

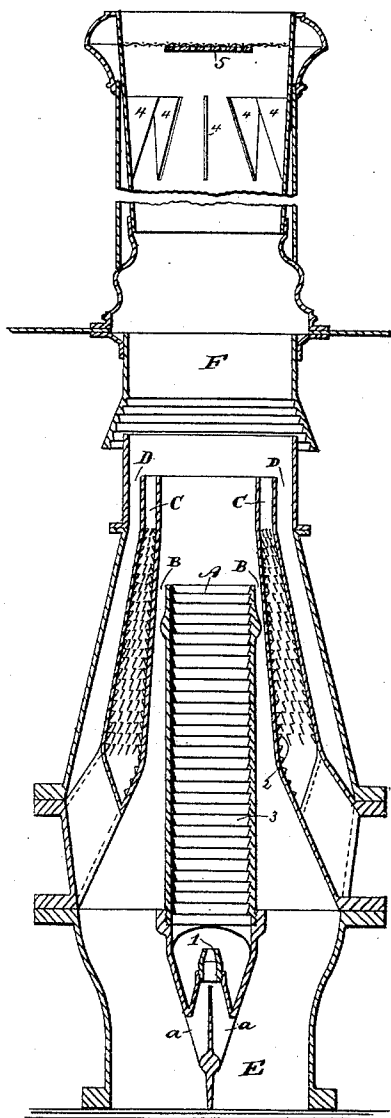
(No Model.)

J. Y. SMITH.
SPARK EXTINGUISHER.

No. 460,224.

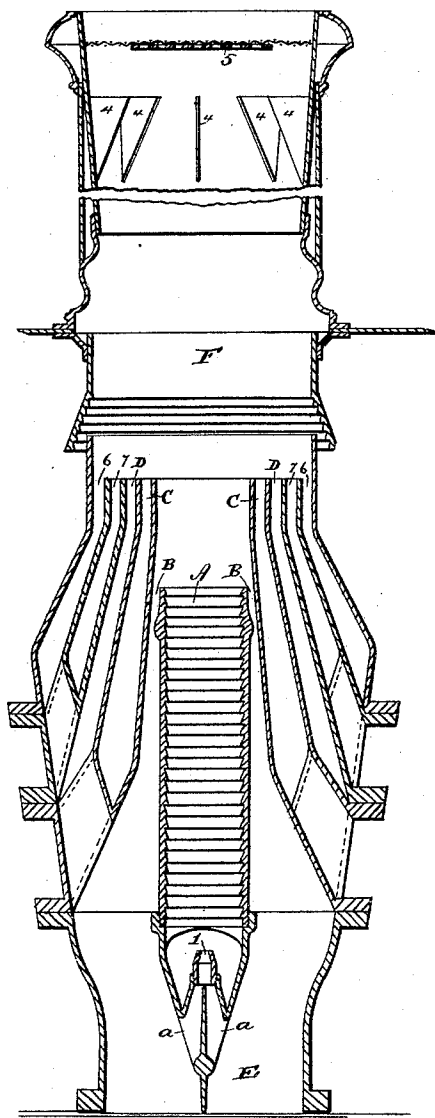
Patented Sept. 29, 1891.

Fig. 1.



Witnesses.
Chas R. Burr.
Thomas Durant

Fig. 2.



Inventor.
John Y. Smith
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UNITED STATES PATENT OFFICE.

JOHN Y. SMITH, OF DOYLESTOWN, PENNSYLVANIA, ASSIGNOR TO THE
SMITH EXHAUST PIPE COMPANY, OF NEW JERSEY.

SPARK-EXTINGUISHER.

SPECIFICATION forming part of Letters Patent No. 460,224, dated September 29, 1891.

Application filed September 20, 1888. Serial No. 285,866. (No model.)

To all whom it may concern:

Be it known that I, JOHN Y. SMITH, of Doylestown, in the county of Bucks and State of Pennsylvania, have invented certain new and useful Improvements in Spark-Extinguishing Exhaust Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to improvements upon or applicable to exhaust apparatus of the character described in my prior patents, No. 378,340, dated February 21, 1888, and No. 386,502, dated July 24, 1888, and has for its object primarily to more completely effect the extinguishment of sparks, thereby diminishing or entirely avoiding danger from fire and incidentally increasing the power or draft produced by the exhaust apparatus.

