Nov. 17, 1942. W. B. WHITSITT 2,302,485

STOKER

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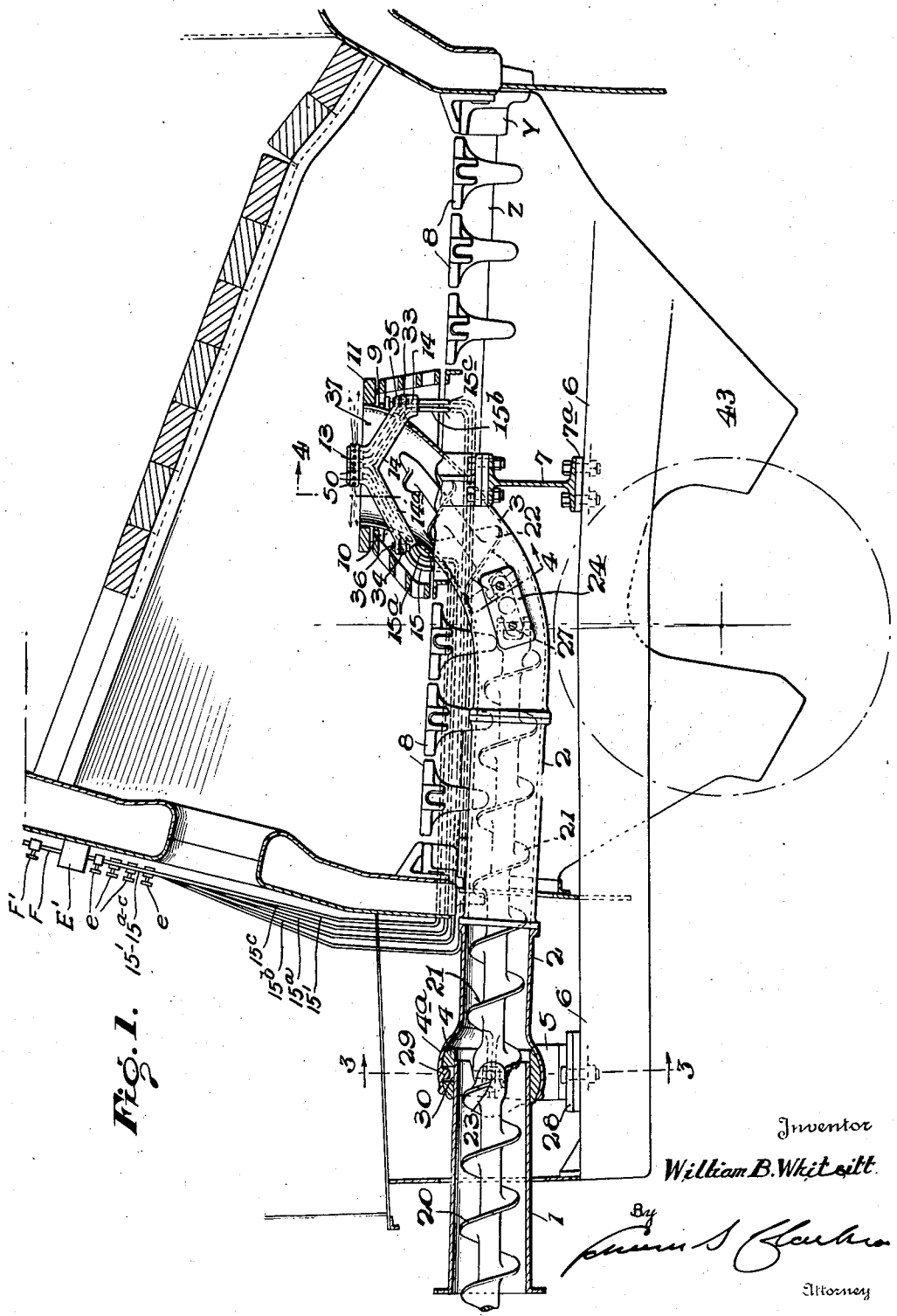


Fig. 1.

