Nov. 18, 1924. 1,516,047

D. M. LEWIS

DRAFT APPLIANCE FOR LOCOMOTIVES

Filed May 27, 1920 3 Sheets-Sheet 1

Fig. 1.

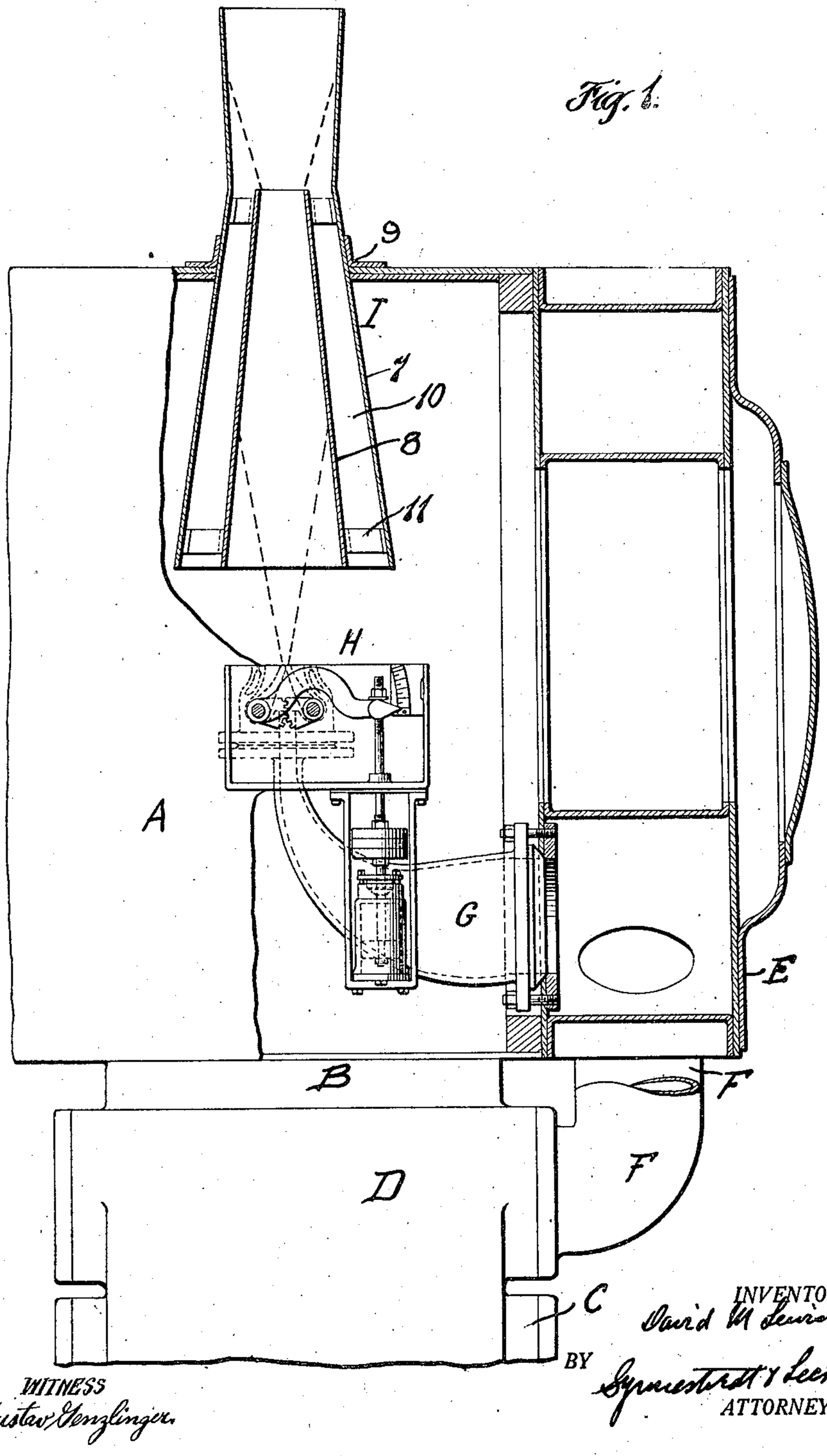

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