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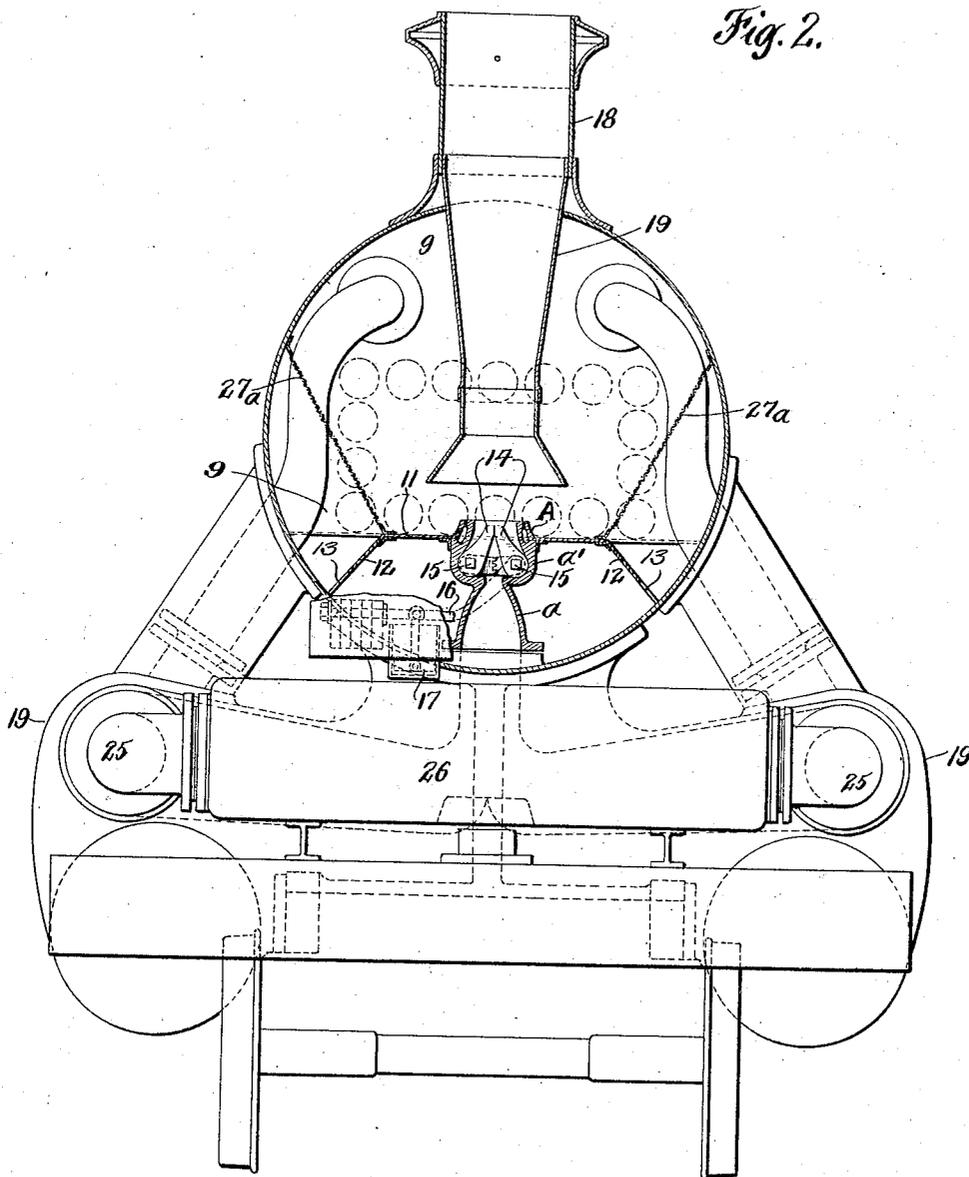
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D. M. LEWIS

