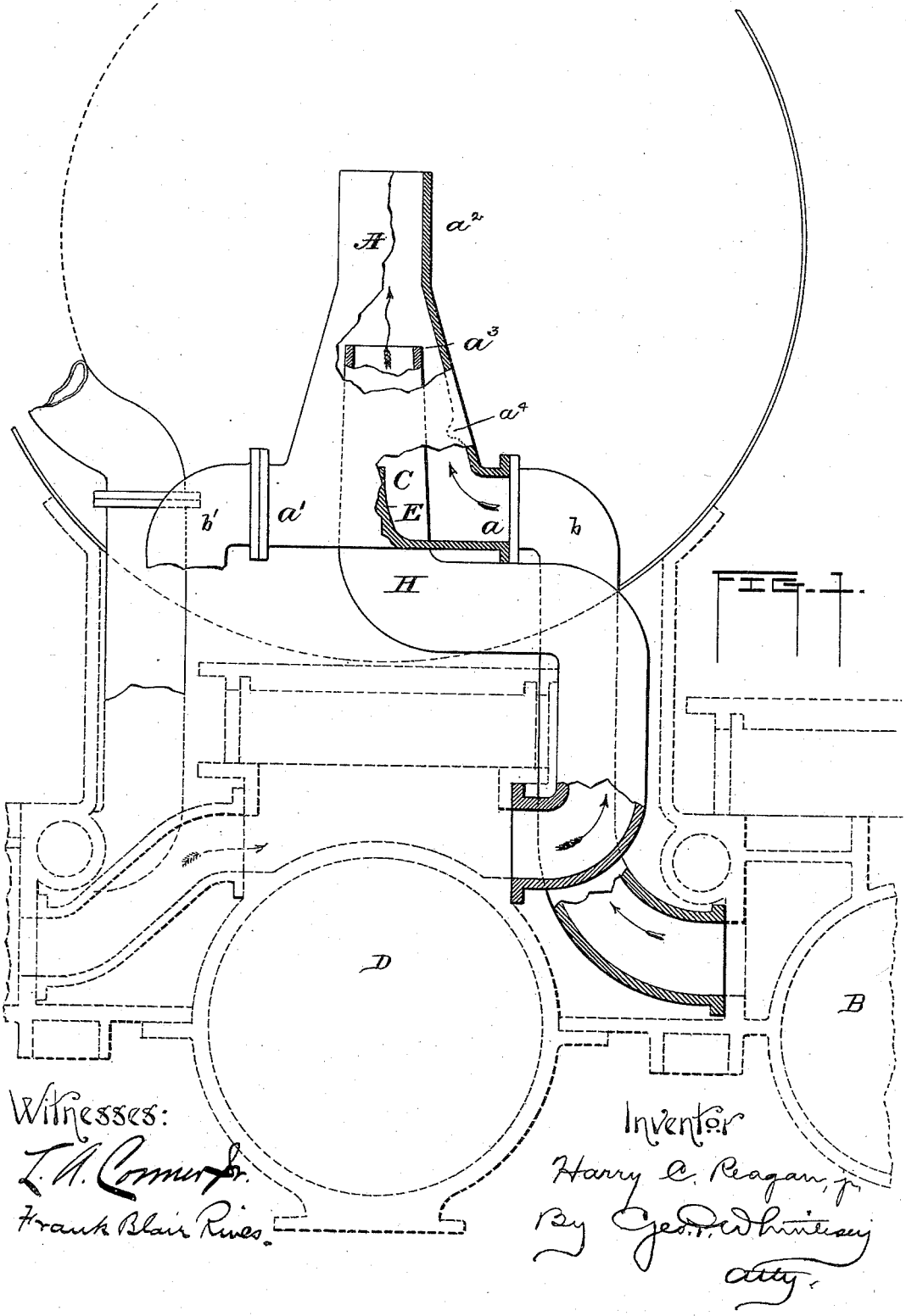
(No Model.)

2 Sheets—Sheet 1.

H. C. REAGAN, Jr.

EXHAUST NOZZLE.

No. 493,783. Patented Mar. 21, 1893.



Witnesses:
T. A. Connor Jr.
Frank Blair Rives.