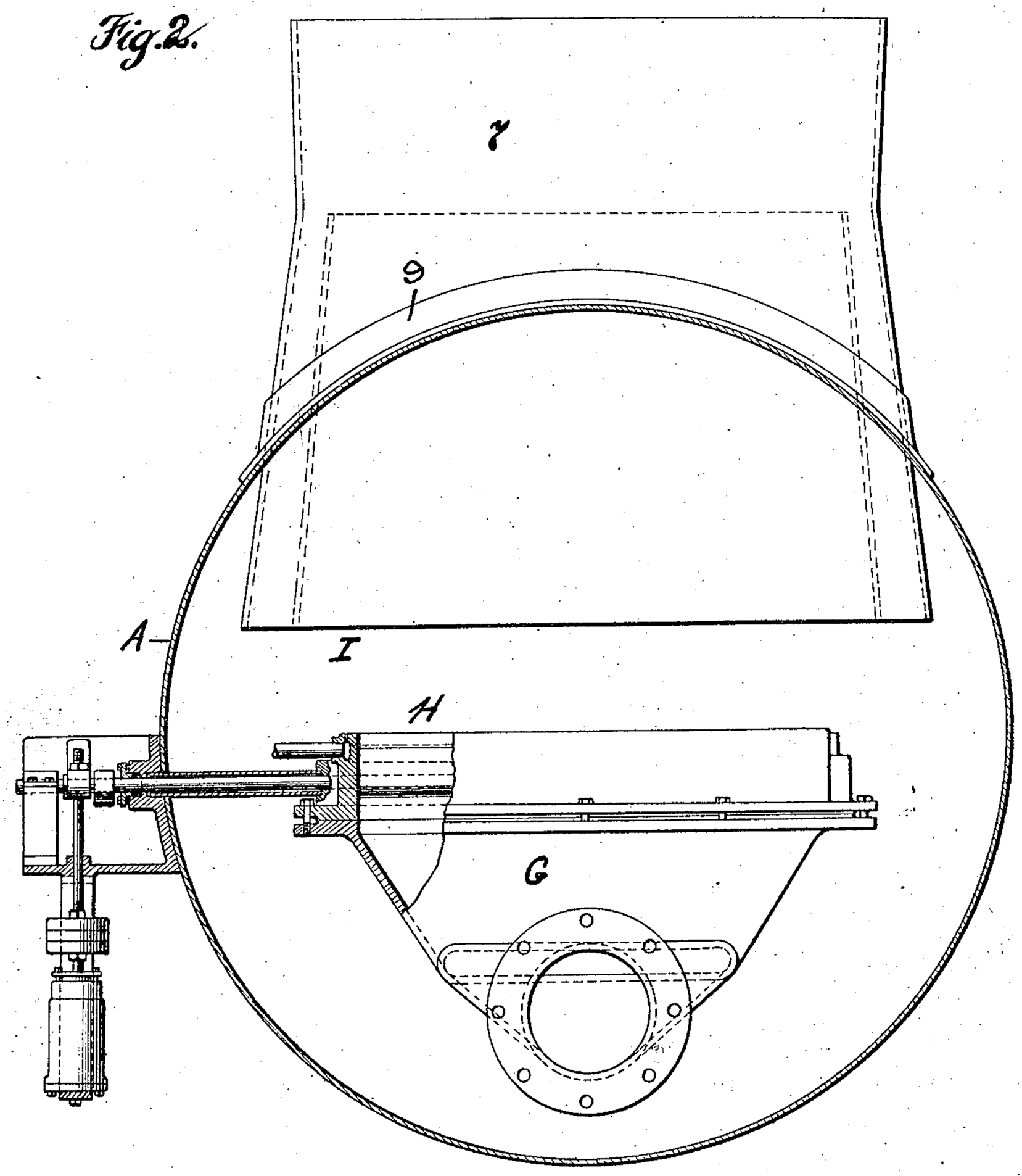
Fig. 2.



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DRAFT APPLIANCE FOR LOCOMOTIVES

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Fig. 3.

