I. H. CONGDON & E. B. WOOD.

Variable Exhaust-Nozzle.

No. 214,992. Patented May 6, 1879.

Fig. 1.

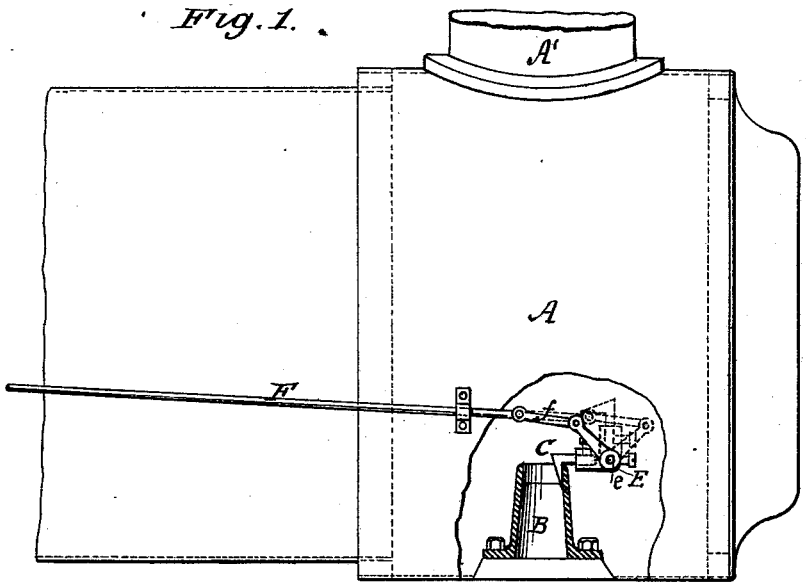


Fig. 2.

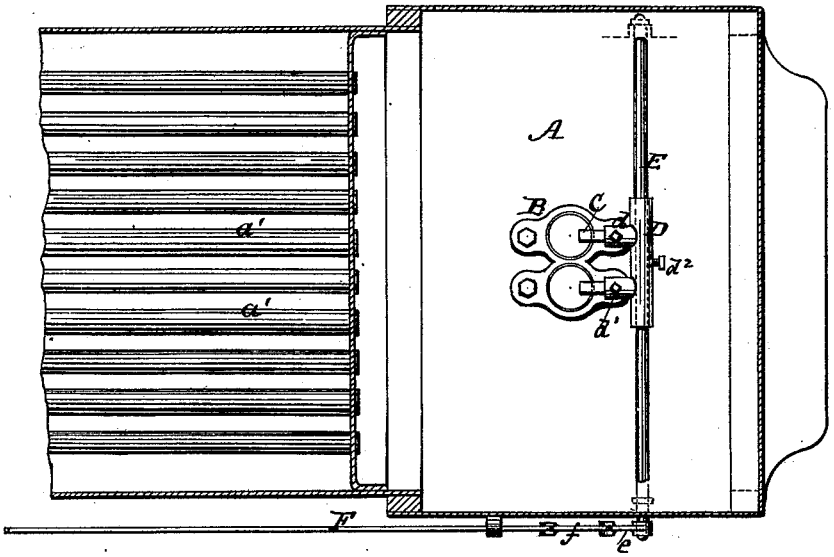


Fig. 3.

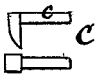
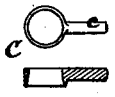


Fig. 4.

Fig. 5.



Witnesses:

W. B. Masson

W. E. Bowen

Inventors

I. H. Congdon

Edward B. Wood

by E. E. Masson

their atty.

UNITED STATES PATENT OFFICE.

ISAAC H. CONGDON AND EDWARD B. WOOD, OF OMAHA, NEBRASKA.

IMPROVEMENT IN VARIABLE EXHAUST-NOZZLES.

Specification forming part of Letters Patent No. **214,992**, dated May 6, 1879; application filed March 10, 1879.

To all whom it may concern:

Be it known that we, ISAAC H. CONGDON and EDWARD B. WOOD, of Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Variable Exhaust-Nozzles; and we hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 represents, in side view, the smoke-box, partly broken open, of an engine having our improvement. Fig. 2 represents a horizontal section of the same. Figs. 3, 4, and 5 represent in top view and section modifications of our bushings used with exhaust-nozzles.

The invention relates to wedge-shaped bushings used in connection with the exhaust-nozzles of locomotive-engines to vary their opening and their effect upon the draft in the fire-box.