LOCOMOTIVE DRAFT APPLIANCE

Filed Aug. 18, 1921

3 Sheets-Sheet 2



David M. Lewis Inventor
By his Attorneys
Dymally & Lechner

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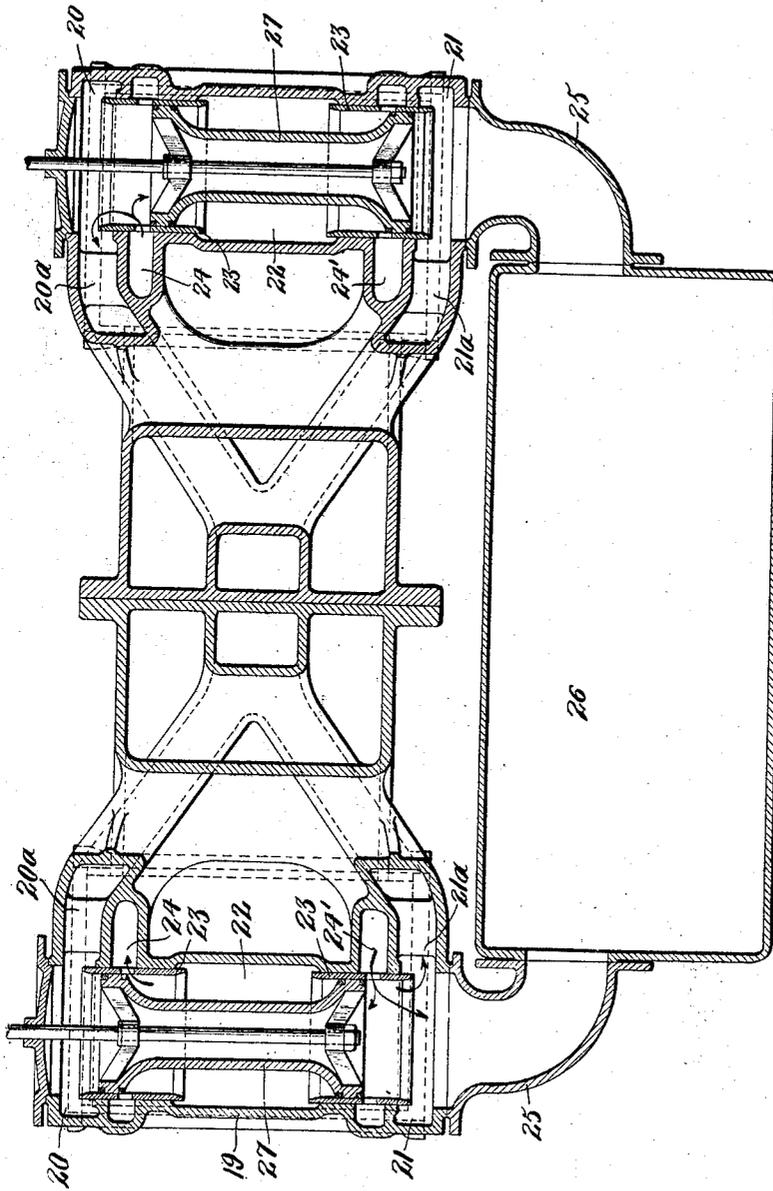
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Fig. 3.



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UNITED STATES PATENT OFFICE.

DAVID M. LEWIS, OF CHICAGO, ILLINOIS, ASSIGNOR TO LEWIS DRAFT APPLIANCE COMPANY, A CORPORATION OF ILLINOIS.

LOCOMOTIVE DRAFT APPLIANCE.

Application filed August 18, 1921. Serial No. 493,311.

To all whom it may concern:

Be it known that I, DAVID M. LEWIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Locomotive Draft Appliances, of which the following is a specification.

This invention relates to locomotive draft appliances, and it has for one of its primary objects the provision of an improved arrangement whereby approximately continuous draft is obtained in contradistinction to the intermittent or pulsating draft of standard practice.

Another object of my invention is to provide an improved draft appliance of the characteristics noted in which obstruction of the smoke box is reduced to a minimum.

Still another object of the invention is to provide an improved draft appliance such that the front end is substantially self-cleaning, and in which an improved and effective arrangement of netting may be employed.

My invention also contemplates an improved arrangement of parts whereby the effectiveness of the draft is increased; and an improved arrangement and combination of stack, petticoat and nozzle.

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

Fig. 1 is a side elevation and partial section of the front end parts of a locomotive; Fig. 2 is a front elevation of Fig. 1, partially in section; and Fig. 3 is a section taken on the line 3—3 of Fig. 1.

