Feb. 17, 1942. O. JABELMANN ET AL 2,273,490

EXHAUST NOZZLE FOR LOCOMOTIVES

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Fig. 1

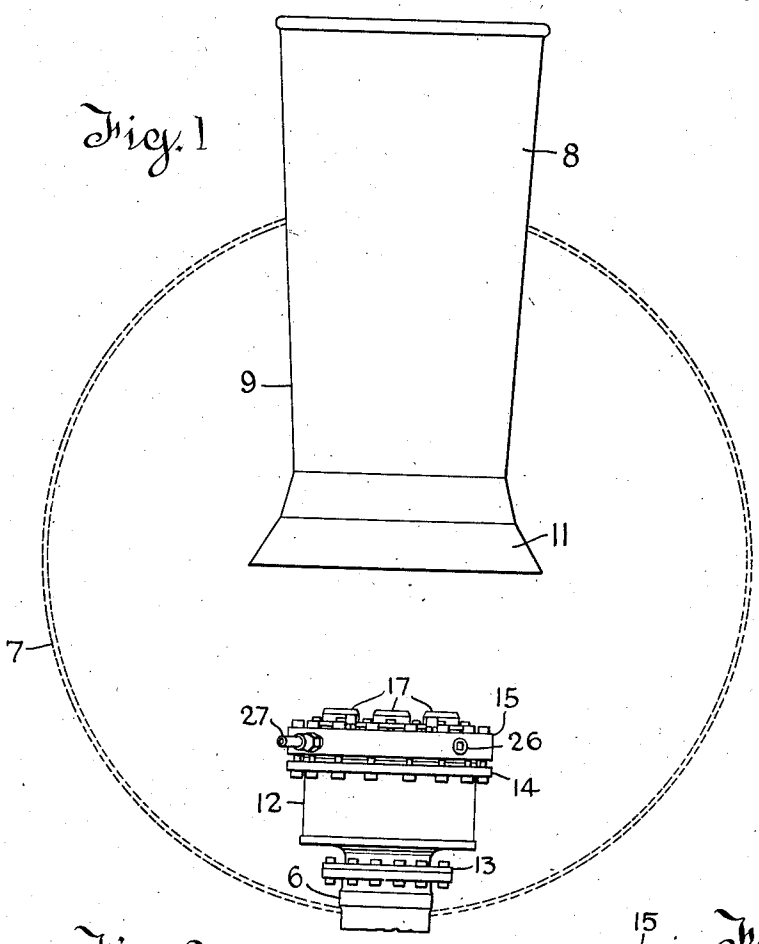

Fig. 2

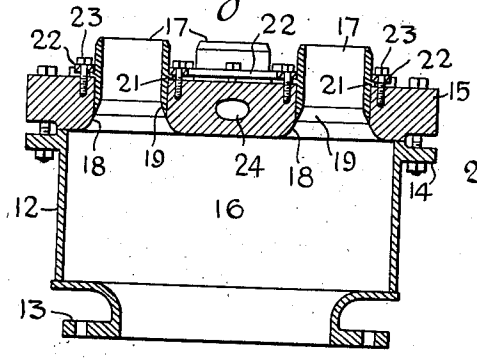

Fig. 3