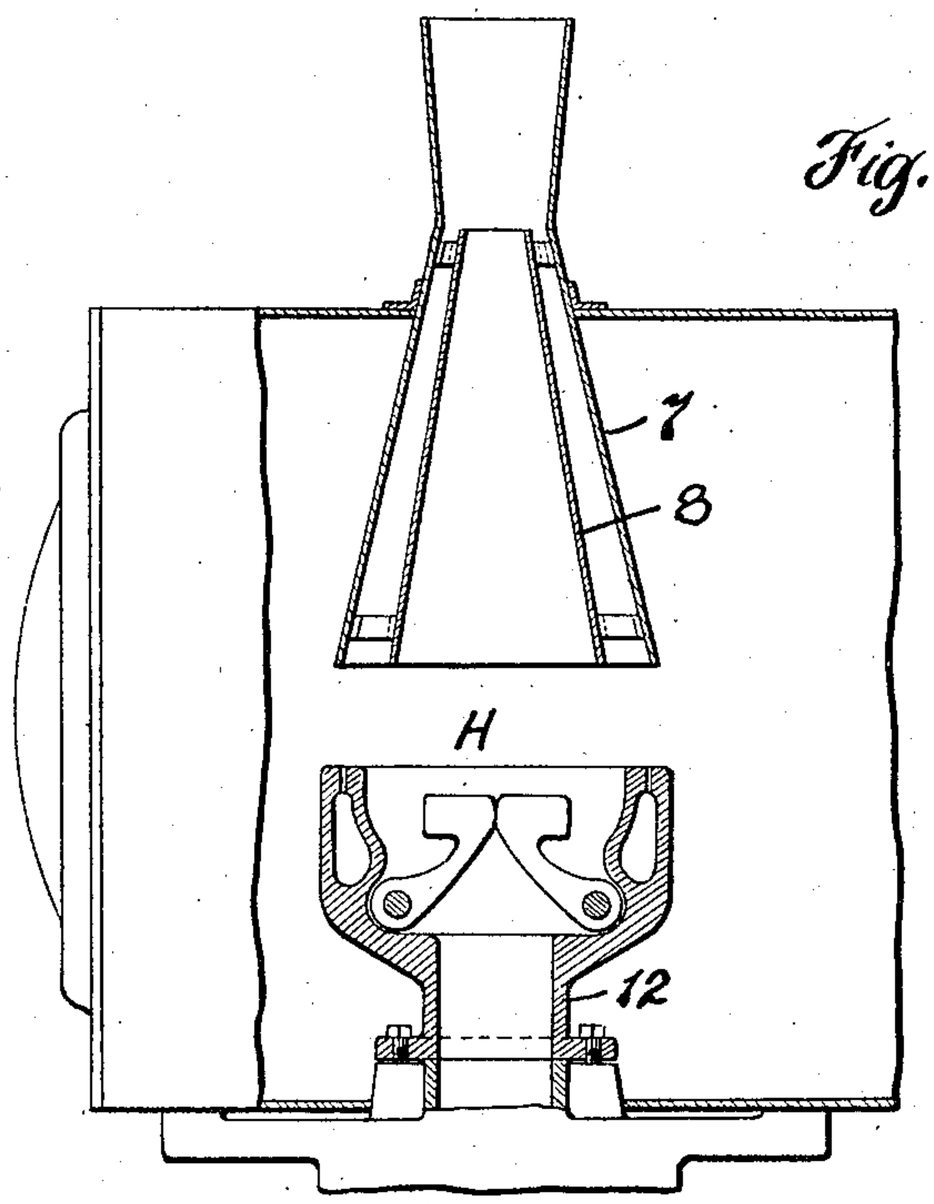
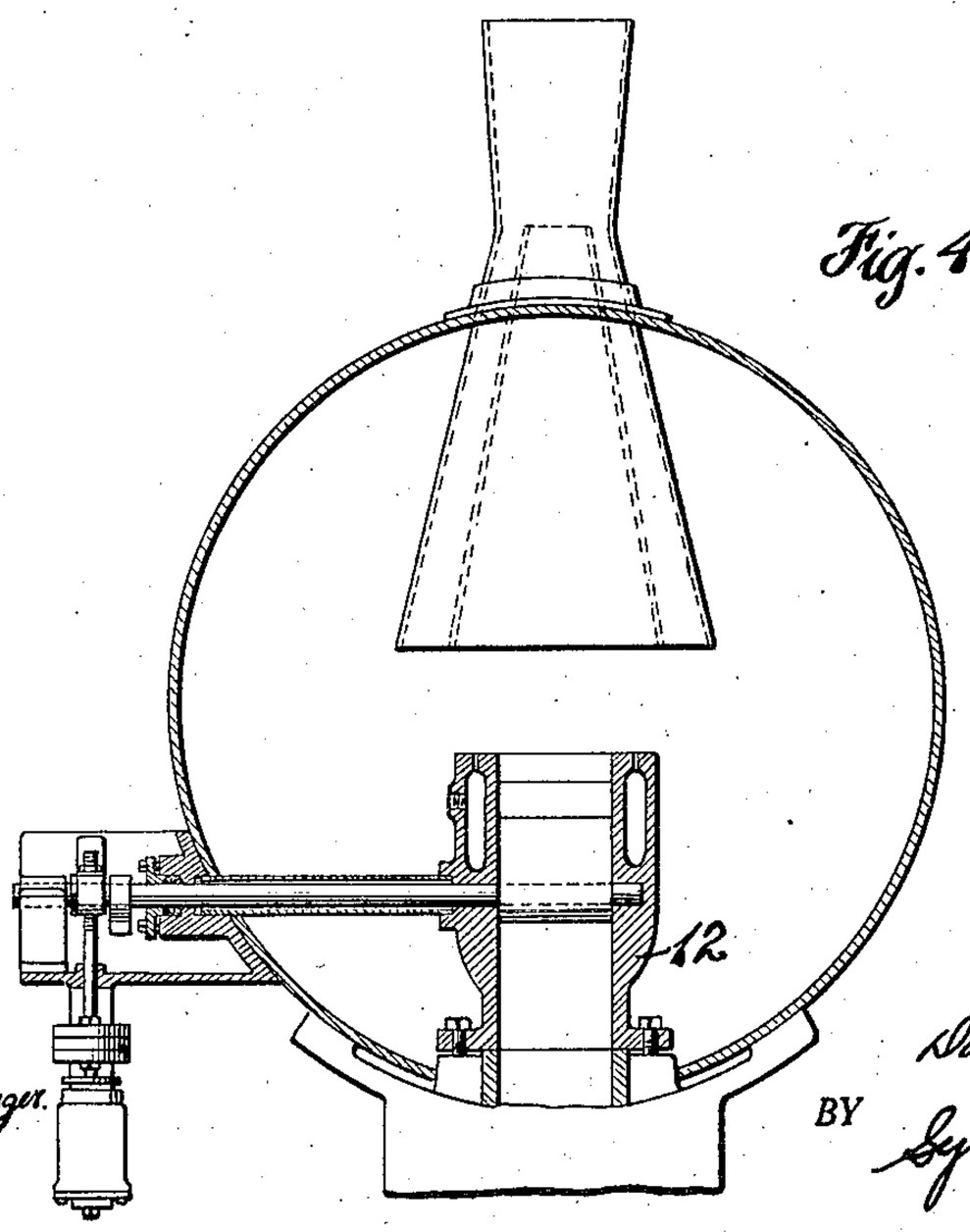