Another object had in view is the enlargement of the capacity of the exhaust apparatus by diminishing the width of the steam-nozzle of the outer ejector without materially changing the size of the air-nozzle and conducting the surplus steam through an exterior nozzle adjacent to another air-passage, whereby with the same volume of steam a larger volume of air is drawn into and propelled through the ejector and at the same time the passage for the exhaust is increased.

To these ends my invention consists, first, in the addition or introduction of a steam nozzle or jet within the central air-tube, and, preferably, near the base or the lateral openings therein; second, the introduction of deflecting plates or surfaces within the air-passages to engage the larger and heavier particles, so that they will be broken in their passage or deflected from side to side and retained for a longer period within the tube or tubes and subject to the extinguishing action of the steam, and, third, the addition of one or more air and steam nozzles in proximity to or surrounding the outer ejector, all as hereinafter more fully described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section through a blast

or exhaust apparatus, illustrating the application of my several improvements. Fig. 2 is a similar view of a blast apparatus, showing the manner of applying the central jet and deflecting surfaces to a duplex ejector of the type previously patented by me.

Similar letters and numerals of reference in the several figures indicate the same parts.

My present improvements are illustrated as applied to a duplex ejector or blast apparatus of the type heretofore patented to me, comprising a central air-tube A and surrounding steam-nozzle B, forming the inner ejector, and an air-passage C and steam-nozzle D, forming the outer ejector, both of said ejectors receiving steam from the exhaust-ports through a base E and delivering air and steam into the smoke stack or chimney preferably through an intermediate flue F, movable and adjustable vertically, as set forth in my patent, No. 386,502.

An exhaust or blast apparatus for use on locomotives to be entirely satisfactory must not only produce a sufficiently even and copious flow of air through the fire and at the same time furnish a ready escape for the exhaust-steam to avoid back-pressure, but it should also operate so as to prevent, if possible, the accumulation of ashes and cinders in the smoke-chamber and effectually extinguish the fire in those particles which are discharged, in order to avoid accidental conflagrations so common in the neighborhood of railways. It is, too, for the purpose of more effectually extinguishing the sparks and removing the larger particles from the interior of the smoke-box that my present inventions are principally designed, the changes, additions, and improvements in the apparatus made with this end in view having developed as an incident increased power and capacity in the apparatus to maintain and equalize the draft and secure a more free escape of the exhaust-steam.

Practice has demonstrated that the duplex ejector or blast-pipe will under certain conditions, as when applied to some of the older styles of locomotives, develop a tendency to accumulate ashes, cinders, &c., in the forward portion of the smoke box or chamber and will

sometimes fail to entirely extinguish all the larger particles driven out through the smoke-stack.

As the result of many observations and tests of the apparatus, I have come to the conclusion that this defective action is due in part at least to the fact that those particles taken up through the inner ejector, being carried up in the central column of air, are partially protected by the latter against the action of the surrounding column of steam, so that some are permitted to escape through the smoke-stack without being subjected to the direct action of the steam; hence are not entirely extinguished. This, in a measure at least, accounts for the occasional delivery of ignited particles, while the failure to carry out all the larger bodies is due to the fact, first, that being too large to pass through the netting they may pass down into the smoke-box and find a lodging-place therein, and, second, the larger and heavier particles drawn through the flues acquire sufficient momentum to carry them past the induction-opening leading to the inner ejector and beyond the range of action of the injector, which is principally directed toward the flues, through which latter the supply of air or gases is drawn to supply the partial vacuum created in the smoke-box. To overcome these defects and at the same time augment the power of the inner or central ejector by starting the column in motion and increasing the local action at or near the induction-opening, I arrange a small orifice or jet-pipe 1 within the central air-passage A and preferably at the base thereof at the junction of the lateral openings *a*, said jet-pipe communicating with the steam-chamber in base E and delivering into the passage A. This small supplemental jet of steam, delivered into passage A, as described, operates to increase the local action in the immediate vicinity of the inlet-passages *a*, drawing in many of the larger particles, which would otherwise be carried beyond and lodged in the farther ends of the smoke box or chamber, while the steam, being delivered centrally of the passage A or between the inlet-passages *a*, partially divides or penetrates the moving column of air, so that a more thorough admixture of steam and air or gases is effected. The central jet also acts advantageously in connection with another feature of my invention, which consists in providing a means whereby the solid particles, as they are drawn into and forced through the apparatus, will be subjected to a grinding or crushing action, tending to reduce their size and at the same time delay their movement through the passages by alternately changing the angle or direction of flight, so that they will be subjected for a longer period to the action of the steam. This I accomplish by providing the inner faces of the air-passages with teeth or corrugations or plates, as shown at 2, 3, and 4, (either form may be used exclusively, if desired,) presenting faces

standing more or less at an angle to the line of movement of the particles, but preferably so disposed as not to present such a surface as will cause the particles to be directed downward.

