(No Model.)

C. M. MARSHALL.

EXHAUST NOZZLE.

No. 569,561. Patented Oct. 13, 1896.

Fig. 1.

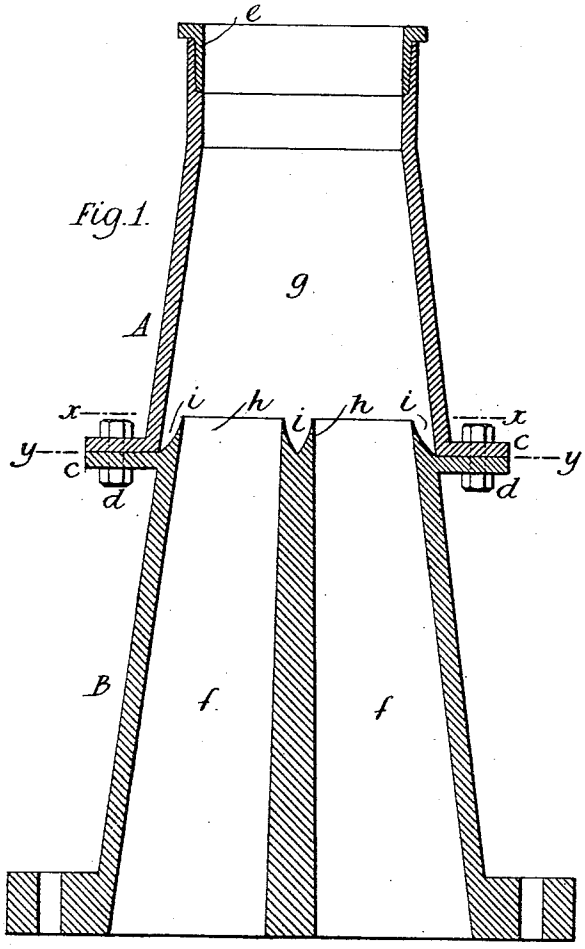


Fig. 2.

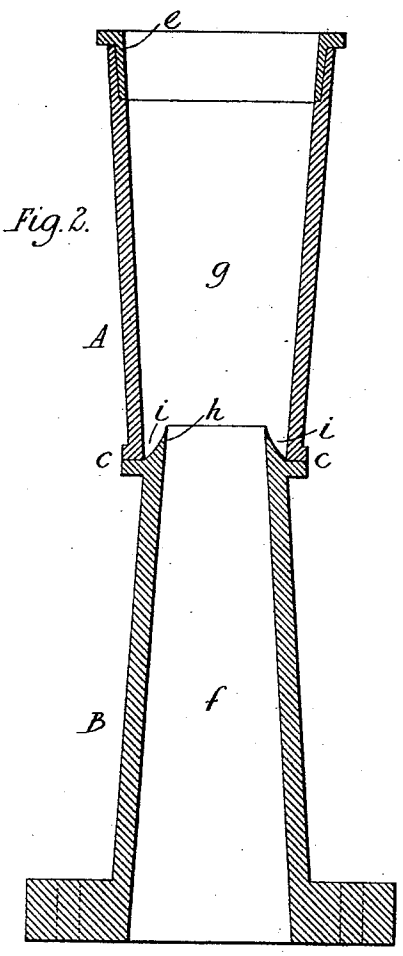


Fig. 3.

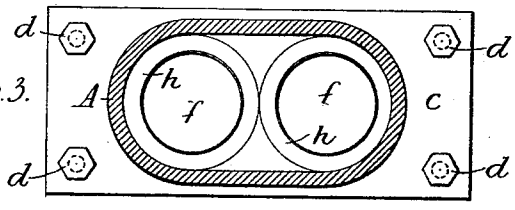
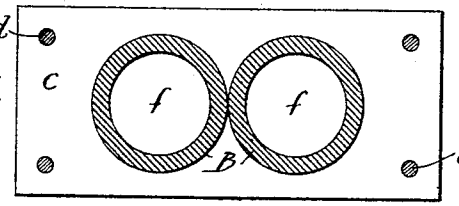


Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

CASSIUS M. MARSHALL, OF FRANKFORT, INDIANA, ASSIGNOR OF ONE-HALF TO ALFRED N. BERRY, OF SAME PLACE.

EXHAUST-NOZZLE.

SPECIFICATION forming part of Letters Patent No. 569,561, dated October 13, 1896.

Application filed September 23, 1895. Serial No. 563,432. (No model.)

To all whom it may concern:

Be it known that I, CASSIUS M. MARSHALL, a citizen of the United States, residing at Frankfort, in the county of Clinton and State of Indiana, have invented certain new and useful Improvements in Exhaust-Nozzles; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention is directed to improvements in exhaust-nozzles for locomotive and other engines, and contemplates the production of a nozzle by the use of which back pressure in the cylinders is entirely obviated and an increase of power is obtained with the usual boiler-pressure; also by my invention the live steam may be cut off at a comparatively earlier period than heretofore, owing to the provisions of means whereby an expansion of the steam is secured, and incidentally my invention by its operation produces material economy in the consumption of fuel.