Fig. 4.



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UNITED STATES PATENT OFFICE.

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DRAFT APPLIANCE FOR LOCOMOTIVES.

Application filed May 27, 1920. Serial No. 384,770.

To all whom it may concern:

Be it known that I, DAVID MILLER LEWIS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Draft Appliances for Locomotives, of which the following is a specification.

This invention relates to draft appliances for locomotives, and the primary object of the invention is to create the draft by what may be termed a steam ejector in contradistinction to the standard stack which is practically an entrainer only. Stated in other words it is the purpose of my invention to utilize the kinetic force or pressure of the steam to the fullest extent to create the draft, and thereby to increase the velocity and the efficiency of the draft blast and, therefore, of the locomotive.

Still another object of my invention is to lift the steam and gases discharged higher with the production of greater vacuum without necessarily reducing the gas area at the lower portion of the ejector, and with very low back pressure.

My invention also contemplates the creation of efficient draft without necessarily involving the concomitant high back pressure incident to standard practice.

The foregoing together with such other objects as may hereinafter appear, I obtain by means of a construction, the preferred embodiment of which is shown in the accompanying drawings, wherein:

Figure 1 is a side elevation of and partial section through a front end equipped with my improvements;

Figure 2 is a transverse section through the front end of Figure 1;

Figure 3 is a side elevation and partial section through the front end of another form of locomotive, embodying my improvements; and

Figure 4 is a transverse section through the front end shown in Figure 3.

