2 Sheets—Sheet 1.

T. COOPER.

AIR EXHAUST FOR VACUUM CAR-BRAKES.

No. 184,460. Patented Nov. 21, 1876.

FIG 1.

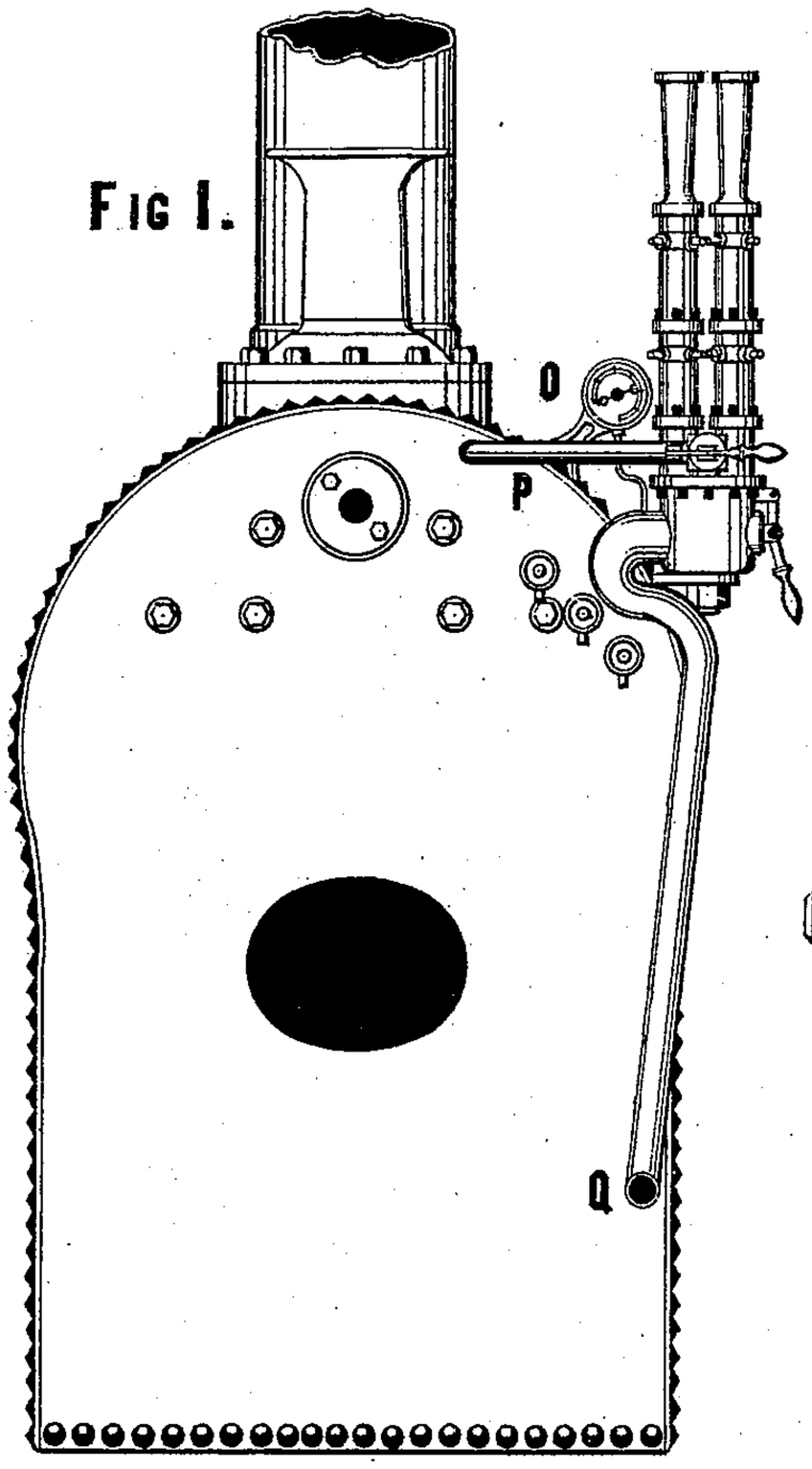


FIG 2.

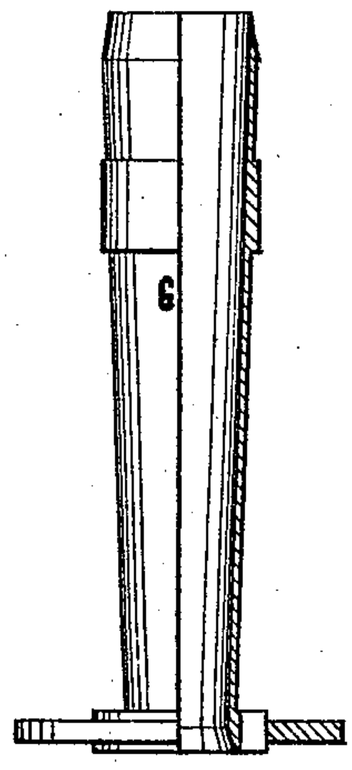


FIG 5.

