of discharge-opening, according to the amount of steam to be exhausted. Thus the nozzle may be so constructed that the normal discharge-orifice will be of a size to discharge the minimum amount of steam and the total amount of discharge-opening increased in proportion to the increased amount of steam to be exhausted. This affords a relief from back-pressure, so that the engine will steam freely under all conditions. The valve may be made to work either automatically by the pressure of steam in the nozzle or may be constructed to be set by a hand device. In my preferred construction I provide a valve-controlling device which may be set to work in conjunction with the pressure of steam in the nozzle-section to make the valve automatic, or which may be set to be worked entirely by hand.

The invention is illustrated in the accompanying drawings, wherein like letters refer to like parts throughout the several views.

Figures 1 and 2 are respectively an end elevation, partly in section, and a central longitudinal vertical section, some parts being broken away, showing my preferred form of the nozzle in working position in the stack of an ordinary thrashing-engine. Fig. 3 is a horizontal section on the line X X′ of Fig. 2. Figs. 4, 5, 6, 7, and 8 are all details of the nozzle shown in Figs. 1, 2, and 3 and of which Fig. 4 is a central longitudinal vertical section. Figs. 5 and 6 are respectively side and rear elevations, some parts being broken away. Fig. 7 is a plan, and Fig. 8 is a detail in section, having the valve in its open position. Fig. 9 is a detail of my preferred valve-controlling device removed. Figs. 10, 11, and 12 are respectively a front elevation, a front elevation partly in section, and a side elevation of a modified form of the nozzle.

A represents the boiler, B the smoke-stack, and C the cylinder, of an ordinary thrashing-engine.

D is the exhaust-pipe from the cylinder, terminating at the center of the stack in the nozzle E.

F is the normal discharge-orifice, and G is the supplemental discharge-orifice, surrounding the orifice F, practically concentric therewith and in communication through an opening or port H with the nozzle-section E. This port H is opened and closed by a tilting valve H′. This valve H′ is fulcrumed at its lower end on a shoulder or ledge *h* and swings with its upper end working steam-tight against a

projecting abutment *h'*. The valve is held in position on its supporting-ledge with freedom for its tilting movement by a pin K, working through perforated lugs K' on the nozzle and a slot K'' in the valve. By this construction a comparatively tight joint may be preserved between the valve and its supporting-ledge. It should be noticed that the supplemental discharge-orifice G is the widest in its part diametrically opposite the valve. This is done to permit a more ready escape to compensate for the extra pressure near the valve, and thus produce an even flow at all points of the orifice. It should also be noticed that this orifice G is constructed with a converging mouth, so as to deliver its blast into the same column with the discharge from the main orifice D, thus securing the benefit of the single-column blast.

The valve-controlling device is in the form of sectional telescoping connections L L', the section L' being secured to the valve and the section L extending to the exterior of the stack and terminating in a screw-thread in engagement with a hand-nut M. This nut M is secured in the stack against endwise movement and may be provided with a crank-arm M' for turning the same. The telescoping portions of the sections L L' are square in cross-section to prevent the section L from turning with the nut M.

N is a coiled spring surrounding the section L under compression between the free end of the section L' and a collar N', rigid on the said section L. By turning the nut L the spring M may be set under the proper tension to resist any desired maximum steam-pressure in the nozzle-section. Hence whenever this normal pressure is exceeded the valve will be opened more or less, according to the pressure, and when the pressure falls below the tension of the spring the valve will be again closed. The device is therefore perfectly automatic, permitting the engine to steam freely under all conditions.

The telescoping portions of the section L L' are provided with coincident perforations P. Hence by inserting a pin therein the two sections may be rigidly connected together and the valve-controlling device be thereby converted into a hand device controllable at will by the hand-nut M.

In the modifications shown in Figs. 10, 11, and 12 I provide two valves located diametrically opposite each other. This removes the necessity of enlarging one side of the supplemental discharge-orifice. In this modification the valves R are of the rotary class and are caused to move together by a pair of engaging spur-gears S, rigid one on the outer ends of each of the said valves. One of the gears S is provided with a projecting arm T, which may be operated by any suitable connection, as U, extending to the exterior of the stack and connected to any suitable hand device.

What I claim, and desire to secure by Letters Patent, is as follows:

1. An exhaust-nozzle constructed with a primary and a supplemental discharge-orifice, the supplemental discharge-orifice having an annular form and surrounding the primary discharge-orifice, and a valve located in said nozzle normally closing the said supplemental discharge-orifice to the said nozzle and adapted to be actuated to open the said supplemental discharge-orifice to the said nozzle under the action of an excessive pressure in the said nozzle, substantially as described.

2. An exhaust-nozzle constructed with a primary and a supplemental discharge-orifice, the supplemental discharge-orifice having an annular form and surrounding the primary discharge-orifice, and a valve located in one side of the nozzle for opening and closing the supplemental discharge-orifice to the said nozzle, the said supplemental discharge-orifice being widest at a point diametrically opposite the valve, substantially as and for the purpose set forth.

3. The combination, with the nozzle E, having the primary and supplemental discharge-orifices F and G, respectively, of the valve I, fulcrumed at its lower edge and moving at its upper edge with steam-tight engagement against the abutment K and provided near its fulcrumed edge with the slot-and-pin engagement K', substantially as and for the purpose set forth.

4. The combination, with the nozzle E, having the primary and supplemental discharge-passages F and G, respectively, of the valve I, located in one side thereof, and a valve-controlling device connecting the valve with the exterior of the stack comprising the telescoping sections L L', the hand-nut M, the spring N, and the telescoping portions *g*, the sections L L' being provided with the perforation P, through which a pin may be inserted to secure the said sections together, substantially as described, and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

PAUL SWENSON.

Witnesses:
JAS. F. WILLIAMSON,
ELLIS J. WOOLF.