Referring now particularly to Figs. 1 and 2, the smoke box shell indicated by the reference letter 7, is of the usual cylindrical type. The flue sheet is indicated at 8 (the flues, however, being omitted); 9 is a diaphragm extending from the top of the smoke box well towards the bottom thereof; and 10 is a damper governing the flow of the products of combustion from the flues into the smoke box beneath the diaphragm 9. Extending forwardly of the diaphragm, preferably to the front wall of the smoke box, is a table plate 11 which surrounds the nozzle A, the construction of which will be hereinafter described. As will be seen in

Fig. 2 the table 11 extends only part way across the smoke box and it has secured to its side edges downwardly inclined reflector plates 12, which preferably extend to the sides of the smoke box shell with an intermediate portion opposite the main nozzle casting *a* cut out providing openings or passages, 13 for the passage of the products of combustion at the sides of the smoke box.

The nozzle A preferably consists of the single piece main casting *a*, round at the bottom and flanged for bolting to the saddle casting, but flaring upwardly and outwardly from said round portion in a direction longitudinal of the smoke box and narrowing in a transverse direction and terminating in an elongated housing portion *a'*, the major axis of which is arranged longitudinally of the smoke box. The nozzle opening is adapted to be formed by the two vanes 14, geared together so as to move in unison and having shafts 15, suitably mounted in the housing *a'*. One of said shafts has an extension 15' extending forwardly through the front wall of the box, and provided with a weighted arm 16, which normally tends to hold the vanes in closed position, as indicated in Fig. 2. The arm 16 is also connected to a dash pot mechanism 17, adapted to cushion its movements. These vanes extend longitudinally of the nozzle casting and when they open they create a long narrow nozzle opening which also extends longitudinally of the smoke box.

The stack, 18, of the smoke box is preferably round in cross section and its petticoat 19 is also round at the top but narrows toward the bottom in a direction transverse the smoke box and elongated in a direction longitudinal of the smoke box, to correspond with the shape and disposition of the nozzle. The bottom of the petticoat is flared laterally and longitudinally of the smoke box.

The saddle casting is preferably of the outside exhaust and inside admission type, each valve chest 19 having exhaust cavities 20 and 21 and a live steam cavity 22. The exhaust passages 20^a and 21^a leading from the exhaust cavities merge in the usual manner and deliver the exhaust steam to the nozzle. The valve chest bushings are shown at 23 and the steam ports or passages at 24 and 24'.

The valve chests have their forward ends

open and have secured over such open ends elbow fittings 25 connected to opposite ends, respectively, of a volume chamber or receiver 26, located in front of the saddle casting and extending transversely thereof. The valves 27 are of the hollow piston type.

It will be seen that by the arrangement just described the volume chamber is connected at either end to the respective forward end of each valve chest so that the volume chamber or receiver may be said to be connected in parallel with the exhaust through the nozzle. The volume chamber is made of ample capacity to act as a reservoir for a relatively large quantity of steam.

With the parts in the position shown in Fig. 3, it will be seen that the cylinder at the left is receiving live pressure in the back through the port 24, and the front end of cylinder is exhausting through the port 24', to the exhaust cavity 21 of the chest from whence it flows to exhaust passage 21^a and also to the receiver 26 through elbow 25. Exhaust steam may also flow through the hollow piston valve 27 to the exhaust cavity 20 of the right hand valve chest and thence to exhaust passage 20^a.

In the cylinder and valve chest at the right of Fig. 3, exhaust is occurring from the back end of the cylinder through the port 24 at the same time as from the front end of the other cylinder, and this exhaust steam may flow through the exhaust cavity 20 and passage 20^a at the right or through the valve in a direction the reverse of that through the valve at the left. Thus, it will be seen that exhaust steam is bound to flow into the volume chamber until pressure equilibrium is established.

In the event that the valve at the right of Fig. 3 covers the port in the rear bushing, then the exhaust steam in the volume chamber, will flow through both exhaust passages on that side of the saddle casting. In the event that all of the exhaust ports in the forward valve chest bushings are closed, then the exhaust steam from the volume chamber is free to flow through all four exhaust saddle passages to the exhaust stand base cavities.

The operation is as follows:—When exhaust takes place from the cylinders, the exhaust steam divides, a portion finding its way directly to the nozzle through the exhaust passages and the remainder going to the volume chamber, the pressure of the exhaust steam being lowered by virtue of the expansion which takes place. The steam which is in the volume chamber backs up the steam passing directly to the nozzle and is free to flow, particularly in the interval between exhausts from the cylinders, to the nozzles so that there is practically, a continuous flow of steam from the nozzle at all times when the engine is using steam. In

fact the pulsations except at low speed, are substantially ironed out so that at the higher speeds the blast issuing from the nozzle is not only continuous but practically constant in pressure.