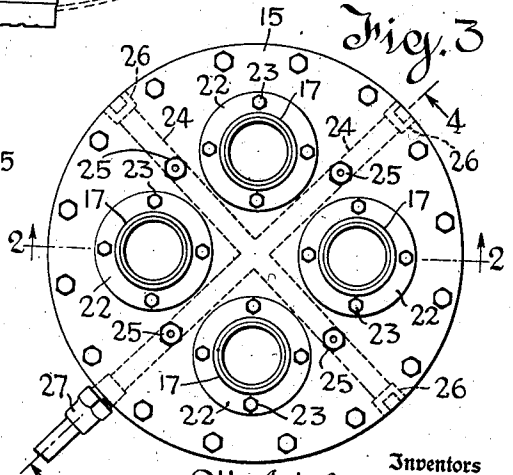

Fig. 4

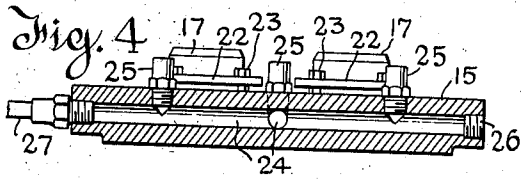

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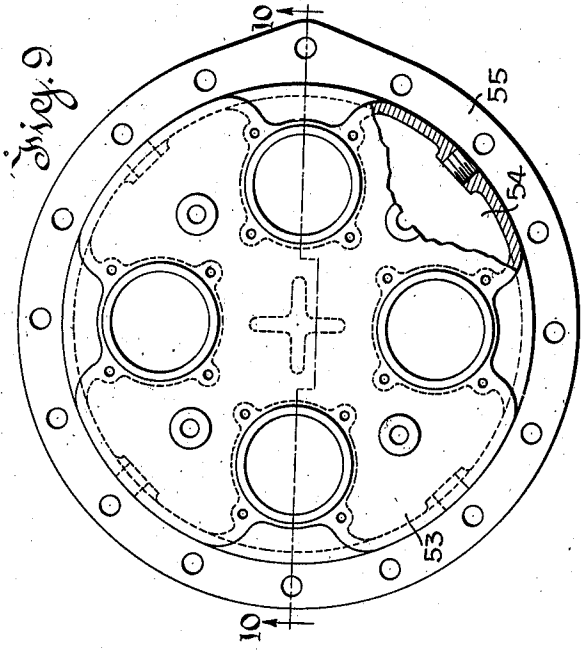
Fig. 9



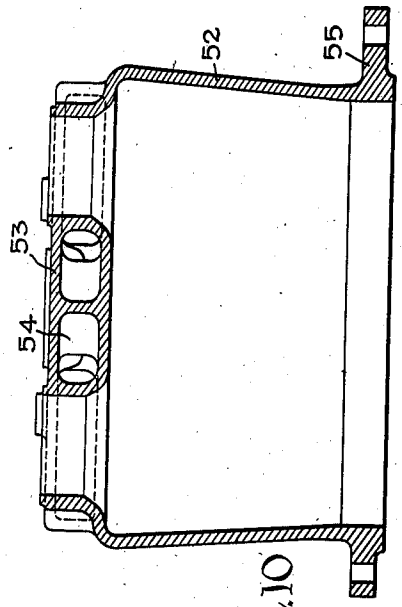
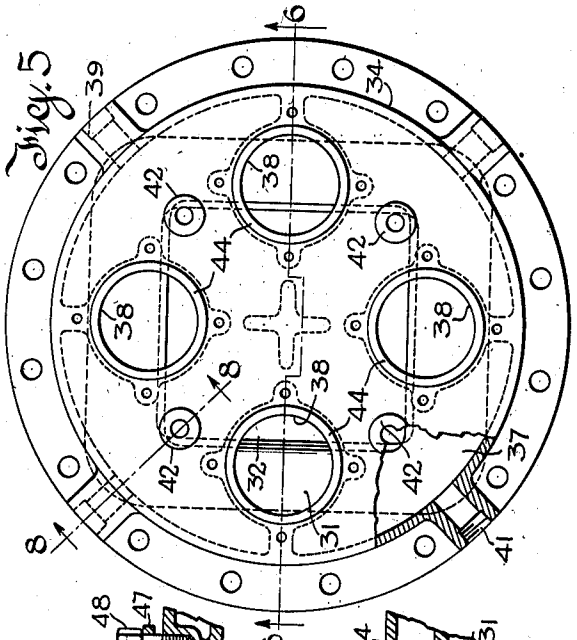


