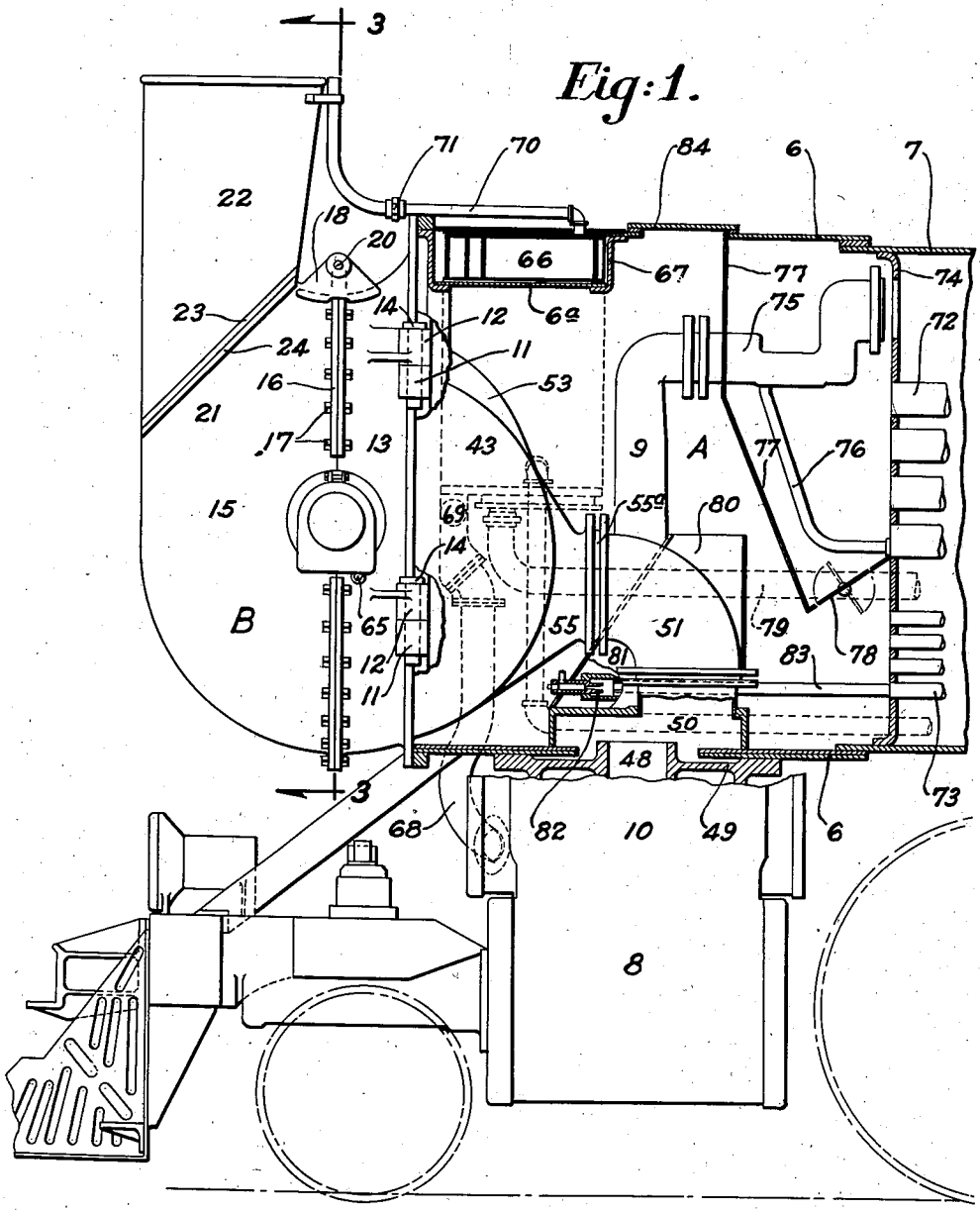
Dec. 15, 1936. C. A. SCHELLENS ET AL 2,064,126

LOCOMOTIVE

Filed Nov. 7, 1931 7 Sheets-Sheet 1

Fig:1.



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LOCOMOTIVE

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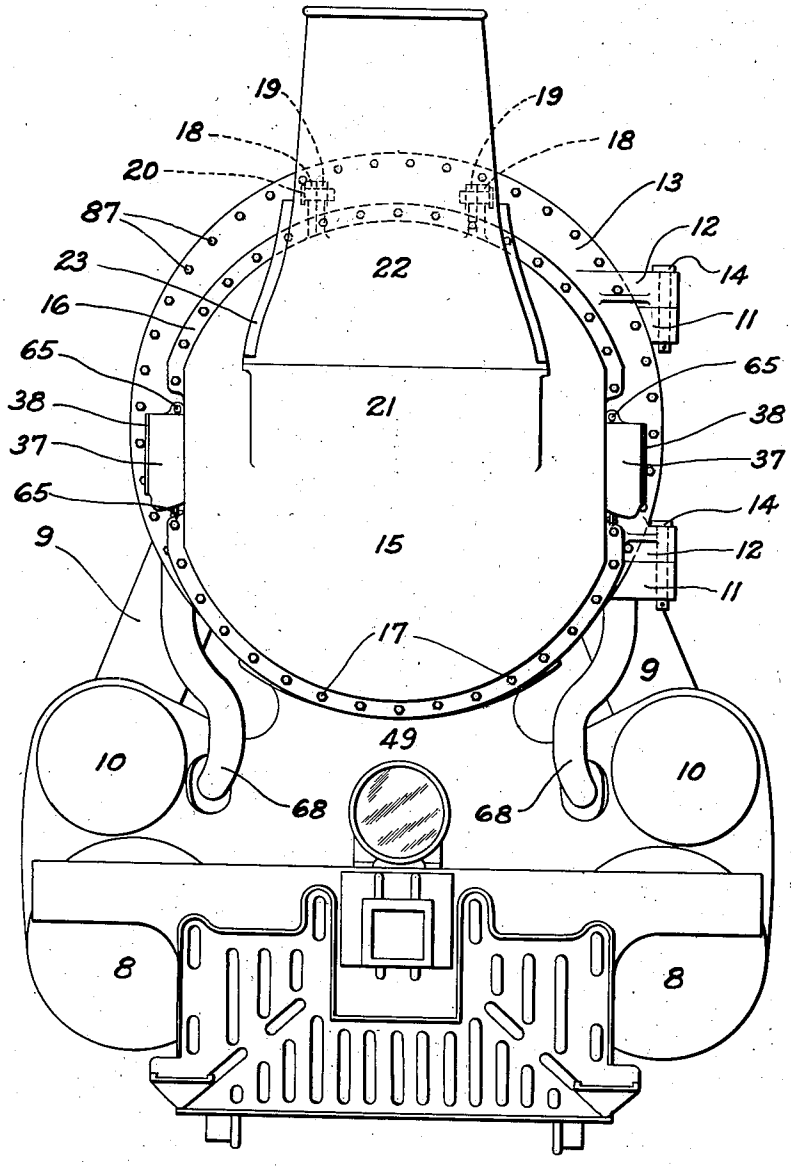


Fig: 2

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Filed Nov. 7, 1931 7 Sheets-Sheet 3