The weighted vanes constitute a governor mechanism which acts not only to keep the back pressure in the cylinders within a selected maximum, but also to maintain substantially constant pressure of the exhaust blast. The vanes are weighted so as to open at a predetermined value of pressure on the exhaust side of the cylinders and maintain their position, when once open, by slightly less pressure. If for any reason the pressure obtaining in the exhaust passages and receiver should tend to increase, the vanes will open more widely against the action of their weights, thus increasing the area of nozzle opening and automatically lowering the pressure, while if the pressure tends to decrease, the vanes will move toward each other, reducing the size of the nozzle opening, automatically bringing back the pressure to the preselected value. The governor mechanism is thus actuated by the exhaust pressure conditions obtaining in the exhaust passages and in the receiver, on the exhaust side of the cylinders. The pressure to which the weights of the vanes should be adjusted depends upon the type of engine and the class of service, but it is preferably to so weight the vanes as to maintain a pressure which is just sufficient to maintain proper draft throughout the range of working speeds. Because of the continuous character of the blast and because of the fact that the blast column is elongated in cross section and thus secures a maximum entrainment area, I have found by experience that adequate draft can be maintained with a back pressure greatly lower than that which obtains in standard practice.

In so far as the draft created is concerned, it will be observed that the arrangement of the diaphragm, table plate and deflector plates in combination with the peculiarly shaped nozzle, is such that the flow of the products of combustion from the flues is for the most part downward beneath and past the diaphragm, under the table plate and then laterally outward toward the sides through the passages 13, and then inwardly toward the exhaust blast. The diaphragm 9, of course, extends entirely across the width of the smoke box while the table 11 does not and at the extreme lower outer edges or corners of the diaphragm there is a small area between such edges and the deflector plates 12 through which the hot gases, after passing under the diaphragm, are drawn into the petticoat without passing beneath the table plate or under the deflector plates. Thus, notwithstanding the fact

that the exhaust blast is in the form of a relatively thin, wide sheet, the major axis of which is longitudinal of the smoke box, the flue section is approximately uniformly subjected to draft so that the center flues are not overworked in comparison to the side flues, and neither is there too much draft at the side flues which is also to be avoided and is incident to some forms of prior practice.

In addition to the obtaining of adequate draft at all operating speeds, by my improvements I also have found that no sparks are thrown because of the lower velocity of the blast and the fine particles which are drawn through the flues from the fire box are scoured out from the smoke box, and carried out in suspension by reason of the fact that all gas flow therein is close to the sides and bottom of the smoke box. The smoke box is thus very effectively self-cleaning.

With respect to the netting, the arrangement is such that only two longitudinally extending sheets 27^a need be employed. These sheets are secured to the table plate at the junction with the deflector plates and extend upwardly and outwardly to the sides of the box so that all the gases must pass therethrough. This is a simple arrangement which tends, along with other features of construction, to render the smoke box relatively unobstructed.

The combination of the round stack with a petticoat or extension and the nozzles of the shapes described is also very effective for the reason that the shape of the parts first secures maximum entrainment by virtue of creating an elongated blast column of maximum entrainment area and then secures a complete filling of the stack by changing the blast and gas column into a round column which results in maximum efficiency of the blast in the creation and maintenance of draft.

I claim:

1. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage.

2. In a locomotive draft appliance the combination of a pair of cylinders, a nozzle, exhaust passages leading from the cylinders to the nozzle, and a receiver connected so as to be in parallel with the exhaust passages.

3. In a locomotive draft appliance, the combination of a pair of cylinders having chests with outside exhaust passages and inside admission, a nozzle, a receiver, and a connection between the receiver and each chest establishing communication between the receiver and the exhaust cavities of the chests.

4. In a locomotive draft appliance, the combination of a saddle casting having a

pair of cylinders, a pair of valve chests, and outside exhaust passages and inside admission, a transversely extending receiver adjacent the saddle, and an elbow connecting each end of the receiver to the exhaust cavity of a chest.

5. In a locomotive draft appliance, the combination of a saddle casting having a pair of cylinders, a pair of valve chests, and outside exhaust passages and inside admission, a hollow valve in each chest, a receiver, and a connection between the receiver and the exhaust cavities of the chests.

6. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage, said nozzle having automatic means creating the nozzle opening responsive to the exhaust pressure conditions.

7. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage, said nozzle having an automatic governor means responsive to the exhaust pressure conditions.

8. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage, said nozzle being elongated.

9. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage, said nozzle being elongated with its major axis extending longitudinally of the smoke box.

10. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage, said nozzle being elongated with its major axis extending longitudinally of the smoke box, together with a stack and an apron of corresponding cross section.

11. In a locomotive draft appliance the combination of a cylinder, an exhaust passage, a nozzle, and a receiver in parallel with the exhaust passage, said nozzle being elongated with its major axis extending longitudinally of the smoke box, together with a round stack and an apron therefor, the lower portion of which is elongated in cross section in accordance with the nozzle.

12. In a locomotive, the combination of a flue sheet, a cylindrical smoke box, an elongated nozzle with its major axis longitudinal of the box, a diaphragm intermediate the nozzle and flue sheet, and a table plate surrounding the nozzle and extending longitudinally of the box from the diaphragm forwardly and having its side edges terminating short of the sides of the smoke box, together with deflector plates angling from the side edges of the table plate.

13. In a locomotive, the combination of a flue sheet, a cylindrical smoke box, an elongated nozzle with its major axis longitudinal of the box, a diaphragm intermediate the nozzle and flue sheet, and a table plate surrounding the nozzle and extending longitudinally of the box from the diaphragm forwardly and having its side edges terminating short of the sides of the smoke box, together with deflector plates angling from the side edges of the table plate and netting arranged longitudinally of the smoke box extending from the intersections of the table plate and deflector plates upwardly to the sides of the smoke box.
14. In a locomotive, the combination of a flue sheet, a cylindrical smoke box, an elongated nozzle with its major axis longitudinal of the box, a diaphragm intermediate the nozzle and flue sheet, and a table plate surrounding the nozzle and extending longitudinally of the box from the diaphragm forwardly and having its side edges terminating short of the sides of the smoke box, together with deflector plates angling from the side edges of the table plate and netting arranged longitudinally of the smoke box extending from the intersections of the table and deflector plates upwardly and outwardly to the sides of the smoke box.
15. In a locomotive, the combination of a flue sheet, a cylindrical smoke box, an elongated nozzle with its major axis longitudinal of the box, a diaphragm intermediate the nozzle and flue sheet, and a table plate surrounding the nozzle and extending longitudinally of the box from the diaphragm forwardly and having its side edges terminating short of the sides of the smoke box, together with netting extending upwardly from the side portions of the table plate to the sides of the smoke box and longitudinally thereof.
16. In a locomotive, the combination of a flue sheet, a cylindrical smoke box, an elongated nozzle with its major axis longitudinal of the box, a diaphragm intermediate the nozzle and flue sheet, and a table plate surrounding the nozzle and extending longitudinally of the box from the diaphragm forwardly and having its side edges terminating short of the sides of the smoke box, together with deflector plates angling from the side edges of the table plate and providing passages for gas flow at the sides of the smoke box.
17. In a locomotive, the combination of a flue sheet, a cylindrical smoke box, an elongated nozzle with its major axis longitudinal of the box, a diaphragm intermediate the nozzle and flue sheet, and a table plate surrounding the nozzle and extending longitudinally of the box from the diaphragm forwardly and having its side edges terminating short of the sides of the smoke box, together with deflector plates angling from the side edges of the table plate extending to the sides of the smoke box and cut away intermediate their ends to provide passages at the sides of the box.
18. In a locomotive draft appliance the combination of an elongated nozzle, a substantially round stack, and a petticoat for the stack the lower portion of which has a cross section corresponding to that of the nozzle.
19. In a locomotive draft appliance, the combination of an elongated nozzle, a substantially round stack, and a petticoat for the stack the lower portion of which has a cross section corresponding to that of the nozzle together with means producing a substantially continuous blast from the nozzle.
20. In a locomotive draft appliance the combination of a cylinder, a nozzle adapted to receive exhaust steam directly from the cylinder for creating draft blast and a receiver also open to the exhaust from the cylinder and adapted to deliver exhaust steam to the nozzle.

In testimony whereof, I have hereunto signed my name.

DAVID M. LEWIS.