The particles are driven with considerable force through the apparatus when the latter is in action, and in their flight have a tendency to move toward the sides of the passage, and this tendency is increased in passage A by reason of the central jet, so that when driven against these inclined surfaces they will be broken and reduced in size, while the larger and heavier particles, if not broken, will be caused to take a zigzag course, as in passing through the flue and smoke-stack, and in so doing will be subjected to the action of the steam until finally discharged.

The impact and delay surfaces located within the smoke-stack are preferably applied in the form of thin blades or plates 4, fastened to a suitable support or to the walls of the passage, while the netting at the upper end of the smoke-stack, if employed, is furnished with a perforated breaking-plate 5, against which the larger particles are directed as they pass from the plate 4.

The impact and deflecting surfaces may be varied in form, arrangement, and composition, providing they are so disposed as to intercept the larger particles and cause their rupture or deflection through the column of steam, as described.

Another feature of my invention consists in augmenting the capacity of the exhaust apparatus without diminishing its power or increasing the area of the steam-nozzles beyond the point necessary to produce the required intensity of blast and freedom of escape to prevent back-pressure.

As is well known, in an apparatus of this kind, wherein the motive power is the exhaust-steam from the cylinders, it is essential that the area of the steam-nozzles shall bear a certain relation to the size of the exhaust-ports in order not to produce back-pressure upon the cylinders and at the same time preserve the requisite sharpness or intensity of action to move the required volume of air or gases. Experience has shown, moreover, that the capacity and sharpness of the blast depend in a great measure upon the velocity at which the steam issues from the nozzle and the area of the surface of the jet of steam acting directly upon or brought into contact with the air as it flows through the air nozzle or opening. While these conditions are almost perfectly fulfilled in the duplex exhaust apparatus, with its inner and outer ejectors having long and narrow steam-openings, it sometimes happens that the requisite sharpness of blast combined with larger capacity and free escape cannot readily be secured with the inner and outer ejector alone. Hence to meet this emergency I have devised an apparatus such as shown in Fig. 2, wherein one or more supplemental ejectors

are combined with the duplex ejector. To accomplish this it is not sufficient to add additional steam and air passages, for that would merely have the effect of reducing the sharpness without materially increasing the capacity; but I have discovered that by diminishing the size of the steam-nozzle of the outer ejector without materially altering the size of the adjacent air-passage, and forming the supplemental steam-nozzle 6 of a size corresponding to or slightly exceeding the area by which the outer steam-nozzle C has been reduced, and arranging a supplemental air nozzle or passage 7 adjacent said nozzle 6 and between the latter and nozzle C, the capacity of the ejector can be materially increased in a degree proportional to the area of the air-nozzle 7 without diminishing the sharpness of the blast or otherwise interfering with the normal operation of the other parts.

I do not claim herein the combination *per se* of the central jet and an annular exhaust apparatus irrespective of the use of the deflecting or retarding surfaces, said subject-

matter being reserved in a separate application, Serial No. 299,245, filed February 9, 1889.

Having thus described my invention, what I claim as new is—

1. In an exhaust apparatus such as described, the combination, with the steam-nozzle and air-passage C, opening into the ejector, of deflecting surfaces or plates located within said air-passage, whereby the solid particles are broken up during their flight through said air-passage and before mingling with the steam from the exhaust-nozzle, as and for the purpose set forth.

2. In a blast or exhaust apparatus such as described, having inner and outer ejectors and a steam-jet opening into the central air-passage of the inner ejector, a series of deflecting plates or surfaces to receive the impact of solid particles drawn through the ejector, as set forth.

JOHN Y. SMITH.

Witnesses:

HENRY LEARY,
HENRY S. MURFIT.