Inventor
Harry C. Reagan, Jr.
By Geo. P. Whittemore
Atty.

(No Model.) 2 Sheets—Sheet 2.

H. C. REAGAN, Jr.

EXHAUST NOZZLE.

No. 493,783. Patented Mar. 21, 1893.

FIG. 2.

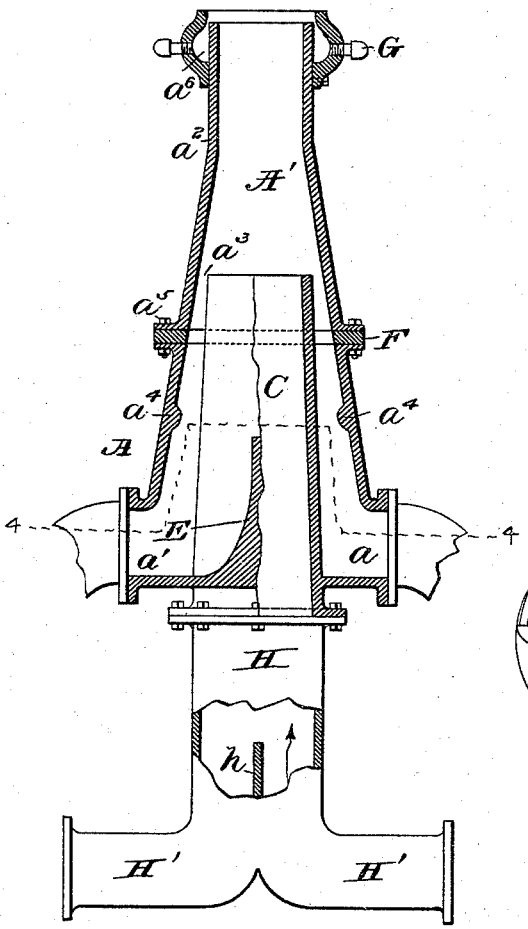


FIG. 3.

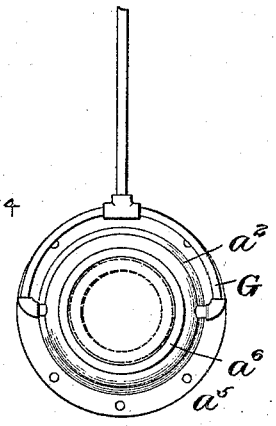
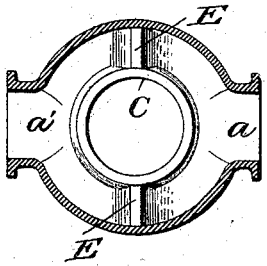


FIG. 4.



Witnesses:
I. A. Conner Jr.
Frank Blair Ries.

Inventor
Harvey C. Reagan
By Geo. P. Whittemore
Atty.

UNITED STATES PATENT OFFICE.

HARRY C. REAGAN, JR., OF PHILADELPHIA, PENNSYLVANIA.

EXHAUST-NOZZLE.

SPECIFICATION forming part of Letters Patent No. 493,783, dated March 21, 1893.

Original application filed April 19, 1892, Serial No. 397,988. Divided and this application filed May 2, 1892. Serial No. 431,521. (No model.)

To all whom it may concern:

Be it known that I, HARRY C. REAGAN, Jr., a citizen of the United States, residing at West Philadelphia, in the county of Philadelphia and State of Pennsylvania, 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.

My invention relates to steam engines, and especially to compound locomotives. Its object is to increase the efficiency of said machines by so arranging the exhaust nozzles as to produce a vacuum in the low pressure cylinder.

The invention consists in certain novel features of construction and arrangement hereinafter pointed out and claimed.

In the drawings, Figure 1 is a transverse vertical section of a high pressure and a low pressure cylinder and their exhaust passages, and of my improved exhaust nozzle. Fig. 2 is a sectional elevation of a modified nozzle. Fig. 3 is a top plan view of the same, and Fig. 4 is a cross section of Fig. 1 on line 4—4.

