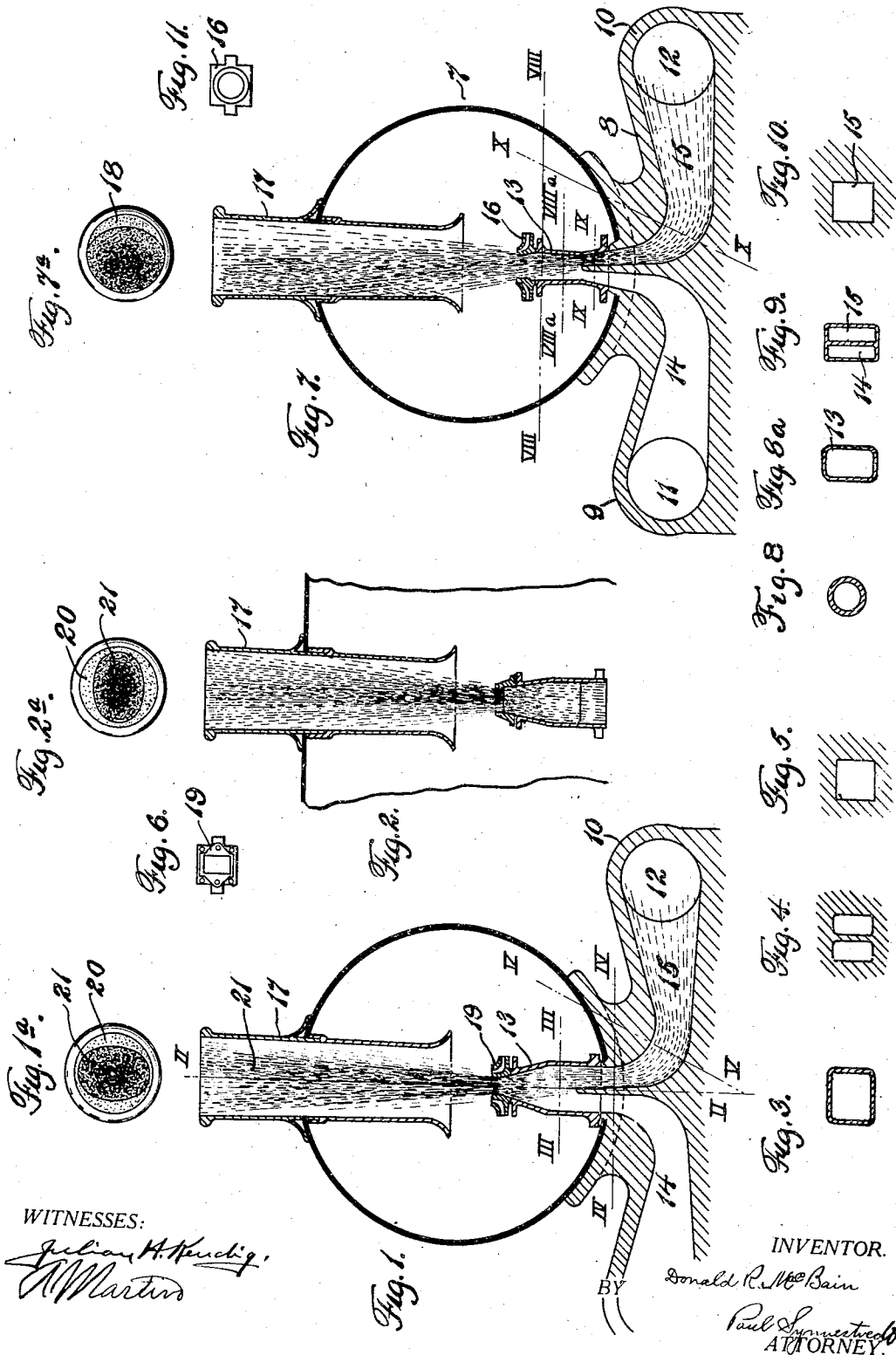


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LOCOMOTIVE EXHAUST APPARATUS.
APPLICATION FILED MAY 31, 1912.

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Patented Feb. 4, 1913.



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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, DONALD R. MACBAIN, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Locomotive Exhaust Apparatus, of which the following is a specification.

My invention relates to locomotive exhaust apparatus and particularly to the exhaust nozzle of a locomotive. It has for its primary object the provision of an improved exhaust nozzle whereby increased draft is obtained and back pressure on the cylinders reduced to a minimum, thus securing greater efficiency in operation. This, together with such other objects as may hereinafter appear, or are incidental to my invention I attain by means of a construction illustrated in preferred form in the accompanying drawings wherein,—

Figure 1 is a transverse section through the front end of a locomotive diagrammatically showing the exhaust passages from the cylinders and the application of my invention; Fig. 2 is a section on the line II—II of Fig. 1; Figs. 3, 4 and 5 are sections taken on the lines III—III, IV—IV, and V—V, respectively, of Fig. 1; Fig. 6 is a plan view of the top of the exhaust nozzle; Fig. 1^a and Fig. 2^a are plan views of the exhaust stacks of Fig. 1 and Fig. 2 respectively, diagrammatically showing the relative cross-sectional areas, density and location of the volumes of steam and gases exhausted from the stack during the operation of the locomotive; Fig. 7 is a transverse section of a locomotive front and diagrammatically illustrating the arrangement of parts usually employed in locomotive construction; Fig. 7^a is a view similar to those of Fig. 1^a and Fig. 2^a, but shows the composition of the exhaust of the device of Fig. 7; Figs. 8, 9 and 10 are sections taken on the lines VIII—VIII, IX—IX and X—X, respectively, of Fig. 7; Fig. 11 is a plan view of the top of the exhaust nozzle shown in Fig. 7, and Fig. 8^a is a section through the exhaust nozzle on the line VIII^a—VIII^a.