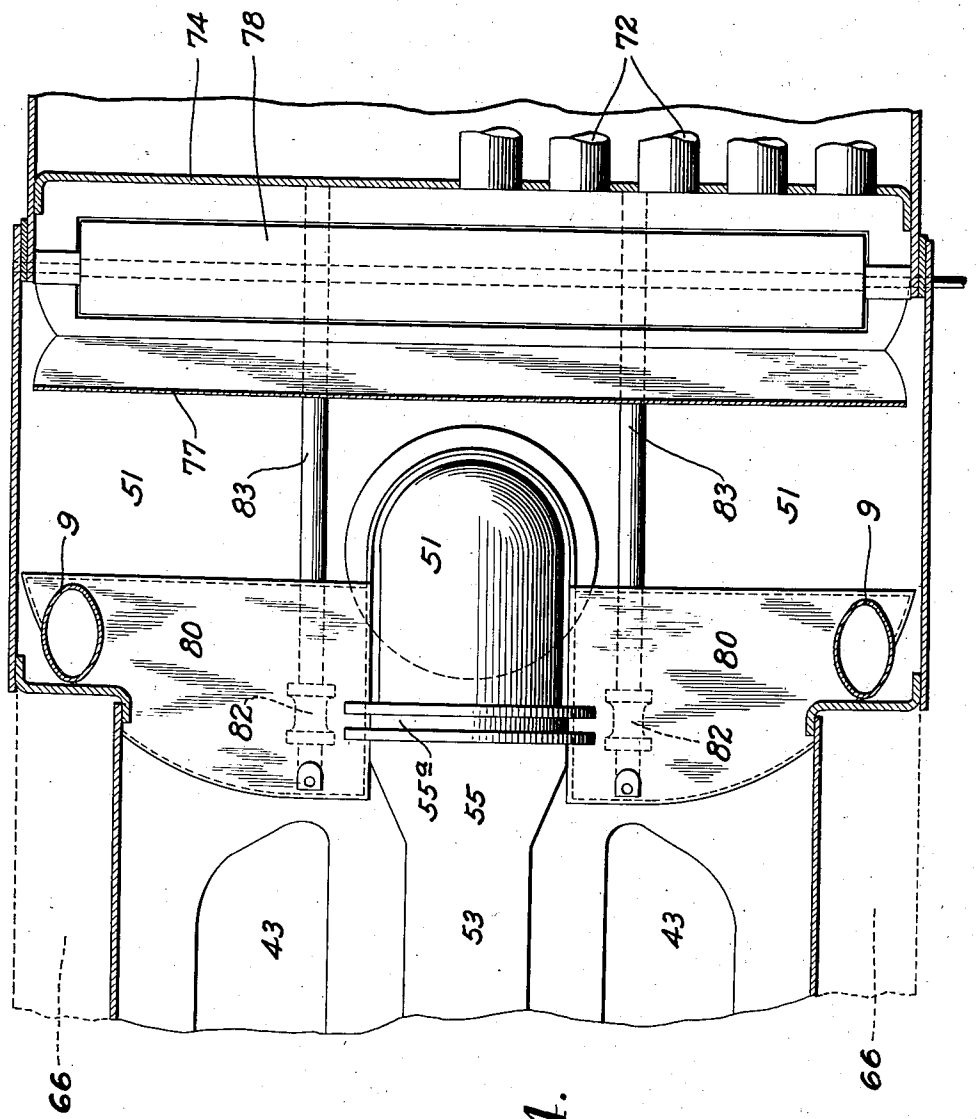


Fig. 4.

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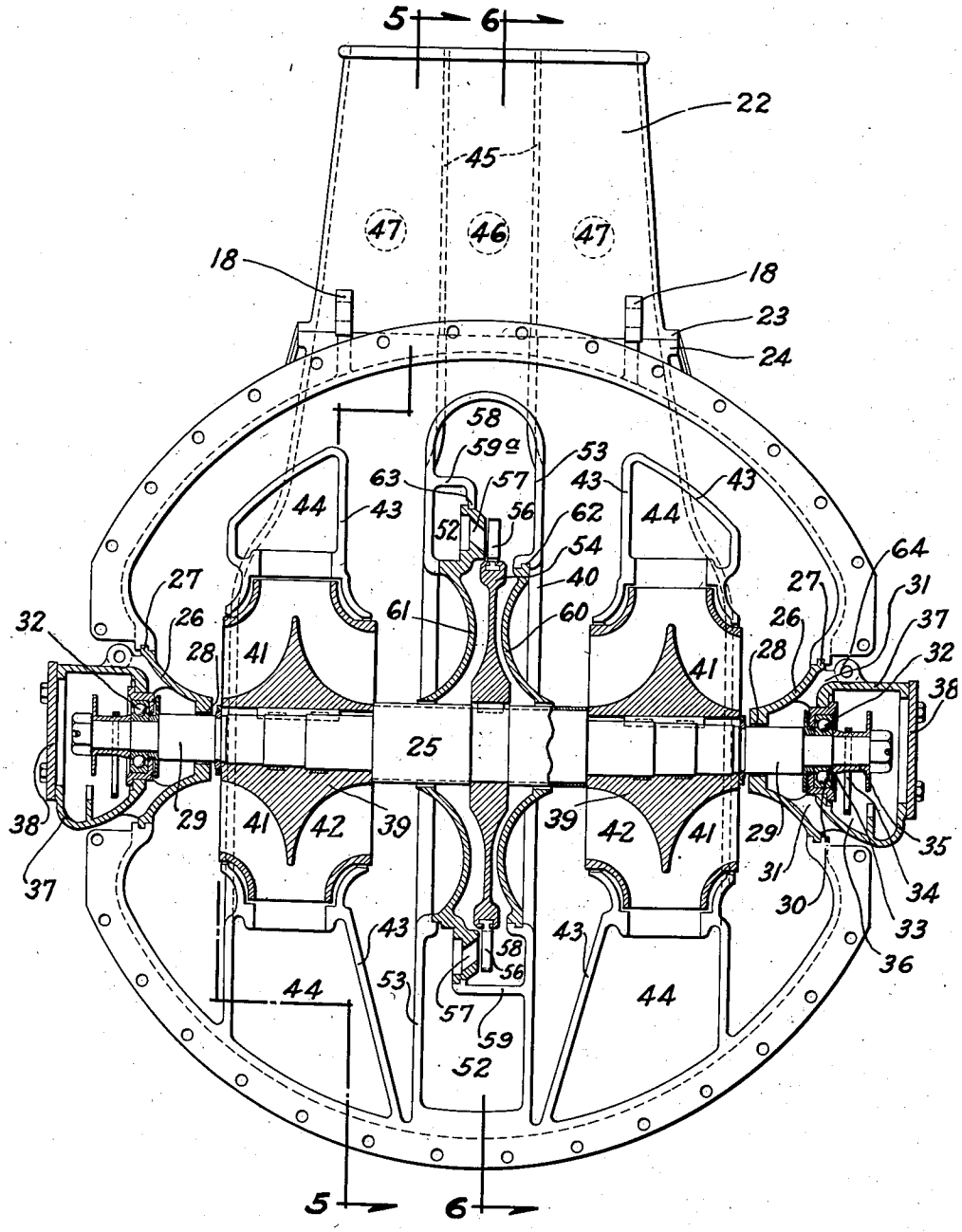


Fig: 3.

