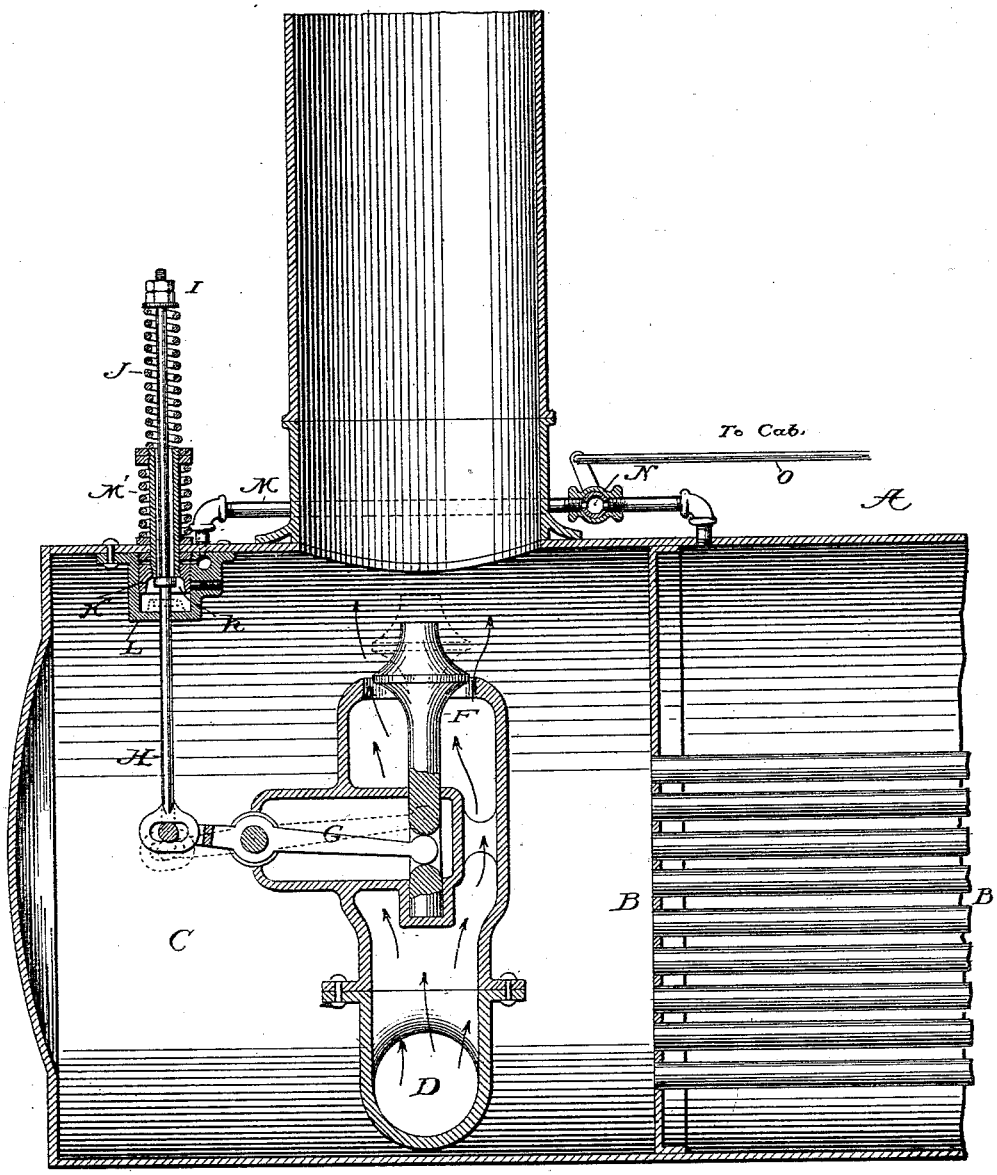
(No Model.)

J. H. PITKIN & J. S. LANE.

EXHAUST NOZZLE FOR LOCOMOTIVES.

No. 458,320. Patented Aug. 25, 1891.



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UNITED STATES PATENT OFFICE.

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EXHAUST-NOZZLE FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 458,320, dated August 25, 1891.

Application filed November 22, 1890. Serial No. 372,350. (No model.)

To all whom it may concern:

Be it known that we, JULIAN H. PITKIN, of Ravenswood, in the county of Cook and State of Illinois, and JULIUS S. LANE, of Oak Park, in the county of Cook and State of Illinois, have invented certain Improvements in Exhaust-Nozzles for Locomotives, of which the following is a specification.

Our invention has reference to locomotives and other engines in which the exhaust-steam from the engine-cylinder is directed through a nozzle into the stack in such manner as to increase the draft through the fire.

The aim of the invention is to secure efficiency and economy of action by changing the area of the exhaust-nozzle and the consequent strength of the draft, according to the demand made on the boiler for steam and at the same time to provide against the existence of an objectionable back-pressure on the exhaust. To this end we provide automatic means whereby the steam-pressure in the boiler and the back-pressure of the exhaust are applied jointly and severally to control the area of the exhaust-nozzle.