My improved nozzle is composed of two concentric nozzles, an outer one A for the exhaust of the high pressure cylinder B, and an inner one C for the low pressure exhaust from the cylinder D. The outer nozzle is essentially conical, having two opposite openings $a\ a'$ at its base to afford connections for the high pressure exhaust pipes $b\ b'$. This conical portion is surmounted by a cylindrical pipe a^2. The inner nozzle is preferably slightly conical, and rises centrally to a point somewhat below the junction of the conical portion of the outer nozzle, and its upper pipe a^2, leaving a narrow annular space a^3 for the passage of the high pressure steam.

Midway between the openings $a\ a'$, on each side of the nozzle C is a web E, which unites the two nozzles. A lip a^4 is cast upon the inside of the conical portion above each opening $a\ a'$, and about on a level with or slightly above the top of the webs E. This lip and the curved base of the webs serve to deflect the entering high pressure steam and send it obliquely upward, whereby it is caused to completely envelop the inner nozzle and issue through the entire circumference of the passage a^3. The effect of this upon the inner nozzle is similar to that of an ejector, causing a powerful vacuum in said nozzle C and behind the low pressure piston, greatly increasing the efficiency of the latter.

In order to provide for an adjustment of the size of the passage a^3, I may make the upper part of the nozzle separate from the lower as shown in Fig. 2, each part having a flange a^5, which enables them to be bolted together. Between the flanges is clamped a ring F, the inner diameter or the thickness of which determines the size of the opening around the inner nozzle C. By using rings of different internal diameters or thicknesses, this opening can be altered to suit varying conditions of pressure, ratio of cylinders, &c., since a ring of smaller diameter than the one shown contracts the space between it and the inner nozzle C, while a ring of less thickness causes the conical portion of the upper part A′ to approach more closely to the upper end of the nozzle C, and thus narrows the opening a^3. It is evident that the line of separation between the upper and the lower parts may be located anywhere below the top of the inner nozzle C in the conical portion of the outer nozzle. In the case of a four cylinder compound, in which there is a low pressure cylinder on each side of the engine, the low pressure pipe shown in Fig. 2 is used. This consists of an upright part H, bolted to flanges on the bottom of the nozzle, and in line with the inner nozzle C. The lower end of the pipe H has two opposite branches H′ H′, with which communicate the exhaust pipes from the low pressure cylinders. A diametrical web or partition h divides the pipe H into two parts for a portion of its length, and directs the exhaust steam up to the nozzle C.

When it is desired to increase the force of the ejector, or to obtain a vacuum at starting, the upper part A′ of the nozzle may be provided with an annular chamber a^6 surrounding the mouth of the nozzle and having a discharge opening concentric therewith. Steam from the boiler is admitted to a pipe G, by which it is conveyed to the chamber a^6, and

issuing around the nozzle A′, it augments the blast.

I am aware that it has been proposed to arrange the high pressure exhaust nozzle inside of the low pressure exhaust nozzle in a compound locomotive, and I do not claim broadly the concentric arrangement of such nozzles.

This application is in part a division of the application Serial No. 397,988, upon which Patent No. 473,437 was granted to me on April 19, 1892.

Having thus described my invention, what I do claim, and desire to secure by Letters Patent, is—

1. In a compound locomotive, an exhaust nozzle consisting of a conical portion having connections for the high pressure exhaust pipe and the low pressure exhaust pipe, the discharge pipe for the latter being within and concentric with said conical portion, and terminating below its upper end, substantially as described.

2. In a compound locomotive, an exhaust nozzle composed of a conical portion A, having lateral openings a a', for connection with the high pressure exhaust pipes, a cylindrical pipe a^2 surmounting the conical portion, and a nozzle C for the low pressure exhaust arranged concentrically within the portion A and terminating below the junction of said portion and the pipe a^2, substantially as described.

3. In an exhaust nozzle, the combination with the conical portion A having openings a a', and lips a^4, of the inner concentric nozzle C, and the curved webs E uniting said nozzle and conical portion, substantially as described.

4. In an exhaust nozzle, the combination with the lower part A, of the inner nozzle C, the upper part A′ extending above the nozzle C and having an annular chamber a^6, provided with a discharge opening concentric with the mouth of the nozzle A′, and a pipe G for connecting said chamber with the boiler, substantially as described.

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

HARRY C. REAGAN, JR.

Witnesses:
A. L. MULHERN,
JOSEPH THOMASSON.