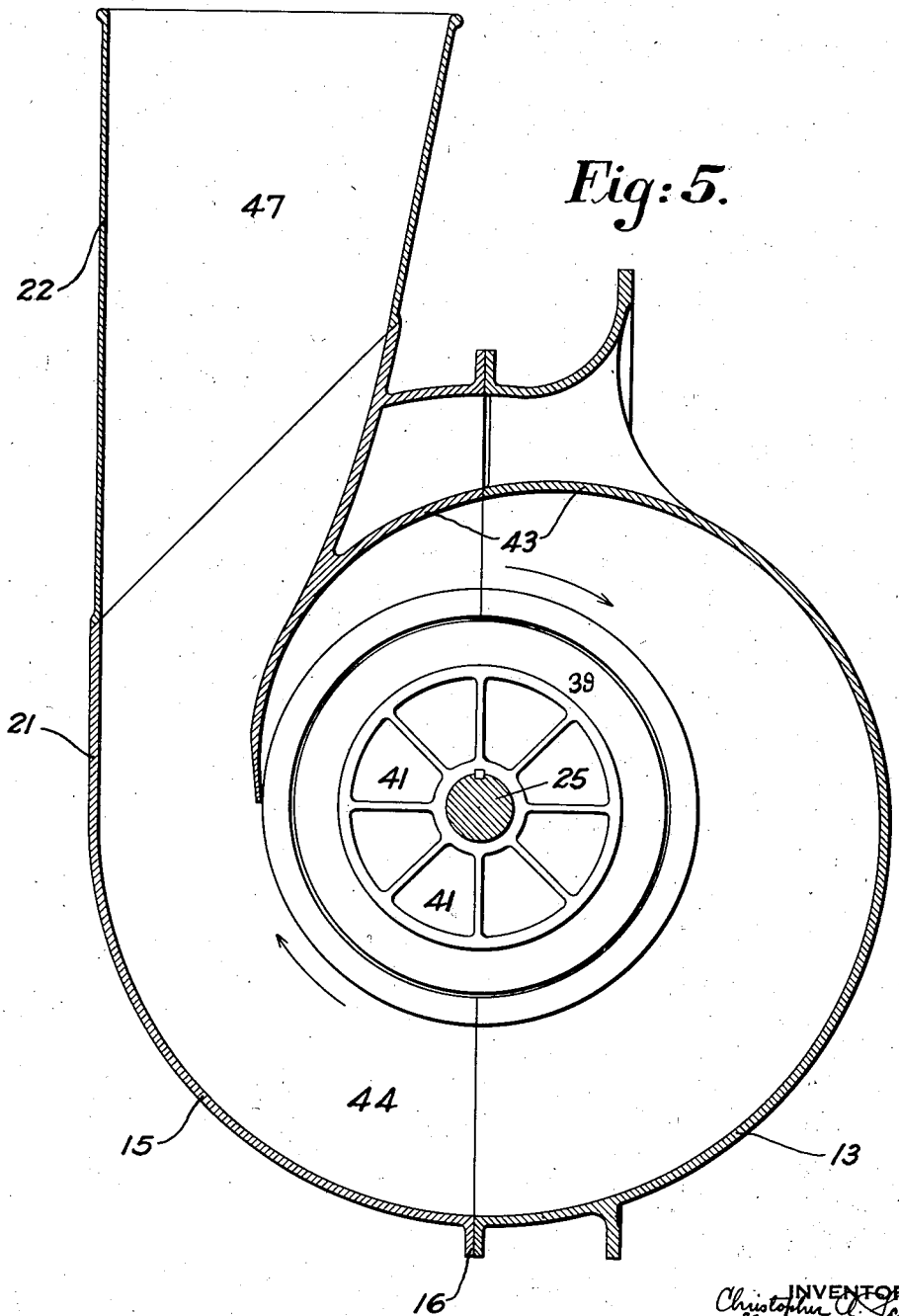
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LOCOMOTIVE

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Fig: 5.



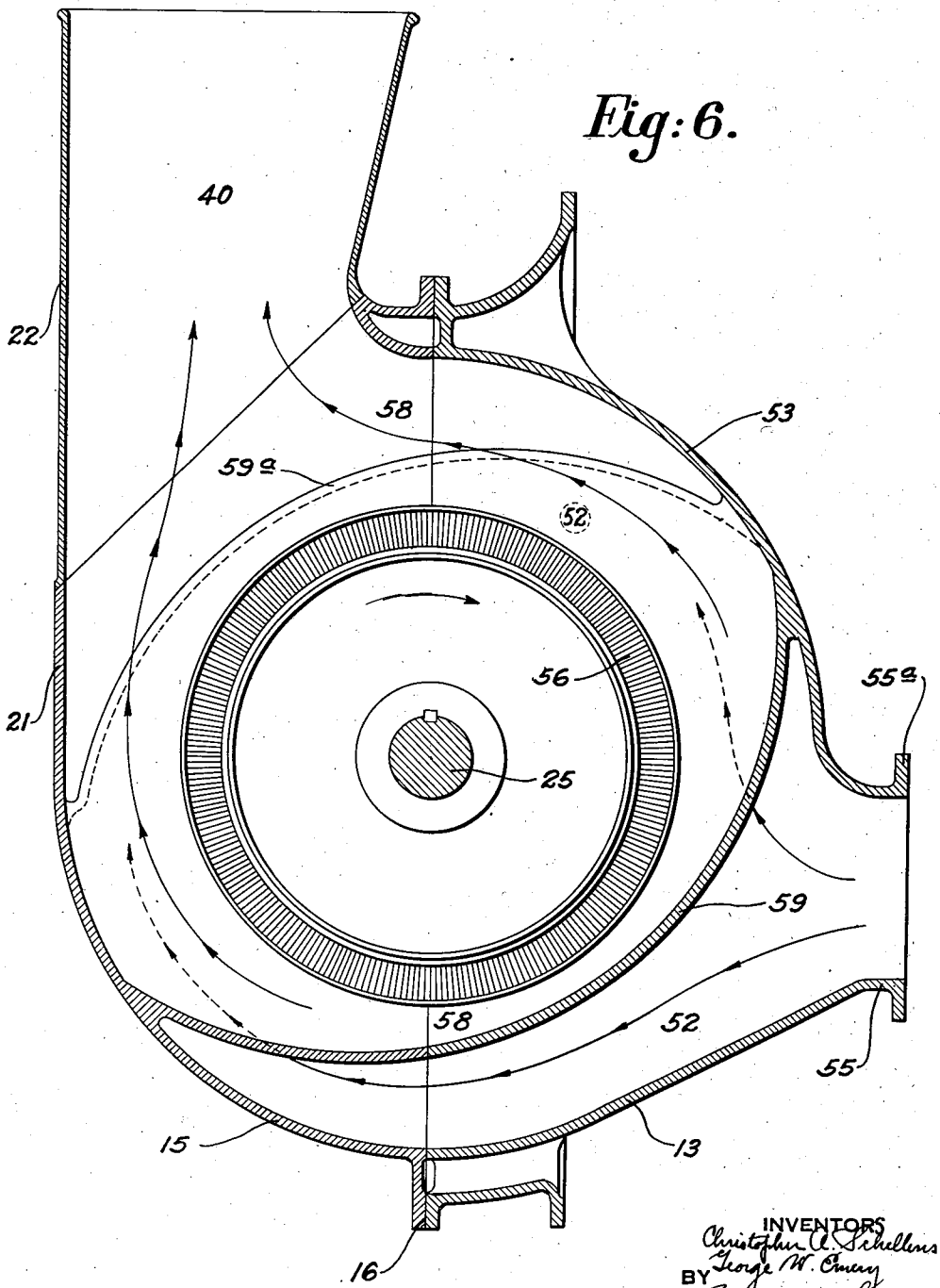
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Filed Nov. 7, 1931 7 Sheets-Sheet 6

Fig: 6.