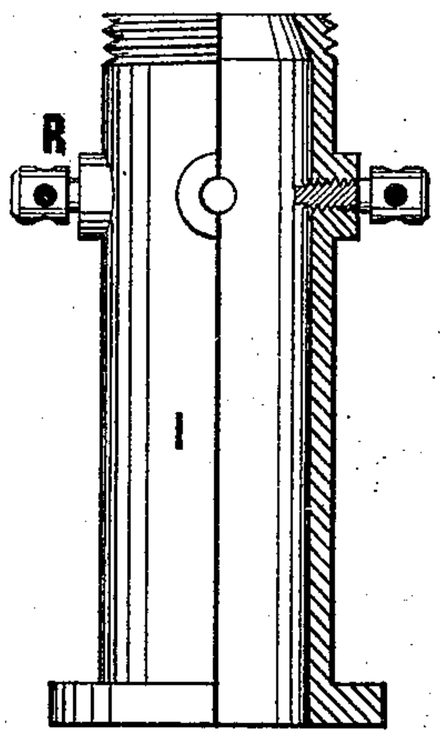
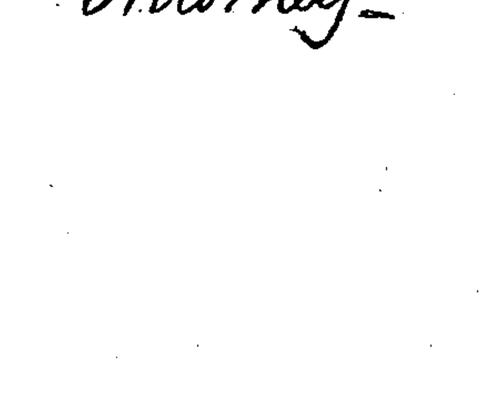


FIG 3.

FIG 4.

FIG 6.



WITNESSES.

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2 Sheets—Sheet 2.

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AIR EXHAUST FOR VACUUM CAR-BRAKES.

No. 184,460. Patented Nov. 21, 1876.

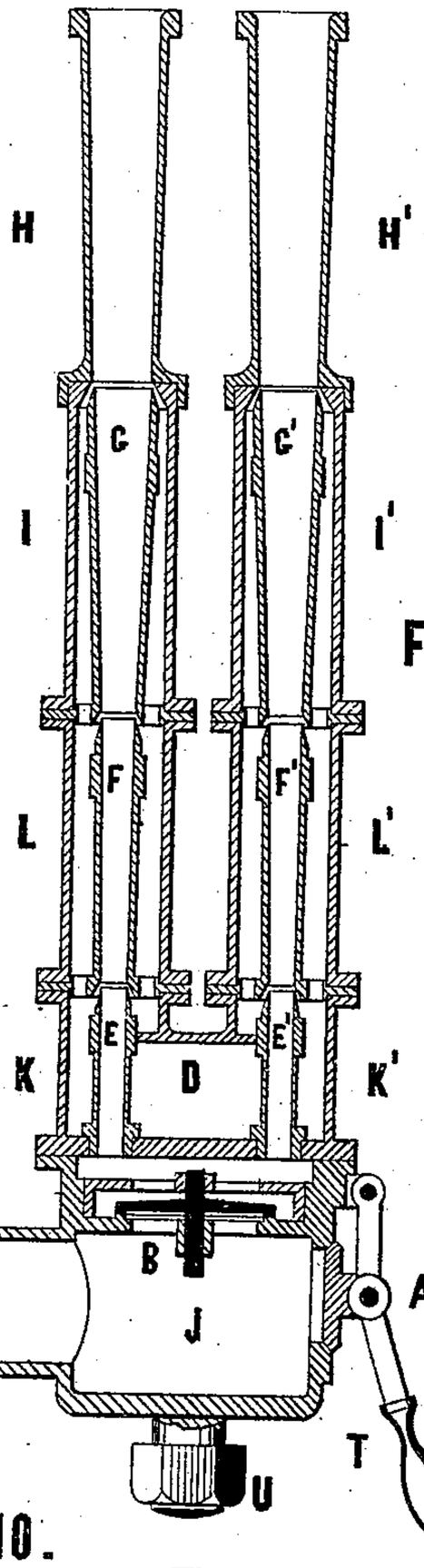

FIG 7.