Fig. 10

Fig. 5



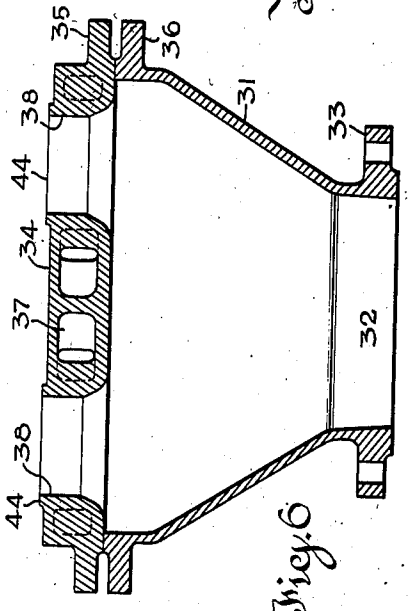


Fig. 6

Fig. 7

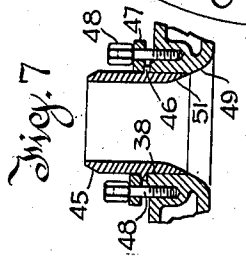
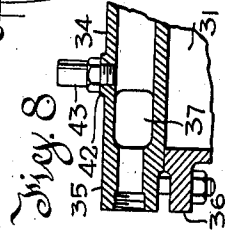


Fig. 8



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UNITED STATES PATENT OFFICE

2,273,490

EXHAUST NOZZLE FOR LOCOMOTIVES

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Omaha, Nebr.

Application May 14, 1940, Serial No. 335,184

6 Claims. (Cl. 230—100)

This invention relates to exhaust nozzles for locomotives.

In steam locomotives the draft on the fire is created by an ejector effect produced by directing the exhaust steam into a so-called lift pipe which is a flaring extension of the stack mounted in the smoke box.

The exhaust being intermittent or pulsing, the action is severe and varies considerably according to the conditions of load and speed under which the locomotive is operating.

The purpose of the present invention is to stabilize the draft, reduce back pressure, and in consequence materially improve performance and reduce maintenance costs.

Generally stated, the invention contemplates an exhaust stand having a chamber to which the cylinder exhaust passages deliver and from which a plurality of nozzles are fed. These nozzles are symmetrically arranged and deliver their blasts toward the open lower end of the lift pipe.

The multiple nozzles permit the use of a lift pipe and stack of large diameter. The effect is to produce a more effective draft.

The use of interchangeable nozzles of different size or configuration or both is a valuable feature, because it permits the installation to be modified according to the characteristics of different locomotives.

Embodiments of the invention which have demonstrated valuable operating characteristics in actual service will now be described by reference to the accompanying drawings, in which:

Figure 1 is an elevation of the exhaust stand, nozzles, lift pipe and stack, the contour of the smoke box being indicated in dotted lines.

Figure 2 is a section of the exhaust stand and nozzles on a somewhat larger scale than Figure 1. The plane of section is indicated by the line 2—2 in Figure 3.

Figure 3 is a plan view of the parts shown in Figure 2.

Figure 4 is a section on the line 4—4 of Figure 3.

Figure 5 is a plan view of a modified structure.

Figure 6 is a section thereof on the line 6—6 of Figure 5.

Figure 7 is a section showing one of the nozzles in place in the nozzle plate of Figure 6.

Figure 8 is a section on the line 8—8 of Figure 5 with the blower nozzle in position.

Figure 9 is a plan of a further modified construction in which the exhaust stand and nozzle plate are cast as one piece.

Figure 10 is a section on the line 10—10 of Figure 9.

Referring first to Figures 1 to 4, the exhaust connection of the cylinder castings is indicated at 6 and the smoke box shell at 7. The stack 8 is formed integrally with the lift pipe 9 which has a flaring open lower or entrance end 11. The lift pipe 9 and exhaust connection 6 are vertically and axially aligned.

The exhaust stand comprises a cylindrical shell 12 having a bottom flange 13 which is bolted to the flange of the connection 6 and a top flange 14 to which the nozzle plate 15 is bolted. The shell 12 thus encloses a cylindrical chamber 16 from which the nozzles proper lead. In one actual installation the chamber 16 has a transverse area of about 347 square inches, a volume of about 3000 cubic inches and the transverse area of the entrance passage from connection 6 is 135 square inches.