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LOCOMOTIVE

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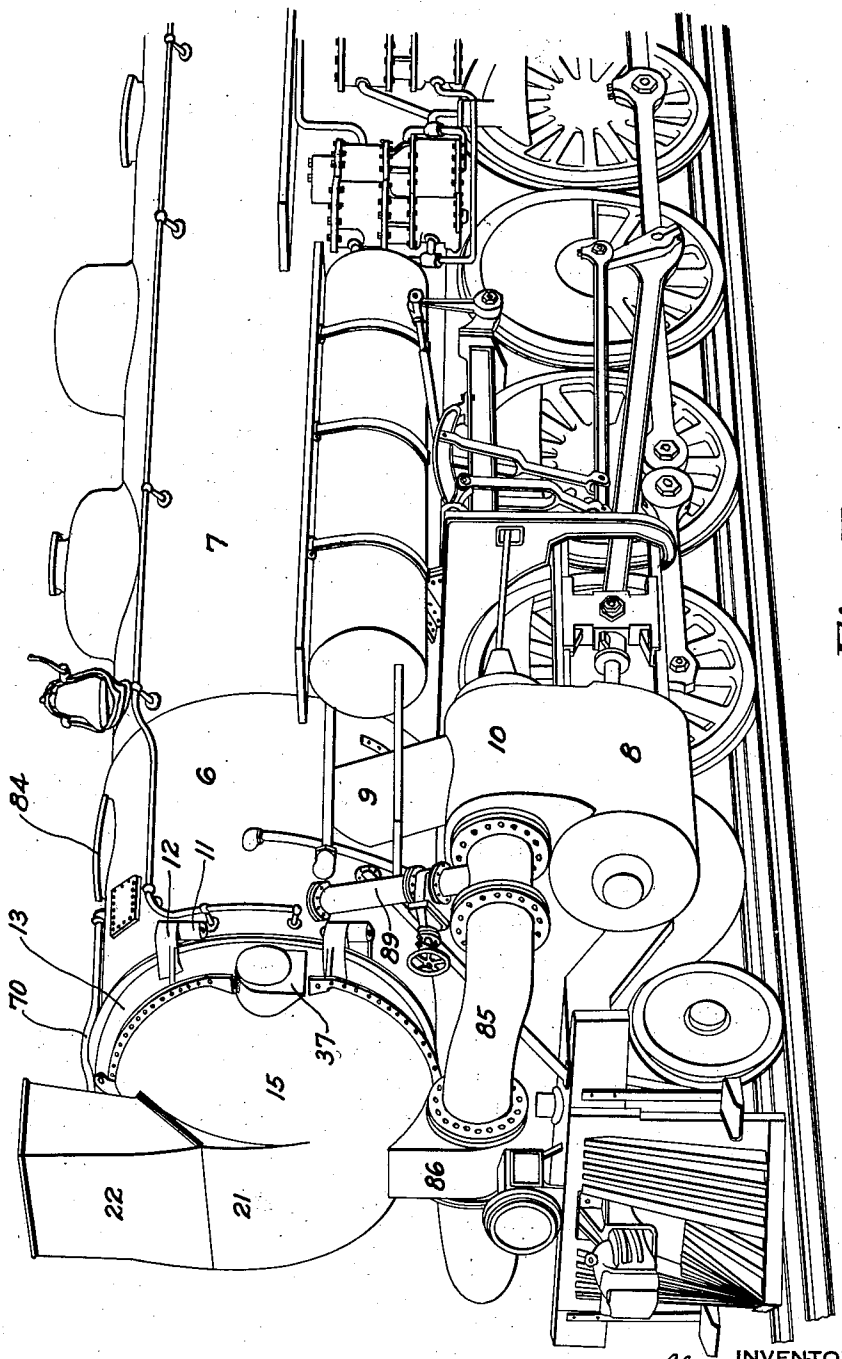


Fig: 7.

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Patented Dec. 15, 1936 2,064,126

UNITED STATES PATENT OFFICE

2,064,126

LOCOMOTIVE

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Application November 7, 1931, Serial No. 573,618

20 Claims. (Cl. 110—162)

This invention relates to locomotives and is more especially concerned with the front end structure thereof, i. e., the front end of the boiler, a fan drafter, feed water heater, stack and other parts constructed in a new and improved manner or arranged in a novel relationship.

Generally considered, the present invention has in view increasing the efficiency of the locomotive as a whole and also the disposition of various parts in the front end in such manner that maximum convenience and adaptability are afforded in initial construction or installation as well as in subsequent inspection or repair.

More specifically, the present invention has in view the construction and application of a relatively large capacity fan drafter unit arranged in such manner as to cooperate conveniently with other parts or elements of the locomotive front end without encroaching on the restricted or limited space of the smoke box or front end and without unduly complicating or crowding the internal structure thereof. The foregoing advantages are attained by means of a construction which has the additional advantage of being applicable or adaptable to a large range of smoke box sizes or types without encountering many difficulties which have been met heretofore, particularly from complication of the parts within the smoke box or interference of one element or mechanism thereof with another.

The invention further has in view relative disposition of a fan drafter mechanism and a boiler feed water heater in a convenient manner so that these units do not interfere with each other or with any other portions of the internal structure of the smoke box.

Still further, in accordance with the present invention, the drafting mechanism is arranged with the bearings for the rotating parts thereof disposed at opposite sides of the boiler shell, with the result that they are readily accessible for purposes of inspection, lubrication or repair, and, in addition, are well protected from the heat of the gases passing through the smoke box and the drafter. This invention further makes provision for the circulation of air in the vicinity of these bearings, the circulation being accomplished or effected by the fan members of the drafter.

Additional advantages of the arrangement of fan drafter with a transversely extended axis and bearing means therefor at opposite sides of the locomotive will be apparent when it is considered that, with constructions heretofore adopted, one or more bearings for the rotatable parts were frequently disposed interiorly of the smoke box or, at least, in some position which resulted in lubrication complications or in undue subjection of the bearings to the high gas temperatures in the box. Other arrangements heretofore adopted have employed rotating fan parts mounted at an end of an axis spindle or shaft, with the result that the shaft bearing means afforded support at one side of the rotating fan parts only. On the other hand, in accordance with this invention, the bearings are not only conveniently located for purposes of inspection and the like as well as protection from heat, but, in addition, are arranged to provide support for rotating fan parts at either side thereof, i. e., toward the ends of the axis shaft or spindle. A much more stable and smooth running construction is provided in this way.

Additionally, the present invention contemplates a novel disposition of the fan drafter, housed partly within the boiler shell and partly within a supplementary casing projecting forwardly therefrom, the rotary members, including the fan runners, being mounted for rotation on an axis extended transversely or laterally of the boiler. In this way a central and upward discharge of the products of combustion results from the mere extension, vertically upwardly, of one or more discharge passages which are tangent to the fan runner or runners. Friction losses which have been encountered heretofore where the discharge passages from the fan runners were curved, beyond the point of tangency, are eliminated. Heretofore, in view of the manner of mounting drafting fans or mechanisms in locomotive smoke boxes, it has been necessary to employ more or less extended and circuitous exhaust passages in order to provide a central discharge upwardly at a suitable point.