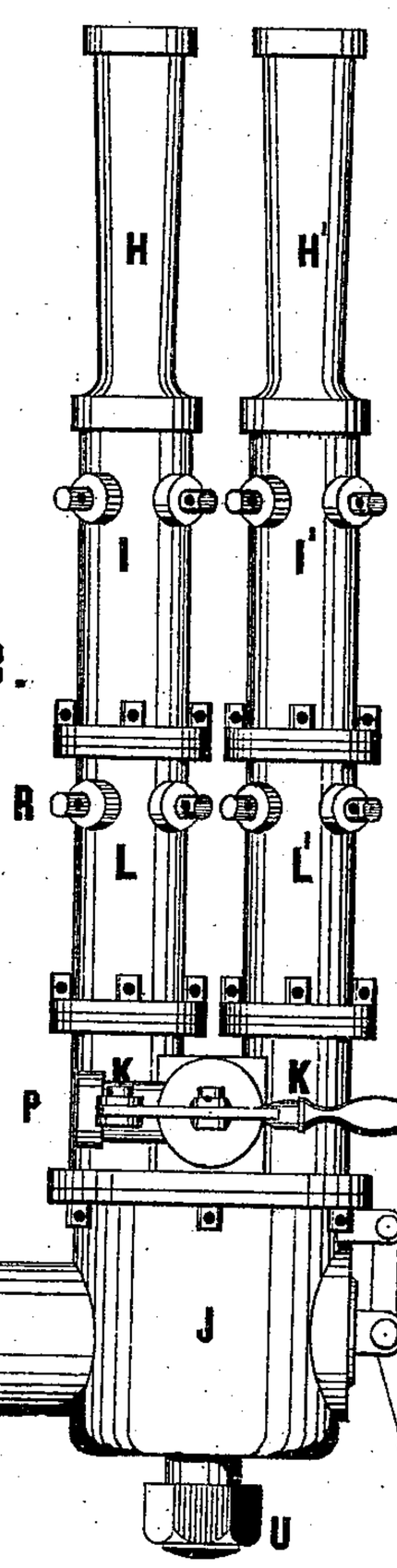

FIG 8.

FIG 9.

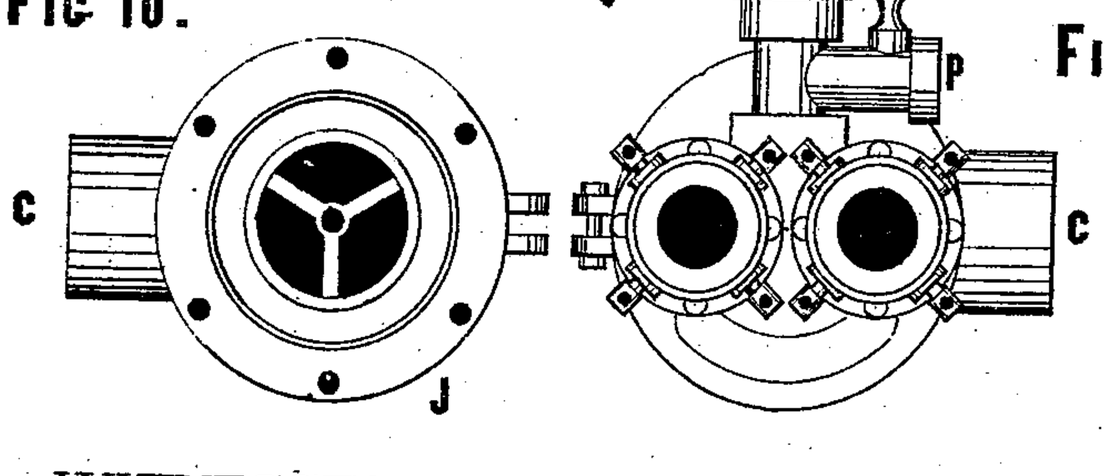

FIG 10.

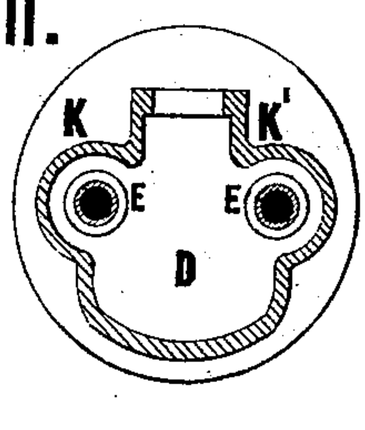

FIG 11.

WITNESSES.