Referring now to the construction shown in Figures 1 and 2, A is the front end or smoke box; B is the saddle casting; C one of the cylinders; and D one of the steam chests. An expansion chamber E is provided and preferably secured to the front of the smoke box and the exhaust steam is conducted thereto from the chests by pipes F, preferably of a cross section at least as large as the cross sectional area of the exhaust passages in the chests. The exhaust steam expands in chamber E and is led therefrom by a stand G to an automatic jet creating governor H. The stand G is widened laterally from the front to the rear and narrowed in the opposite direction, so as to maintain a substantially uniform total discharge area throughout its length, preferably equal to the cross sectional area of the pipes F, as shown. The automatic governor H is shown, described and claimed in my copending application, Serial No. 374,019, filed April 15, 1920, and no claim thereto is specificially made herein. It will suffice for the purpose of this specification to point out that the size of the jet is automatically varied in accordance to the exhaust pressure conditions so as to produce the desired character of draft blast with the back pressure reduced to a minimum far below that which is obtained in standard practice.

The general arrangement described produces a draft jet of great width, relatively large volume, relatively low pressure and velocity, and of substantial continuity, the exhaust pulsations being practically eliminated particularly at moderate and higher speeds. This jet produces an efficient draft of the same general characteristics, with a minimum back pressure which by the automatic action of the governor may be maintained at a constant value throughout the operating speeds, or at varying values, as described in said copending application. It will be seen as will further appear that a blast having these characteristics lends itself particularly well to the utilization of the kinetic force of the exhaust steam for the creation of the draft vacuum, as compared to the intermittent, high pressure, high velocity, low volume draft blast of standard practice. The ejector indicated as a whole by the reference letter I, will now be described.

This ejector comprises an outer member 7 which is of relatively large volumetric capacity, being preferably widened transversely of the smoke box,—approximately being substantially coextensive with the flue section (not shown)—and an inner member 8. The member 7 is, roughly speaking, given a Venturi tube shape, and its lower end is spaced a suitable distance above the governor H, while its upper end projects

above the smoke box. It is secured to the shell of the smoke box in any preferred manner, as indicated, for example, at 9. The shape of the inner member 8 corresponds, in general, to the shape of the outer member, save that it is smaller in cross section, and it may also be venturi shaped, although I have shown it with a single taper. Its upper end may terminate approximately at the neck of the outer member and its lower end may be approximately at the same level as the lower end of the outer member. By this arrangement a space 10 is provided between the two tubular members. The inner member may be supported by any desired means, as for example, the brackets 11.

The operation is as follows: The exhaust steam jet or column leaving the governor, enters the inner member 8, entraining gases and mixing with the same. The kinetic force of the steam increases the velocity in such member, the shape of the latter also tending to emphasize such action—and the column of steam, leaving the top of the said member at relatively high velocity, (compared with that obtained by the construction of my earlier patent hereinafter referred to), flares or diverges, as indicated in dotted lines in Figure 1, completely filling that portion of the outer member above the upper end of the inner member and thereby creating a vacuum in the space 10 which draws the gases into such space which are later mixed with and carried out by the steam. The mechanism may, therefore, be called a combination or two stage steam ejector, roughly comparable to some extent and in some respects with the well known air ejector employed in other arts. The latter, however, employs a high pressure, small volume jet, while the former employs a low pressure, large volume jet.

I have found that this ejector not only lifts the discharging steam and gases much higher than occurs with the stack of my earlier patent hereinafter mentioned, but it also increases the vacuum and, therefore, the effective draft. I thus not only prevent "trailing" of the gases and the steam, but am also enabled to cut down back pressure. To be specific, in standard practice the high back pressure is mainly, if not entirely, due to the restriction of the exhaust nozzle necessary to create the high pressure, small volume intermittent blast required to produce the desired draft, and the kinetic force or pressure of the steam in the stack is not, or at best negligibly used, to create the draft, while by my present improvements, since the kinetic pressure in the stack is utilized for draft purposes, a very high draft, comparatively, is secured with a markedly low pressure jet and correspondingly reduced back pressure. In this connection, while the use of the large volume, low pressure draft blast, as set forth in my reissued Letters Patent No. 14,809, reduces the back pressure very materially, the present improvements permit of a still greater reduction in such pressure.