A further advantage of applicants' arrangement of tangential discharge passages extended directly upwardly, lies in the fact that the gas velocity is maintained at a higher value. This, of course, is of substantial advantage in raising or clearing the smoke substantially above the locomotive cab. At this point it should also be observed that, in accordance with the present invention, the forward portion of the housing or casing for the fan unit is rounded to provide a stream-lined effect. This further enhances the discharge or projection of the gases upwardly to clear the locomotive cab.

As another object the present invention contemplates a movable mounting for the fan drafter which is preferably arranged to permit swinging

of the drafter, as a unit, outwardly and to one side of the smoke box. This mounting is advantageous not only for purposes of inspection and repair of the drafter itself but also as it greatly facilitates access to other elements disposed internally of the box. For example, removal and replacement of boiler and superheater tubes is greatly facilitated, this having been particularly troublesome in many front end constructions heretofore employed in which fan drafters were used.

The casing for the fan drafter of this invention, being substantially spherical at least in its forward portion, lends itself readily to construction in two or more casing parts which may be separably secured to each other. As a result, access to the interior of the casing, i. e., to the fan runners, driving means, etc., is greatly facilitated, it being noted that the internal fan parts and the like are preferably arranged for removal from the casing after separation of the parts thereof. Still further, in the preferred arrangement, the fan parts proper, including the runners, driving means and supporting bearing structures, are associated with a single axis structure so that this structure together with its associated parts may be removed from the casing as a unit and, further, without disturbing various inlet and discharge passages.

The present invention also includes construction of a drafter in such manner that either internal or external steam connections may be employed between the exhaust cavities of the cylinder valves and the fan driving means, the internal connections, however, being preferable. With respect to the matter of steam connections, attention is also called to the fact that the drafter of the present invention cooperates neatly with a smoke box in which an arcuate or semi-circular feed water heater is employed without producing interference between steam connections to the heater and to the fan driving means.

Another object which might here be noted is the extension of the gas or smoke discharge passage or passages upwardly through a stack structure which is removably mounted on the drafter casing. This feature is of advantage as it provides for the application of stacks of different height or passage configuration with the result that the drafter unit is adaptable to a wide variety of locomotives each one of which may have somewhat different characteristics requiring somewhat different stack arrangements.

This invention also has in view the utilization of a pair of fan runners mounted on the transverse axis hereinbefore referred to and having driving means therefor in the form of a steam turbine disposed between the pair of runners. This arrangement is highly desirable in obtaining relatively high capacity without encroaching upon the very limited space of the smoke box. Still further, with the turbine disposed between a pair of fan runners (all three of these parts being mounted on the transverse axis) the exhaust steam is conveniently discharged upwardly through the stack structure in a passage which is disposed intermediate the gas discharge passages extending from the runners. In this connection, it should be noted that the separation of the steam discharge from the gas discharge permits conducting the exhaust steam away from the stack to a suitable condenser where the locomotive is of the condensing type.

The driving turbine of this invention also embodies advantageous features, among which might be mentioned general compactness resulting in large part from a novel arrangement of interfitting or complementary supply and exhaust steam passages therefor.

How the foregoing objects and advantages are obtained together with others which will occur to those skilled in the art will be more apparent from a consideration of the following discussion making reference to the accompanying drawings, in which

Figure 1 is a side view of the front end of a locomotive embodying various features of the present invention; the locomotive smoke box, as well as a feed water heater recessed therein, being shown substantially in vertical section;

Figure 2 is a front view of the locomotive illustrated in Figure 1;

Figure 3 is a vertical sectional view through the fan drafter casing of the present invention, the view being taken substantially as indicated by the section line 3—3 on Figure 1;

Figure 4 is a top plan view of certain portions of the apparatus appearing in Figure 1 within the smoke box, this view illustrating the boiler shell, as well as certain baffle and tube plates, in section;

Figures 5 and 6 are sectional views of fan drafter parts taken substantially on the section lines 5—5 and 6—6 of Figure 3; and

Figure 7 is a perspective view of the forward portion of a locomotive illustrating a modified application of the fan drafter of the present invention thereto.

In making reference to the drawings in general, it should be noted that we have indicated a locomotive smoke box by the reference letter A, this box being formed as by means of enclosing plates 6 which, in effect, constitute an extension of the boiler shell 7. Below and at each side of the smoke box the main engine cylinders 8 are arranged substantially in the usual manner with dry pipes 9 extended out of the box to the cylinder valve chests 10.

In accordance with the present invention, in place of the usual smoke box door, we have mounted and positioned a fan drafter generally indicated by the reference letter B, the mounting, as seen especially in Figures 1 and 2, including hinge members 11, associated with the forward or front edge of the smoke box structure, and cooperating hinge members 12 which are secured to the fan drafter casing member 13. Suitable hinge pins 14, of course, are also provided. As seen most clearly in Figures 1, 2, and 7, the casing member 13 serves to support a cooperating and substantially hemispherical member 15. These two parts 13 and 15 may suitably be secured to each other by means of cooperating flanges 16 and bolts 17. Still further, in the preferred arrangement, these two casing parts are pivoted to each other in their upper portions as by means of pairs of cooperating apertured ears 18 and 19, pivot pins 20 being employed to pivotally connect each pair. Various advantages of this pivotal connection of the casing members 13 and 15 will be considered more in detail hereinafter.

Also as best seen in Figures 1, 2, and 7, the casing part 15 has a portion of the stack structure formed integrally therewith as indicated at 21, this portion being rounded or faired into the spherical outside shape or form of the member 15. The stack is preferably completed by the use of an upwardly extended structure 22

which is suitably joined to the portion 21 as by means of cooperating flanges 23 and 24.

Before considering Figure 3 in detail, attention is called to the fact that this figure includes a showing of the drafter parts mounted within the casing member 15. In gaining access to the interior of the drafter casing by separation of the portions 13 and 15, however, upward swinging of the part 15 on the pivot 20 will leave the drafter parts mounted in and secured to the casing member 13 by virtue of the attachment of the supporting bearings to this casing member as pointed out hereinafter.

In this figure it will be seen that the various drafter parts are illustrated in vertical section, and also that the drafter unit includes a central axis or spindle structure 25 which is extended generally transversely or laterally of the smoke box and boiler shell, the shaft being disposed and mounted in the casing formed by the parts 13 and 15 forwardly of the front edge of the smoke box proper. At each end of this shaft we have provided a supporting bearing structure including normally fixed members 26 which are removably mounted, partly in each casing member 13 and 15, as by rabbetting indicated at 27. These bearing mounting parts may suitably be secured to the casing member 13 by means of apertured ears 64 and bolts 65 (see Figs. 1 and 2). As clearly seen in Figure 3, the shaft 25 and the members 26 are arranged substantially at the joining point or line between the casing elements 13 and 15, so that upon separation of the casing elements, the rabbetted joints 27 permit withdrawal of the supporting members 26 along with the axis structure.