Heretofore various means have been used to regulate the draft and pressure of steam. The practice of opening the fire-door to keep the steam low not only causes a great waste of fuel, but is often the cause of cracks in the fire-box plates by admission against them of a large volume of cold air. Variable exhausts have been tried before this, but generally found to be defective, either because they scatter or deflect the blast or neutralize its effects, or that from their construction they become clogged or gummed by the tallow from the cylinders, and become immovable, or cannot stand the continual variation of temperature in the smoke-box.

The object of our invention is to overcome these defects, and to provide exhaust-nozzles with a variable device that cannot gum up, nor be affected by variations of temperature in the smoke-box, nor interfere with the blast, only to raise or lower its force. At the same time it can be operated by a rod from within the engineer's cab, even more easily than the ordinary ash-pan damper. This device is very simple, and can be applied to any engine at very little expense.

Our invention consists in combining, with the exhaust-nozzles of a steam-engine, wedge-shaped bushings attached to a rock-shaft, and in position to enter said nozzles, to diminish their area, and capable of being removed clear off the path of the escaping steam by said rock-shaft, operated, if desired, by a rod from a distance or from the cab of the engine.

In the drawings, A represents the smoke-box of a locomotive-boiler. About the center of the lower portion of this smoke-box, and directly under the center of the chimney A′, are placed the nozzles B, to conduct steam from the cylinders, and allow it to escape in the smoke-box in front of the boiler-flues *a′* on its way up the smoke-stack, causing a vacuum in said flues that has to be supplied by the products of combustion from the fire-box, and thus adding greatly to the draft.

From the foregoing it will be understood that practically the exhaust-nozzles control the amount of fuel burned, and their control is a matter of great importance.

It is found that in locomotives the steam-pressure constantly fluctuates. When going up grade, or running very fast, or against strong head or side winds, and from other causes, the pressure in the boiler will fall. On the other hand, at times, from other causes, the engine is blowing off steam at the safety-valve, causing a great waste of fuel. When the engineer has the power to vary the exhaust-opening to adapt the steaming power of the boiler to different circumstances, much economy is the result. This we accomplish by means of wedge-shaped bushings C, placed in sockets *d*, forming part of a sleeve, D, mounted upon a rock-shaft, E. The sockets *d* are the same distance apart as the centers of the nozzles B, and the bushings C project such a distance out of them as to enter, when locked down, within the nozzles, as shown in full lines in the drawings, and thus reduce the area of said nozzles and increase the draft from the fire-box. The stem *c* of each bushing is secured in its socket *d* by a binding-screw or bolt, d^1.

Each socket may be provided with its own sleeve to be readily adapted to nozzles standing at various distances apart, or the two sockets may form a part of the same sleeve. Either way said sleeves or sleeve D is secured by a screw-bolt, d^2, or otherwise, to the shaft E, and is to be operated thereby. This shaft

E may be mounted in suitable bearings, or, as shown, connected to the smoke-box in the simplest way, by having it extending from one side to the other, and projecting therefrom is secured by a flange or nut. To its projecting end is attached an arm, *e*, and to the latter a long rod, F, by means of a link, *f*. The rod F extends to the engineer's cab, and is provided with notches, by which it is retained upon a projecting pin or stop in any desired position to keep the bushings C either clear of the openings of the nozzles or within said opening a short distance to slightly reduce their area, or their full length for the largest reduction, according to circumstances under which the engine is working.

In Figs. 3, 4, and 5 are represented our bushings of various sizes and forms to regulate the draft in different engines, or in the same engine, according to work being done and quantity of fuel. In Figs. 1 and 2 the wedge-shaped bushings are about of the same width as their stem. In Fig. 3 the bushing shown is wider than the stem. In Fig. 4 it is still wider and of crescent form, to fit, when brought down, one side of the interior of the nozzle to contract its area and increase the draft. In Fig. 5 it is made to line the whole opening of the nozzle; but in each case these bushings are provided with a stem to enter a socket, or its equivalent, attached to a rock-shaft, and by which they are raised clear of the nozzles, or off the path of the escaping steam, or brought down within the nozzles by a positive movement controlled by the engineer.

Having now fully described our invention, we claim—

1. In combination with the smoke-box and exhaust-nozzles of an engine, a rock-shaft carrying wedge-shaped bushings, rigidly attached thereto, said bushings to be carried in or entirely out of line of said nozzles, as shown, to regulate their area, substantially as and for the purpose specified.

2. In combination with a rock-shaft, E, and exhaust-nozzles placed in the smoke-box of an engine, the wedge-shaped bushings C, adapted to be carried in and entirely out of line of said nozzles, as shown, and provided with a stem, *e*, to enter a socket attached to said rock-shaft, substantially as and for the purpose set forth.

ISAAC H. CONGDON.
EDWARD B. WOOD.

Witnesses:
BYRON REED,
LEWIS S. REED.