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THEODORE COOPER, OF WARWICK, RHODE ISLAND.

IMPROVEMENT IN AIR-EXHAUSTS FOR VACUUM CAR-BRAKES.

Specification forming part of Letters Patent No. **184,460**, dated November 21, 1876; application filed April 6, 1876.

To all whom it may concern:

Be it known that I, THEODORE COOPER, of Warwick, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Air-Exhausting Apparatus for Operating Vacuum Car-Brakes and for other Purposes; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

My improvements relate to that class of apparatus in which a steam-jet is employed for exhausting the air from a pipe or chamber, and they may be used with good results in connection with vacuum car-brakes. Such apparatus has been heretofore designated under several names, among which are "injector" and "ejector" attachments.

All apparatus of this class necessarily involves the use of an exhaust or air stack or pipe, which communicates with the chambers or pipes from which the air is to be drawn, and a steam-pipe centrally located within the stack, which communicates with a steam-boiler. Various forms and arrangements of steam-pipes and stacks have been proposed, devised, and employed, many of which have been heretofore patented.

So far as my knowledge extends, no exhaust-stack has been heretofore made with which more than one steam-jet pipe was employed, although two or more stacks have been heretofore placed side by side, each of which were provided with a single jet-pipe.

The main feature of my present invention is based upon my discovery of the fact that by combining within one exhaust-stack two or more steam-jet pipes placed one above the other, and properly arranged with relation to the interior of the stack, I can obtain a more complete vacuum than can be obtained by the same jet-pipes, if each were singly combined with a stack, and all of the stacks were placed side by side and arranged to exhaust air from the same pipe or chamber. In other words, I have discovered that the exhausting power of two jets properly located and arranged within one stack is greater than the sum of the powers of the two jets in two stacks, the two jets in each case being arranged to draw air from a pipe or chamber common to both stacks. This main feature of my invention consists in the combination with an air-stack of two or more steam-jet pipes centrally located within the stack, and arranged one above the other, so that the steam from each enters into a vertical central air-space, enabling said jets to co-operate upon a column of air which is drawn from below the stack and ejected from its top.

Another feature of my invention consists in the combination, within an air-exhaust stack, of two or more annular steam-jets, located at different longitudinal points in an air-stack, having an interior passage for the steam and air, which is gradually enlarged in diameter from the first or lowest jet-pipe to the top of the stack, whereby I attain a free ejection of air and steam from the stack.

Still another feature of my invention consists in the combination with the jet-pipes of adjusting mechanism exteriorly accessible, whereby a perfect adjustment of the annular steam-space may be readily effected.

To more fully describe my invention I will refer to the accompanying drawings, of which there are two sheets, and in which—

Figure 1, Sheet 1, represents, in rear end view, a locomotive-boiler with my exhausting apparatus properly attached. Fig. 2 represents one of the jet-pipes and its flange, partly in side view and partly in vertical section. Figs. 3 and 4 represent, respectively in top and bottom view, the pipe and flange in Fig. 2. Fig. 5 represents a portion of the stack, partially in side view and partially in vertical section. Fig. 6 represents the same as in Fig. 5 in top view. Fig. 7, Sheet 2, represents the apparatus in vertical central section. Fig. 8 represents the apparatus in side view, on a larger scale than in Fig. 1. Fig. 9 represents the apparatus in top view. Fig. 10 represents, in top view, the base-flange on which the apparatus is mounted, and shows the guides for a check-valve. Fig. 11 represents, in lateral section, the steam-chamber at the base of the stack, which is connected with the boiler from which the several jet-pipes are supplied.

In Fig. 1 the exhaust apparatus is shown to be connected with the steam-boiler by way of

pipe at P, and provided with a pipe at Q, for connection with the operative vacuum-chambers wherever they may be located.

Referring to Sheet 2, it will be seen that the apparatus is mounted on a base at J, which is provided with a screw-neck at U, for connection with a flange-plate projecting from the outside of the boiler. The base is hollow, constituting an air-chamber, with which, as at C, the pipe Q (shown in Fig. 1, and already described) is connected. At the top of the base-chamber, guarding an upward passage therefrom, is a check-valve, as at B. A relief-valve is shown at A, with lever at T, whereby air may at any time be admitted into the base-chamber, and thence to the working-chambers, with which it is connected.