The elements 26 are provided with apertures 28 at the inner ends thereof, preferably of a diameter slightly greater than that of the shaft portions 29 which project through these apertures. The shaft bearings are preferably of the ball bearing type, shown at 32, and include outer races 30 which are rigidly positioned with respect to the members 26 as by means of bracket parts 31. The inner races 33 are, of course, directly associated with the central shaft. In accordance with this invention these main shaft bearings are arranged for lubrication by means of floating rings 34 which are arranged for movement around the part 35 and which are of sufficient dimensions to extend downwardly into the oil reservoir 36 which is formed within the bearing box or closure 37. The outer side of each bearing box may have an inspection or repair aperture suitably closed by a cover plate 38. It will be observed that bearings arranged in the manner herein disclosed are readily accessible from the exterior of the smoke box and fan drafter housing and, in addition, are well protected from the heat of the gases passing through the box and drafter. Still further, the bearing location externally of the casing parts 13 and 15 results in their subjection to cooling air currents during movement of the locomotive. In accordance with the present invention, however, provision is made for a more positive circulation of air in the vicinity of these bearings and their associated lubricant reservoirs. As illustrated herein, the means employed for this purpose include formation of the openings 28 in the members 26 of somewhat larger diameter than the shaft parts 29. Air may, therefore, be drawn in through these openings 28 by the fan runners which are indicated generally by the reference numerals 39—39. These runners, as appears in Figure 3, are mounted at either side of a centrally arranged turbine driving means generally indicated at 40. The fan runners preferably have gas passages formed therein as indicated at 41 and 42 each having an axially directed inlet opening and a radially directed discharge opening.

The fact that the openings 28 in the members 26 communicate with the interior of the smoke box results in forced draft of air from the exterior of the fan casing around the bearings 32 and their housings 37 and into the interior of the fan casing. This air draft or suction around the bearings is especially strong and effective in view of the fact that the fan runner passages 41 have their inlet openings disposed adjacent to the openings 28 in the members 26.

As seen in Figures 3 and 5, each fan runner has oppositely curved passages 41 and 42, respectively, all arranged for radial discharge and for axial intake at opposite sides. Each runner, furthermore, is provided with a substantially volute or scroll shaped passage or chamber for the radially discharged gases. This passage, in accordance with the present showing, is formed by means of wall members 43 and increases in size from a point forwardly of the associated runner adjacent its tangential discharge, upwardly over the runner, then downwardly at the rear thereof and finally upwardly from the point of tangency into the stack structure 21 and 22. These passages are indicated by the reference numerals 44. The stack structure, furthermore, preferably includes division plates 45 which serve to define three stack passages 46 and 47—47. Each one of the passages 47, of course, communicates or merges with the tangential discharge from the scroll passage 44 of one fan.

Referring now to Figures 1, 4, and 5, it will be seen that, as here shown, the gases and products of combustion in the smoke box pass forwardly from the boiler flues and have access to both sides of each one of the fan runners, the cooperating scroll casings 43 for these runners being fragmentarily indicated in Figure 4.

As above noted, the driving mechanism for the fan runners preferably takes the form of a steam turbine which derives its operating fluid from the exhaust cavities of the main valves 10. In Figure 1, a connection 48 is extended upwardly from the saddle 49 into a chamber 50 disposed within the smoke box just above the bottom thereof. It will be understood, of course, that the exhaust cavities of the cylinders 10 are provided with suitable conduits or communications extending inwardly through the saddle 49 to the passage 48. From the chamber 50 the exhaust steam is conducted through the elbow 51 into the passage 52 (see Fig. 6) formed by walls 53, 59, and 59*a*, the latter two walls being referred to more in detail herebelow. This passage 52, in accordance with the form of invention disclosed in Figures 1 to 6 inclusive, is of greatest cross sectional area at the point 55 (see Figs. 1 and 6), i. e., adjacent to the elbow 51. Passage 52, furthermore, diminishes in cross sectional area from the point 55 to a point diametrically opposite thereto (see Fig. 6). At the point 55 the casing 53 is joined to the elbow 51 by means of a flanged and separable connection indicated at 55*a*.

It will be noted that with these various passages constructed as brought out above, the inlet and exhaust passages for the turbine (indicated at 52 and 58, respectively) are complementary to each other, that is, they interfit with the large

portion of one adjacent the small portion of the other and vice versa. The division walls such as indicated at 59 and 59a, of course, serve to separate or define the chambers 52 and 58 within the casing walls 53. This arrangement of passages and the steam flow therein will readily be understood from inspection of Figure 6, in which the arrows indicate steam flow direction.

Steam is delivered from the passage 52 to the turbine blades 56 through suitably directed nozzles or passages 57. The steam collecting and discharge chamber for the turbine is indicated by the reference numeral 58 and, as best seen in Figure 6, is of relatively large and small cross sectional area at points respectively adjacent the small and large portions of the supply cavity 52.

In Figures 3, 5, and 6, it will be observed that the various gas and steam passages which are defined by the walls or casings 43, 53, and 59 are formed as a part of the general fan housing elements 13—15. In the preferred arrangement, furthermore, the various gas and steam passages are formed by means of enclosing wall members or casings which are split or separated along the line on which the two casing parts 13 and 15 are joined to each other. Therefore, each passage for gas or steam is formed partly by defining walls which are associated with the two fan casing elements 13 and 15 and which interfit or register with each other when the elements 13 and 15 are secured together in normal operative position. The splitting of these passages in this manner is provided in order to permit removal of the axis structure 25 and all the parts associated therewith, as a unit, upon separation of the two casing halves 13 and 15. With this in mind, the turbine diaphragm plates 60 and 61, which are centrally apertured to receive the shaft 25, have rabbetted connection or engagement with the casing 53 as indicated in Figure 3 at 62 and 63. These diaphragm plates, between which the rotor 54 is mounted, are, therefore, removable with the central axis mechanism.

In Figure 1 we have illustrated an application of the fan drafter unit above described to a smoke box structure in which a feed water heater 66 is mounted. The heater here shown is substantially arcuate or semi-circular in form and is disposed in an arcuate chamber 67 within the smoke box shell adjacent the front end thereof and shielded from the cinders and gases by the portion or plate 6a of the smoke box shell. The steam connections to the heater preferably include those indicated in Figures 1 and 2 at 68, these connections being extended from the exhaust cavities of the valves 10 upwardly to the legs of the heater on each side of the locomotive (see 69 in Fig. 1). The heater may also include a vacuum breaking pipe 70 which is extended upwardly therefrom to terminate adjacent the stack 22. This pipe 70 is also jointed as indicated at 71 to facilitate opening or separation of the drafter casing parts 13 and 15 or swinging of the entire drafter unit on the hinges 11—12. A water connection pipe 79 is also indicated in Figure 1 extending forwardly to a heater leg.

In connection with the relative disposition of the arcuate heater 66 and the drafter unit, attention is called to the fact that these parts neatly cooperate with the smoke box structure to occupy a minimum amount of space and also to utilize the space occupied in the most efficient manner. The net result, of course, is to substantially eliminate interference of these parts with others disposed internally of the smoke box and to admit of direct endwise withdrawal of superheater units.

In Figure 1 we have also shown portions of the usual boiler flues 72 and 73, these flues terminating in a suitable plate or sheet 74 disposed transversely of the boiler shell. We have also here shown a superheater header 75 and superheater units or tubes 76 extended into the flues 72 substantially in the usual manner. The header 75, of course, has communication with the dry pipe 9 and the tubes of the superheater are enclosed as by the casing 77. At its lower end the casing 77 is provided with a gas flow control valve 78 which may be automatically movable under the influence of draft created by the fan or which may be operated by a pressure controlled piston in accordance with various mechanisms heretofore adopted.