By arranging the two tubes so as to have their lower ends in approximately the same plane, the efficiency of the ejector is greatly increased because the gases in the box will flow toward one point that is to say the jet sets up a flow of gases toward the bottom of the tubes and therefor creates a condition on which the vacuum in the space 10 is most effective, since it has to operate on gases, the flow of which is already established in a favorable direction. The necessity of diaphragms is also in large measure avoided.

Furthermore, changes in the volume of the jet do not materially affect the velocity in the inner member so that the ejector action is not substantially affected.

Referring now to the construction of Figure 3 and 4, it will be seen that I have illustrated my improvements as applied to a locomotive drafted by an intermittent or pulsating draft, the exhaust steam being delivered to a stand 12 from the chests. The stand is provided with a governor H as before described which functions, among other things, to elongate the blasts to more closely approximate continuity, without the high back pressure incident to standard practice. By combining the steam ejector with such an arrangement, adequate and efficient and even greater draft can be obtained by the more or less intermittent blast with a still greater reduction in back pressure, for the increased draft obtained makes it possible to more freely exhaust the steam from the cylinders, stand and governor, or stated otherwise, an exhaust jet of lower pressure may be used.

I am aware that it has been frequently customary in this art to utilize one or more petticoat pipes in connection with a stack, but such arrangements do not achieve the results herein set forth.

I claim:

1. The combination with a locomotive using exhaust steam for obtaining draft, of an exhaust steam draft means in the smoke box comprising a steam ejector mechanism consisting of a pair of pipes one within the other of a relative size to provide a space therebetween and having their lower ends in approximately the same plane, the inner of said pipes terminating short of the upper end of the outer pipe and occupying a very material portion of the height thereof and having its smallest cross sectional area above its lower end.

2. The combination with a locomotive using exhaust steam for obtaining draft of

an exhaust steam draft means in the smoke box comprising a steam ejector mechanism consisting of a pair of pipes one within the other of a relative size to provide a space therebetween, the inner of said pipes terminating short of the upper end of the outer pipe and being of reducing cross sectional area upwardly, and the outer of said pipes being shaped after the manner of a Venturi tube and the upper end of the inner pipe coming approximately at the neck of the Venturi tube.

3. The combination with a locomotive using exhaust steam for obtaining draft, of an exhaust steam draft means in the smoke box comprising a steam ejector mechanism consisting of a pair of pipes one within the other of a relative size to provide a space therebetween, and having their lower ends in approximately the same plane, the outer pipe converging upwardly more rapidly than the inner, and the inner pipe occupying a material portion of the height thereof.

4. The combination with a locomotive using exhaust steam for obtaining draft, of an exhaust steam draft means in the smoke box comprising a pair of members one located within the other and cooperating to utilize the kinetic pressure of the exhaust steam for draft purposes, the bottom of the two members being approximately in the same plane and the inner member occupying the major portion of the height of the outer member.

5. The combination with a locomotive using exhaust steam for obtaining draft of means in the smoke box for creating a relatively large volume, relatively low velocity draft jet of exhaust steam, and a steam ejector mechanism cooperating with the jet for draft purposes including two pipes, one within the other and so disposed that the lower ends are approximately in the same plane, and the inner of said pipes extending well toward the top of the outer pipe.

6. The combination with a locomotive using exhaust steam for obtaining draft, of an exhaust steam draft means in the smoke box comprising a steam ejector mechanism consisting of a pair of pipes one within the other of a relative size to provide a space therebetween and having their lower ends in approximately the same plane the inner of said pipes extending well toward the top of the outer pipe, and an exhaust nozzle arranged with relation to the steam ejector to obtain surface entrainment as well as suction in the inner pipe and in the space between the pair of pipes.

7. The combination with a locomotive using exhaust steam for obtaining draft, of an exhaust steam draft means in the smoke box comprising a steam ejector mechanism consisting of a pair of pipes one within the other of a relative size to provide a space therebetween and having their lower ends in approximately the same plane, the inner of said pipes terminating short of the upper end of the outer pipe and occupying the major portion of the height thereof and having its smallest cross sectional area above its lower end.

In testimony whereof, I have hereunto signed my name.

DAVID M. LEWIS.