Mounted upon the base-chamber is a steam-chamber, D (shown in lateral section at Fig. 11;) its sides are shown at K and K′. Each portion thereof so designated serves as a base for one of two separate exhaust-stacks, and is properly flanged to receive them. This chamber receives the steam from the boiler and delivers it to all of the jet-pipes in both stacks. Each stack is shown in this instance to be composed of three flanged pipes, mounted one above the other, and designated at L L′, I I′, and H H′. Each stack has also three jet-pipes, (shown at E, F, and G, and E′, F′, and G′.) The lower jet-pipes E E′ communicate interiorly with the air-chamber J by way of an intervening inclosed space, and the port covered by the check-valve B. At their upper ends they are chamfered and properly entered into the flaring lower ends of the jet-pipes next above at F and F′, respectively. These pipes F F′ are expanded in diameter gradually from bottom to top, at which point they also are chamfered and properly entered into the flaring lower ends of the jet-pipes next above at G G′, respectively, which are in like manner expanded diametrically from bottom to top, at which point they are also chamfered and properly arranged concentrically with relation to the lower ends of top pipes H and H′, respectively, and these are also larger at the top than at the bottom.

It will be seen that the annular spaces surrounding all of the jet-pipes which are above the steam-chamber communicate therewith, while the lower jet-pipes are located wholly within said chamber. The steam enters the chamber D by way of pipe P, and is controlled by valve shown in Figs. 8 and 9 at S.

The jet-pipe G is shown on an enlarged scale in Fig. 2. It will be seen that at a short distance from its upper end it is re-enforced in thickness, in order that it may have sufficient strength to resist the pressure of the radial set-screws at R in the stack, by means of which the upper ends of the pipes are properly adjusted with relation to the lower ends of the pipes next above, in order that the annular steam-space for the jet may be uniform at all points.

When in operation three annular jets of steam are simultaneously discharged upward into the central space of each stack, and the gradual enlargement of said space, as shown, secures a free delivery of the air and steam from the stack, and results in the attainment of a more perfect vacuum than the three pipes could possibly attain if each were operated separately in a stack of its own, and at the same time working collectively, by having all of their stacks communicating with the base-chamber. This increased result is probably due to the fact that each jet of steam from the top of each pipe exercises a certain degree of draft-force below that point, and also to some extent exhausts the air in the pipe above as the steam and air are driven upward. The steam is also favorably exposed for condensation, and this may also in some measure contribute to the increased result referred to. Experimental tests on this point develop the following points: Steam at sixty pounds: the single jet-pipe E in operation gave, as a result, vacuum of nine inches; under same conditions, pipe F eight inches; aggregate, seventeen inches; the two together, one above the other, eighteen inches. Again, steam at seventy pounds, pipe E thirteen and a half inches, F twelve inches; aggregate, twenty-five and a half inches; the two together, as shown in drawings, twenty-seven inches. Steam at sixty pounds, a full stack, with three jet-pipes, as shown and described, gave thirty inches on the vacuum-gage.

As the action of car-brakes should be prompt, it is of value to have an exhausting apparatus of extensive capacities, both in relation to rapidity in execution, and to inducing the proper degree of vacuum for securing the desired degree of atmospheric pressure.

The apparatus shown, under circumstances recited, can exhaust to a practically perfect degree, and that, too, at a steam-pressure less than is commonly available on locomotive-boilers; and it follows that, with the usual high pressure of steam, its rapidity in execution will be proportionately increased.

While I prefer the construction and arrangement of the jet-pipes as shown, I am well aware that approximately valuable results may be attained by locating within an unbroken central pipe a central steam-pipe, arranged to discharge two or more jets at different longitudinal points. Such a steam-pipe may readily be constructed with two or more jet-apertures, and arranged to discharge the steam outwardly from each, with equal force if desired—as, for instance, a two-inch steam-pipe of proper length may have at its top one jet-aperture, and, say, one foot below that one still another, with a lateral plug in the interior of the pipe located midway between them, pierced by still another interior steam-pipe of smaller diameter. Steam being entered into the central pipe and the annular space surrounding it would secure a proper discharge from both jets.

My improved apparatus is applicable to the

various arts in which a complete or partial vacuum has a practical value.

Having thus described my invention, I claim as new and desire to secure by these Letters Patent—

1. In an air-exhausting apparatus, the combination, within an inclosing pipe or tube, of two or more steam-jets, located one above the other, and arranged to discharge upward and into a central air and steam space, substantially as described.

2. The combination, within an air-exhaust stack, of a central air-space, gradually increased in diameter from its base to its exit-aperture, and two or more steam-jets located at different points longitudinally therein, substantially as described.

3. The combination, with a jet-pipe centrally located within an air-stack, of adjusting mechanism, substantially as described, whereby the annular steam-space may be accurately proportioned on all sides, as set forth.

THEODORE COOPER.

Witnesses:
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THOMAS F. COSGROVE.