Referring to Fig. 7, it will be seen that I have diagrammatically illustrated in cross section the present general arrangement of the front end and exhaust passages of a locomotive. The shell 7 of the locomotive is mounted on the valve chest casting or saddle

8 which is provided with the valve cylinders or chambers 9 and 10 in which are mounted the valves 11 and 12 for controlling the admission and exhaust of steam to and from the main cylinders. The exhaust steam is conducted to the exhaust nozzle 13 from the cylinders 9 and 10 by the exhaust passages 14 and 15. The cross section of the exhaust passages is rectangular (see Fig. 10) to conform to the shape of the exhaust ports. The exhaust nozzle 13 is approximately rectangular in cross section and tapers to a circular section (see Figs. 8 and 8^a) but the exhaust tip and the stack 17 are round, as will appear from an inspection of Figs. 7^a and 11. The amount of draft produced by the exhaust depends largely upon the rate at which the steam is delivered from the exhaust tip to the stack, and it has been found that with the use of a round tip there is considerable resistance encountered due to the changing of the exhaust steam from a rectangular to a circular section. This not only retards the flow of steam from the exhaust nozzle with back pressure in the cylinders as a resultant, but also causes the jet of steam to spread as it leaves the exhaust tip, thus tending to completely fill the stack, thereby proportionately decreasing the amount of gases from the flues which can be entrained in the stack by the draft of the exhaust. A further result of the use of the round exhaust tip is that the steam in the stack is most dense at the sides which also serves to decrease the volume of entrained gases. The course of the exhaust steam is diagrammatically indicated in Fig. 7 and as there shown, the exhaust steam from the right hand cylinder, for example, is carried to the left hand side of the stack, leaving only a small crescent-shaped area 18 (see Fig. 7^a) wherein the gases may be entrained. The reverse action occurs with the exhaust steam of the left hand cylinder and it will be readily apparent that the effective area for the entrainment of the gases from the flues will be decreased further when the exhausts from the two cylinders follow each other with great rapidity. One of the chief objects of my invention is to provide a construction wherein the jet of exhaust steam is solidified and the spread thereof reduced, and the above enumerated defects avoided and greater efficiency of draft obtained, and back pressure in the cylinders reduced.

I accomplish the foregoing by providing an exhaust tip which is of the same relative form of cross section as the exhaust passages as will appear from an inspection of Figs. 1 to 6. As there shown, the exhaust tip 19 is rectangular in cross-section, substantially corresponding to the cross section of the exhaust passages, as shown in Fig. 4. It has been found that with the use of such a construction, the jet 21 of the exhaust steam is maintained in solidified form due to the fact that the jet is not changed in cross section just prior to discharge as in the case with round nozzles, and spreading thereof prevented, the steam being most dense at the central portion of the jet. The power of the exhaust is thereby increased, inasmuch as the steam is discharged at a more rapid rate from the nozzle. It has also been found that the jet is not carried as close to one side of the stack, as previously pointed out, thus leaving a substantial area 20 in the stack extending entirely around the jet into which a larger volume of gases may be entrained, thus increasing the efficiency of the draft. It will also be seen that with a body of steam having a relatively rectangular section, there is a more effective space for the entrainment of air between such body and the circular interior of the stack than is the case where the cross-sectional area of the steam is circular. As a result, a better draft is secured with the nozzle having a rectangular outlet than is the case where the nozzle has a circular outlet. By reason of the more effective entrainment of air in the stack by reason of the long axis of the nozzle being placed longitudinally of the locomotive, the sectional area of the rectangular nozzle may be made greater than is the case

with a circular nozzle which is advantageous in that this enlargement of the nozzle reduces the back pressure in the cylinders. The construction therefore not only materially increases the draft in a locomotive, which is the prime object of the improvement, but also reduces the back pressure in the cylinders, giving the locomotive a relatively higher efficiency. Other advantages incident to the construction will be apparent to those skilled in the art.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is the following:

1. In a locomotive, the combination with a stack, of an exhaust nozzle with a tapering interior surface and having the outlet opening at its extreme end of a cross section longer in one direction than in the other, with its long axis extending longitudinally of the locomotive, the said interior surface of the nozzle being throughout substantially smooth and unobstructed.

2. In a locomotive, the combination with a stack, of an exhaust nozzle with a tapering interior surface and having the outlet opening at its extreme end of a substantially rectangular cross section, with the long axis thereof extending longitudinally of the locomotive, the said interior surface of the nozzle being throughout substantially smooth and unobstructed.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

DONALD R. MacBAIN.

Witnesses:

W. F. BOEHRINGER,
RALPH McINTOSH.