Our improvement may be embodied in various equivalent forms and the controlling devices applied in connection with variable exhaust-nozzles of different forms; but we recommend the construction shown in the accompanying drawing.

The drawing represents a vertical cross-section through the forward end of an ordinary locomotive.

In the accompanying drawing, A represents the forward end of the boiler; B, its tubes; C, the smoke-stack, and D the exhaust-nozzle, through which the exhaust-steam of the cylinders is delivered in an upward direction into the stack in a manner familiar to every engineer.

In order to vary the area of the exhaust-nozzle, so that the outgoing blast will produce a more or less violent draft, we locate in the nozzle the vertically-movable valve-spindle F, having an enlarged upper end. When in its lowest position, the spindle leaves but a narrow annular space for the escape of the steam; but when raised, as indicated in dotted lines, it increases the area of the steam-passage. The effect of thus increasing the area of the opening is, first, to lessen the velocity and concentration of the outgoing blast, and thus diminish the draft, and, second, to permit the more ready escape of the exhaust-steam, so as to diminish the pressure within the nozzle and the consequent back-pressure upon the engine-pistons.

To the valve F is connected a lever G on a fixed fulcrum, and to this lever is connected a rod H, extended loosely upward through guiding devices and provided at the top with adjustable nuts I, resting upon a lifting-spring J, which tends through the intermediate parts to keep the valve-spindle in its depressed or closed position. The rod H passes loosely through the neck of a piston K, but is provided with a shoulder *h*, resting against the under side of the piston. The piston is mounted in a cylinder L, the upper end of which communicates through a pipe M with the steam-space of the boiler. A second spring M′, surrounding the neck of the piston and bearing against the collar at its upper end, tends to hold the piston in an elevated position. The cylinder is connected at its top through pipe M with the steam-space of the boiler, and the pipe is provided with a valve N, from which a controlling-rod O extends to the cab of the locomotive, so that the engineer may at will shut off or vary the steam-supply to the cylinder.

As shown in the drawing, the spring M′, designed to resist the boiler-pressure of the steam, is large and strong, while the spring J, which is intended to resist the comparatively feeble back-pressure, is made much lighter and weaker than the spring M′. Under ordinary circumstances the back-pressure should not exceed two per cent. of the pressure in the boiler.

The operation of the parts is as follows: The valve N is usually open, so that the steam may pass freely from the boiler-space into the cylinder L above the piston K. When the boiler and engine are operating in a satisfactory manner—that is to say, when the steam-pressure and the back-pressure are within proper limits—the valve F will stand in its lowest position, so that the exhaust-opening is of minimum area. If, however, the back-pressure in the cylinders becomes objection-

able, the outgoing steam within the nozzle, overcoming the upper and weaker spring J, will force the valve F upward, increasing the area of the exhaust-opening and allowing the exhaust to escape more freely, so as to diminish the back-pressure; or if the steam-pressure in the boiler reaches the predetermined limit it will overcome the stronger spring M′, and depressing the piston K, thereby lift the valve F and increase the exhaust-opening, so as to diminish the blast through the fire and prevent the wasteful generation of steam. It will be observed that either or both the steam-pressure and the back-pressure may operate at one time to increase the exhaust-opening.

By properly adjusting the relative strength of the springs and the area of the valve F the strength of the blast and the generation of steam may be controlled with great nicety and so as to secure under all conditions an economical use of the fuel and the avoidance of objectionable back-pressure on the engine-piston.

In practice it is usual to designate the nozzle and the valve which controls the area of its delivery-opening by the term "variable exhaust," and this expression is therefore used herein as including any nozzle having means for changing the area of its discharge-opening under the influence of steam-pressure.

Having thus described our invention, what we claim is—

1. In combination with an engine-boiler, a variable exhaust-nozzle, devices subject to the boiler-pressure for opening said nozzle, a strong spring to resist said action of the boiler-pressure, and a second and relatively weak spring to resist the opening of the nozzle under the pressure of the exhaust.

2. In combination with an engine-boiler, the exhaust-nozzle, the valve-spindle therein to control the exhaust, the piston connected therewith and subject to the boiler-pressure, the spring to resist the movement of the piston, and a second and weaker spring acting independently to resist the opening movement of the spindle.

3. The exhaust-nozzle, the valve-spindle therein, and the lever to move said spindle, in combination with the lever-operating rod H, the cylinder L, its piston subject to the boiler-pressure and arranged to move the rod in one direction, and the two springs, one acting to resist the movement of the piston and the other acting to resist the movement of the rod.

4. In combination with a steam-boiler, an exhaust-nozzle, a valve controlling the area of its outlet, a spring tending to close the valve, a piston subject to the boiler-pressure for opening the valve, and a throttle subject to the control of the engineer and in turn controlling the delivery of steam to the piston.

In testimony whereof we hereunto set our hands, this 5th day of November, 1890, in the presence of two attesting witnesses.

JULIAN H. PITKIN.
JULIUS S. LANE.

Witnesses:
JOHN LEWIS,
ALBERT A. LANE.