Mounted in nozzle plate 15 are four nozzles 17 symmetrically arranged around the center of the plate. Each of these is mounted in a port bored in plate 15 and having an entrance flare 18 which merges into the entrance flare 19 of the nozzle. The entrance flare reduces eddying and hence reduces back pressure. Each nozzle 17 has an encircling flange 21 which limits the insertion of the nozzle and serves as a shoulder for a hold-down ring 22 which is connected to plate 15 by machine screws 23.

In the commercial embodiment here illustrated there are four nozzles of an aggregate area of about 50 square inches, so that the nozzles determine the back pressure. Because the nozzle area is large and the nozzles have a properly designed entrance, the back pressure is lower than is usual.

The cross ports indicated at 24 feed small blower nozzles 25. Three of the cross-port ends are plugged as shown at 26. The blower steam connection is shown at 27. Steam may be supplied to this to create draft when the engine is standing.

Interchangeable nozzles 17 of different bores may readily be substituted. Interchangeable plates 15 having ports for more or fewer nozzles or nozzles of different dimension may readily be substituted. Thus, extreme flexibility is attained.

Referring now to the modified construction shown in Figs. 5–8, inclusive, the exhaust stand 31 is cast in one piece and has a flaring configuration designed to improve the exhaust flow characteristics. As best shown in dotted lines

in Fig. 5, the exhaust stand 31 is of generally rectangular horizontal cross section, i. e., it has the form of a truncated inverted pyramid with rounded corners. Steam from the exhaust connection enters at 32 and the stand is held in place by a bolting flange 33 of ordinary form.

The nozzle plate 34 is cast separately in one piece and the marginal flange 35 thereof is bolted to the companion marginal flange 36 at the upper rim of the exhaust stand 31. Nozzle plate 34 is cored as indicated at 37, forming a hollow steam jacket which surrounds the ports or openings 38 in which the exhaust nozzles are mounted. Thus it is unnecessary to cross drill the plate to form steam passages for the blower nozzles.

There are four pipe threaded entrance ports 39 leading to the cored space. Three of these are plugged, and the fourth as indicated at 41, receives the steam connection. Small bosses 42 are formed on the upper face of the plate and surround drilled ports which are threaded to receive the blower nozzles. One such nozzle is indicated at 43 in Fig. 8.

Similarly bosses 44 surround the openings in which the exhaust nozzles 45 are mounted. These bosses are faced off so that the flange 46 surrounding the exhaust nozzle 45 will seat accurately. The nozzles 45 are held in place by clamping rings 47 which overlie the flanges 46 and which are held by studs indicated at 48. A wide flaring entrance is provided to each nozzle by the portions 49 and 51 of the plate and nozzle, respectively. Four exhaust nozzles are shown, but it will be understood that the number can be changed by substituting suitably ported plates similar to the plate 34.

In some cases a very large exhaust passage from the cylinder castings can be provided, and in such event the lower portion of the exhaust stand can be enlarged, as indicated in Figs. 9 and 10. In this view opportunity has been taken to show the nozzle plate cast integrally with the exhaust stand, a construction which is favored by the general form of the stand. Thus in Figs. 9 and 10 the exhaust stand 52 is nearly cylindrical and is cast integrally with a top or nozzle plate 53. This is cored out as indicated at 54 to form steam passages for the blower steam. At its lower margin there is a flange 55 by means of which it is attached to the cylinder castings. In Figs. 9 and 10 the exhaust nozzles and the blower nozzles are not illustrated, but it will be readily understood that nozzles of the type shown in Figs. 7 and 8 are to be mounted in position exactly as shown in those figures.