Additionally, in accordance with the present invention, provision is made for cinder collection and separation. As shown in Figure 1, baffle members 80 are arranged to collect cinders in the pockets 81 to be blown therefrom by means of the device indicated generally at 82 rearwardly and into the locomotive fire box through the tubes 83. This device forms no part of the present invention, per se, one such device being described and claimed in the copending application of Eugene L. Schellens, Serial No. 454,020, filed May 20th, 1930, now Patent No. 1,197,751, issued April 16, 1935. It should be observed, however, that in accordance with the present invention the cinder collecting pockets and their associated ejectors are conveniently disposed one at each side of the central exhaust steam connection 51. With the arrangement shown, furthermore, much more adequate space or room is provided for devices of this character than has been possible with fan drafters and smoke box arrangements heretofore employed.

Still referring to Figure 1, attention is called to the provision of the hand hole cover 84 at the top of the smoke box and spaced just behind or rearwardly of the heater casing 67. This opening permits ready and convenient access to any of the various devices disposed internally of the smoke box in a manner which is not possible with the usual locomotive smoke box and stack arrangement.

Turning now to the form of the invention illustrated in Figure 7, it should be noted that this structure, in many respects, rather closely resembles that of Figures 1 to 6 inclusive. Here, however, the exhaust steam passages from the valves 10 to the fan turbine are extended externally of the saddle as indicated at 85. Various of the interiorly disposed parts, as will readily be understood, may be disposed in this arrangement similarly to the manner described above, although with the externally arranged steam connections some modification in the formation of the inlet and exhaust passages for the turbine will be necessary in order to provide for cooperation thereof with the connections 85. For example, these connections may suitably be united in the casing 86 having an upwardly extended passage communicating with the supply side of the turbine at a point disposed therebeneath. Steam connections to the feed water heater are also somewhat differently arranged in this construction, one such connection being indicated at 89 in Figure 7.

The general appearance of a locomotive embodying various features of the present invention clearly appears in Figure 7 although, as will be appreciated from comparison of Figure 7 with Figures 1 and 2, where internally arranged steam connections are employed the general external appearance and streamlining of the locomotive is still further enhanced.

Turning again to Figures 1 to 6 inclusive, when it is desired to gain access to the interior of the smoke box, for example, for the purpose of renewing superheater units, the entire fan drafter may be swung outwardly and to one side of the smoke box on the hinges 11—12, without in any way disturbing the drafter parts themselves. This is accomplished by disconnecting the joint 55a between the elbow 51 and the turbine casing part 55 and, of course, suitable removal of the bolts 87 (see Fig. 2) which serve to secure the fan unit tightly to the front of the smoke box in its normal position. The connection 71 in the heater pipe 70 is also separated before outward movement of the fan unit. With the entire drafter displaced to one side of the smoke box, superheater units, flue tubes and, indeed, any other parts which are accessible from within the smoke box may readily and conveniently be inspected, repaired or replaced.

Still further, when it is desired to inspect, repair or replace any parts of the fan or its driving turbine, such inspection, repair or replacement may be carried out without disconnecting steam piping, by relative pivotal separation of the fan casing elements 13 and 15. This separation is accomplished by removal of the securing bolts 17 and pivoting on the pins 20. If desired, the entire fan and turbine unit, i. e., the axis structure together with the bearings and the fan and turbine parts, may be removed from the casing by an outward displacement thereof after removal of the bolts 65 which normally secure the bearing housings 37 and supporting members 26 to the casing part 13. The various rabbetted connections or joints between the supporting members 26, the turbine diaphragms 61 and 62 and the casing part 13 are provided to permit this unitary fan removal and also to ensure accurate positioning of the various parts upon replacement thereof.

The foregoing various objects and advantages brought out just above as well as toward the beginning of this specification are obtained by the use of a fan drafter unit arranged in a novel manner with respect to the smoke box and various internal elements thereof, all as fully brought out in the foregoing description. The fan unit, furthermore, is of very high capacity and attains maximum efficiency by virtue of reduction of friction losses and the like to a minimum. The quadruple character of gas intake by the fan runners, resulting from provision of intake openings at each side of each runner, is highly advantageous in uniformly distributing the fan action throughout the entire smoke box cross sectional area and the diameter of the fans and the entire unit may thus be kept within comparatively small limits.

We claim:—

1. A fan drafter, for a locomotive smoke-box, including a casing having attachment means for mounting the drafter at the forward edge of the smoke-box with a portion of the casing projecting forwardly from the smoke-box, the casing being split into a plurality of members on a substantially vertical plane adjacent the front edge of the smoke-box to provide for access to the interior of the casing without disconnecting the attachment means.

2. A fan drafter, for a locomotive smoke-box, including a casing, substantially horizontal axis mechanism mounted in the casing generally diametrically of the smoke-box, a driving motor and a fan device mounted in the casing on said axis mechanism, and attachment means on the casing for mounting the drafter including its rotative motor and fan parts at the forward edge of the smoke-box, the attachment means including a hinge providing for pivotal movement of the drafter as a unit to one side of the smoke-box.

3. A fan drafter, for a locomotive smoke-box including a casing, fan drafter parts mounted within the casing, substantially horizontal axis mechanism mounted in the casing generally diametrically of the smoke-box, a driving motor and a fan device mounted in the casing on said axis mechanism, and attachment means on the casing for mounting the drafter at the forward edge of the smoke-box including a hinge providing for pivotal movement of the drafter as a unit to one side of the smoke-box, the casing being split into a plurality of members in a substantially vertical plane forward of said attachment means to provide for access to the interior of the casing without disconnecting the attachment means.

4. A fan drafter, for a locomotive smoke-box, including a generally spherically shaped casing, attachment means for mounting the casing at the forward edge of the smoke-box with one hemisphere of the casing projecting forwardly of the front edge of the smoke-box, rotary fan and driving motor parts mounted within the casing, the casing being split into a plurality of members in a generally vertical plane forward of said attachment means, a stack extended upwardly from the casing at a point ahead of the plane of split, and connection means for supplying actuating fluid to the motor associated with the casing ahead of the plane of split.

5. A fan drafter, for a locomotive smoke-box, including a generally spherically shaped casing, attachment means for mounting the casing at the forward edge of the smoke-box with one hemisphere of the casing projecting forwardly of the front edge of the smoke-box, rotary fan and driving motor parts mounted within the casing, the casing being split into a plurality of members in a generally vertical plane forward of said attachment means, a stack extended upwardly from the casing member in front of the plane of split, and connection means for an actuating fluid for the motor associated with the other casing member.

6. A fan drafter, for a locomotive smoke-box, including a pair of casing members pivoted to each other to provide for access to the interior of the casing, one of the casing members having attachment means for support of the drafter on the smoke-box, the casing members and the attachment means being arranged to provide for relative pivotal separation of the casing members without disconnecting said attachment means.

7. A fan drafter, for a locomotive smoke-box, including a pair of casing members pivoted to each other to provide for access to the interior of the casing, one of the casing members having attachment means for support of the drafter on the smoke-box, the casing members and the attachment means being arranged to provide for relative pivotal separation of the casing mem-

bers without disconnecting said attachment means, and rotary fan drafter parts in the casing including bearing means adapted to engage adjacent portions of the casing members and removable from the casing upon relative pivotal separation of said members.

8. A fan drafter, for a locomotive smoke-box, including a casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a pair of fan runners mounted on the axis mechanism in spaced relation and each having axial inlet openings at both sides thereof to provide large cross-sectional gas inlet area, and gas discharge passage means including a stack extended tangentially upwardly from the peripheries of said runners.