The nature of my invention will become apparent from a reading of the following description when taken in connection with the accompanying drawings, in which—

Figure 1 is a vertical transverse sectional view of my improved exhaust-nozzle. Fig. 2 is a vertical longitudinal sectional view. Fig. 3 is a cross-sectional view on line *x x* of Fig. 1, and Fig. 4 is a cross-sectional view on line *y y* of same figure.

Referring to said drawings by letter, A denotes the top section of my improved exhaust-nozzle, and B is the bottom section, and for convenience in connection each of said sections is flanged at *c* and connected by securing nuts and bolts *d d*, as shown. The lower end of the lower section is also flanged for connection with a suitable part of the engine and the upper section is recessed to receive removably a nozzle-tip *e*, as shown.

In the operation of my invention the steam is led from the cylinders through an unobstructed passage, and hence has a natural free outlet, with the result of rendering back pressure practically *nil*. The natural course of steam is in an upward direction, and steam being of an expansive nature it is evident that the fewer the turns and obstructions presented the less will be the friction, and consequently I am enabled to obtain comparatively more power from the steam than heretofore; as it is evident that friction must be overcome with increased power, which can only come from the live steam from the boiler.

By reference to the drawings it will be observed that the lower section of the nozzle is comparatively short, and that the exhaust-apertures *f f* through the same are contracted, but by reason of the smoothness and straightness of the walls and the short length of passage the friction on the steam is minimum. The contracted or tapering form of the passages has the effect to cause the exhaust from one passage to create a vacuum in the adjacent passage, aided by the top section A, which I will now describe. The passage *g* in said top section is also of tapering form, the walls being straight and smooth, and the inlet of said passage has a much greater area than the combined areas of the outlet ends of the passages *f f* in the lower section. In the upper end is the recess to receive the removable top *e*, previously referred to.

Beyond the flange on the upper end of section B are annular projections *h h*, the inner sides of which form a continuation of the walls of the passages or apertures *f f*, but which are inclined at their outer sides, and thereby form with the wall of the passage of the upper section pockets *i i*, annular in shape and having a depth equivalent to the height of the projection from the flange. These projections *h* consequently extend within the upper section and the steam is discharged therefrom well within the top section alternately from each aperture. The tapering form of the apertures causes a blast of exhaust-steam to enter the pockets *i* and to simultaneously expand and displace the air in the top section; and the area of the latter being, as before stated, in excess of the combined areas of the outlet ends of the passages a displacement of the air in the idle aperture takes place with the result of creating a vacuum and reducing the back pressure to

the minimum. The vacuum created in the lower section draws the steam through the exhaust-port before the piston has moved sufficiently far on its return stroke to cause a pressure, and this vacuum, aided by the facilities for producing a free uninterrupted and natural flow of the exhaust-steam, effectually prevents that back pressure in the cylinder which robs an engine and boiler of available power.

It will be noted that in the passage for the steam through my improved nozzle there are no angular turns, shoulders, bridges, or projections, and consequently the flow of steam is perfectly unimpeded, and aided by the vacuum the exhaust-steam performs its useful functions without the usual necessity of reducing the tip to produce in the fire-box the requisite draft.

The annular projections *h*, extending, as they do, well into the upper section, effectually prevent the exhaust-steam from one passage or aperture in the lower section entering the other passage or aperture and from thence passing into the other cylinder, as is the case where the two apertures terminate at the point of connection with the upper section. The lower end of the upper section, it will be noted, extends in all directions beyond the upper ends of both of the apertures in the lower section, thus obtaining the increased area necessary to produce the results above stated.

An advantage incident to the construction and operation of my improved nozzle is that the exhaust-steam, instead of expelling in the usual sharp jerking manner which is so productive of sparks and cinders, is discharged comparatively gently, yet producing the vacuum necessary to maintain the proper draft for the fire, and consequently little or no sparks or cinders result. On the other hand, those particles of fuel which are usually lost before consumption are retained in the fire-box and there consumed with the result, aside from the advantage above given, of a great saving of fuel.

The facilities provided for insuring a free and natural exhaust also produce economy in steam, as there is, as previously stated, comparatively no back pressure, and incidental to this advantage steam may be cut off a period earlier than heretofore, thus further increasing the economy in this direction.

The device when made in accordance with the above description is simple in construction and may be manufactured at small expense, as the parts are few in number and devoid of complication.

I claim as my invention—

An exhaust-nozzle comprising two sections, the lower section having two tapering exhaust-passages the upper ends of which are provided with annular projections exteriorly tapered to bring said ends to an edge, and the upper section provided with the single tapering passage, the inner wall of said section extending beyond and below said projection and thereby providing upwardly-flared annular pockets, all as and for the purposes set forth.

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

CASSIUS M. MARSHALL.

Witnesses:
ALFRED N. BERRY,
BRADEN CLARK.