The arrangement shown in Figs. 9 and 10 is preferred whenever the exhaust connection is large enough to permit the use of this scheme, for it has the advantage of very free exhaust flow to the exhaust nozzles plus the advantage of one piece construction produced by a very simple casting operation. The unitary construction also saves a number of machining operations which are necessary where a sectional construction is used.

Various embodiments of the invention have been shown to illustrate the flexibility of the scheme. Other modifications are possible within the scope of the invention and no limitations beyond those expressed in the claims are implied.

What is claimed is:

1. An exhaust nozzle structure for locomotives for directing exhaust blast into a lift pipe, comprising in combination an open topped single chamber manifold having means for connection with an exhaust passage; a plate releasably connected directly to said manifold and closing the top thereof, said plate having a plurality of orifices simultaneously opening directly into said chamber; nozzles, one mounted separately and removably in each orifice and projecting exteriorly from said plate; and individual readily-releasable means for holding each of said nozzles in place in its orifice.

2. An exhaust nozzle structure for locomotives for directing exhaust blast into a lift pipe, comprising in combination an open topped single chamber manifold having means for connection with an exhaust passage; a plate releasably connected with said manifold and closing the top thereof, said plate having a plurality of orifices each formed with a downwardly flaring lower entrance end portion opening directly into said chamber; nozzles, one mounted removably in each of said orifices and projecting exteriorly from said plate, each nozzle having a downwardly flaring lower entrance end portion communicating directly with and merging into said flaring end portion of the corresponding orifice and the lower extremity of each nozzle being located above the lower face of said top plate; and releasable means for holding said separate nozzles in place.

3. In a front end arrangement for locomotives, the combination of a lift pipe; a removable casing forming a single chamber adapted to receive exhaust steam; a plurality of substantially straight separately detachable nozzles carried by said casing and fed by said chamber, said nozzles being located outside of said lift pipe and projecting exteriorly from the casing toward said lift pipe in symmetrical relation to the axis of said left pipe and so that the axes of the nozzles when extended are substantially parallel to the lift pipe axis, the inner entrance ends of said nozzles having unobstructed communication with said chamber to provide for free flow of steam to the nozzles from said chamber; and individual readily-releasable means located externally of the casing for detachably securing each of said nozzles separately to the casing.

4. In a front end arrangement for locomotives, the combination of a lift pipe; a casing located below and spaced from said lift pipe, said casing forming a single chamber adapted to receive exhaust steam and provided with a top wall having a plurality of orifices each formed with a downwardly flaring lower entrance end portion opening into said chamber; and a plurality of separately removable nozzles, one mounted in each of said orifices and projecting exteriorly from said casing in the direction of the lift pipe, each nozzle having a downwardly flaring lower entrance end portion communicating directly with and merging into said flaring end portion of its corresponding orifice, said orifices and said nozzles being fed by said chamber and symmetrically arranged relatively to the axis of the lift pipe.

5. In a front end arrangement for locomotives, the combination with a cylinder structure having an exhaust steam passage, of a lift pipe; a detachable casing located below and spaced from said lift pipe, said casing forming a single chamber of substantial volume in direct communication with said exhaust steam passage, the cross sectional area of said chamber exceeding the cross sectional area of said passage; a plurality of nozzles simultaneously communicating directly with said chamber and projecting exteriorly

from the casing toward said lift pipe, the aggregate cross sectional area of said nozzles being less than the cross sectional area of said exhaust passage, said casing having a top wall to which the nozzles are detachably secured for removal from outside of the casing to permit interchange and each of said nozzles being formed with a downwardly flaring lower entrance end portion leading from said chamber; and individual readily-releasable means located externally of the casing for detachably securing each of said nozzles separately in place.

6. The combination defined in claim 5, in which the casing top wall is provided with a plurality of orifices leading from said chamber and in each of which one of said nozzles is removably mounted, and in which each of said orifices is formed with a downwardly flaring lower entrance end portion leading from said chamber, said flaring end portion of each of the nozzles communicating directly with and merging into said flaring end portion of its corresponding orifice and the lower extremity of each nozzle being located above the lower face of said top casing wall.

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