9. A fan drafter, for a locomotive smoke-box, including a casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a driving motor mounted on the axis mechanism generally centrally thereof, a pair of fan runners mounted on the axis mechanism, one on each side of the motor, the runners being spaced from the motor and the casing walls and each runner having axial inlet openings at both sides thereof to provide large cross sectional gas inlet area, and gas discharge passage means including a stack extended tangentially upwardly from the peripheries of said runners.

10. A fan drafter, for a locomotive smoke-box, including a casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a turbine driving motor mounted on said axis structure generally centrally thereof, a pair of fan runners also mounted on said axis structure, one at each side of the driving motor and each having axial gas inlet openings at both sides thereof, smoke exhaust conduit means extended upwardly from the fan runners and terminating in a stack, and steam inlet and exhaust conduits for the motor arranged generally circumferentially at opposite sides thereof, said conduits being of oppositely varying cross-sectional area toward substantially diametrically opposed points and being arranged in interfitting relation.

11. A fan drafter, for a locomotive smoke-box, including a casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a turbine driving motor mounted on said axis structure generally centrally thereof, a pair of fan runners also mounted on said axis structure, one at each side of the driving motor and each having axial gas inlet openings at both sides thereof, smoke exhaust conduit means extended upwardly from the fan runners and terminating in a stack, steam inlet and exhaust conduits for the motor arranged generally circumferentially at opposite sides thereof, said conduits being of oppositely varying cross-sectional area toward substantially diametrically opposed points and being arranged in interfitting relation, and an exhaust passage extended upwardly from the exhaust conduit for the motor in association with the exhaust conduit means from the fan runners.

12. A fan drafter, for a locomotive smoke-box, including a casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a turbine driving motor mounted on said axis structure generally centrally thereof, a pair of fan runners also mounted on said axis structure, one at each side of the driving motor and each having axial gas inlet openings at both sides thereof, smoke exhaust conduit means extended upwardly from the fan runners and terminating in a stack, steam inlet and exhaust conduits for the motor arranged generally circumferentially at opposite sides thereof, said conduits being of oppositely varying cross-sectional area toward substantially diametrically opposed points and being arranged in interfitting relation, connection means for an actuating fluid for the motor associated with the inlet conduit for the motor at a point adjacent the bottom of the drafter, and an exhaust passage extended upwardly from the exhaust conduit for the motor in association with the exhaust conduit means from the fan runners.

13. A fan drafter, for a locomotive smoke-box, including a casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a turbine driving motor mounted on said axis structure generally centrally thereof, a pair of fan runners also mounted on said axis structure, one at each side of the driving motor and each having axial gas inlet openings at both sides thereof, smoke exhaust conduit means extended upwardly from the fan runners and terminating in a stack, steam inlet and exhaust conduits for the motor arranged generally circumferentially at opposite sides thereof, said conduits being of oppositely varying cross-sectional area toward substantially diametrically opposed points and being arranged in interfitting relation, connection means for an actuating fluid for the motor associated with the inlet conduit for the motor at a point adjacent the bottom of the drafter, and an exhaust passage extended upwardly from the exhaust conduit for the motor in association with the exhaust conduit means from the fan runners, said connection means and said passage for the inlet and exhaust conduits of the motor being located peripherally in the general plane of the motor.

14. A fan drafter, for a locomotive smoke-box, including a generally spherical casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a pair of fan runners mounted on the axis mechanism, the runners being spaced from each other and each having axial inlet openings at both sides thereof to provide large cross-sectional gas inlet area, said

casing having a gas discharge passage therethrough in one hemisphere and having four gas inlet passages therethrough in the other hemisphere, one positioned to admit gas to each side of each runner.

15. A fan drafter, for a locomotive smoke-box, including a generally spherical casing, an axis mechanism mounted on the casing, attachment means mounting the casing in the front end of the smoke-box with the axis mechanism extended generally diametrically and horizontally of the smoke-box, whereby the casing and axis mechanism may be removed as a unit, a pair of fan runners mounted on the axis mechanism, the runners being spaced from each other and each having axial inlet openings at both sides thereof to provide large cross-sectional gas inlet area, the casing having attachment means for mounting the drafter at the front edge of the smoke-box with one hemisphere of the casing projecting forwardly of the smoke-box, said casing having a gas discharge passage therethrough in the forward hemisphere and having four gas inlet passages therethrough in the other hemisphere, one positioned to admit gas to each side of each runner.

16. A fan drafter, for a locomotive smoke-box, including a bulbular casing, rotary fan parts mounted on the casing, attachment means mounting the casing adjacent the front end of the smoke-box shell in position to project forwardly therefrom and further to dispose the axis of the rotary fan parts in a horizontal position extended transverse the smoke-box, whereby the casing and rotary fan parts may be removed as a unit, gas discharge means extended upwardly tangentially from said fan parts including a passage through a bulbular portion of said casing located forwardly of the smoke-box shell, and a stack communicating with said passage and extended upwardly from the casing.

17. A fan drafter, for a locomotive smoke-box, including a bulbular casing, rotary fan parts mounted on the casing, attachment means mounting the casing adjacent the front end of the smoke-box shell in position to project forwardly therefrom and further to dispose the axis of the rotary fan parts in a horizontal position extended transverse the smoke-box, whereby the casing and rotary fan parts may be removed as a unit, gas discharge means extended upwardly tangentially from said fan parts including a passage through a bulbular portion of said casing located forwardly of the smoke-box shell, and a stack communicating with said passage and extended upwardly from the casing, said stack being streamlined or faired into the curvature of the casing.

18. A fan drafter, for a locomotive smoke-box, including a bulbular casing, rotary fan parts mounted on the casing, attachment means mounting the casing adjacent the front end of the smoke-box shell in position to project forwardly therefrom and further to dispose the axis of the rotary fan parts in a horizontal position extended transverse the smoke-box, whereby the casing and rotary fan parts may be removed as a unit, gas discharge means extended upwardly tangentially from said fan parts including a passage through a bulbular portion of said casing forward of the smoke-box, and a removable stack communicating with said passage and extended upwardly from the casing.

19. A fan drafter, for a locomotive smoke-box, including a casing structure forming a closure for the front end of the smoke-box, a shaft journalled on said casing, attachment means mounting the casing adjacent the front end of the smoke-box shell with said shaft extended generally diametrically and horizontally of the smoke-box, whereby the casing and shaft may be removed as a unit, a fan runner on the shaft, a driving motor on the shaft, and casing discharge means extended generally tangentially upward from said runner and symmetrically disposed with reference to the two sides of the locomotive, said discharge means further being disposed forwardly of the smoke-box shell whereby to facilitate removal of the drafter.

20. A fan drafter, for a locomotive smoke-box, including a casing structure forming a closure for the front end of the smoke-box, a shaft journalled on said casing, attachment means including a hinge or pivot mounting the casing adjacent the front end of the smoke-box shell with said shaft extended generally diametrically and horizontally of the smoke-box, whereby the casing and shaft may be pivotally displaced as a unit, a fan runner on the shaft, a driving motor on the shaft, and casing discharge means extended generally tangentially upward from said runner and symmetrically disposed with reference to the two sides of the locomotive, said discharge means further being disposed forwardly of the smoke-box shell whereby to facilitate removal of the drafter.

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