Inventor

William B. Whitsitt

By

Attorney

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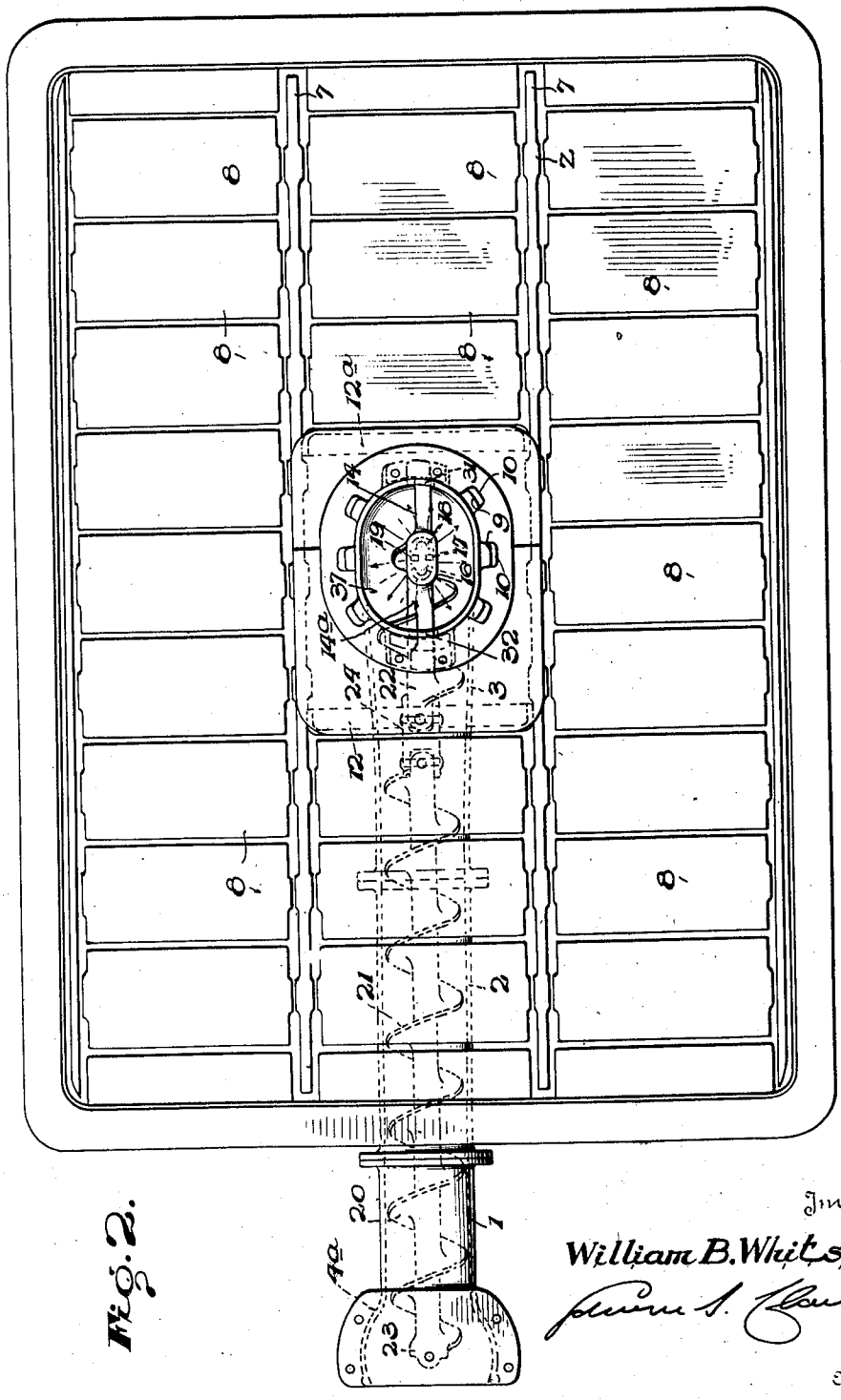


Fig. 2.

Inventor

William B. Whitsitt.

Attorney

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Fig. 5.

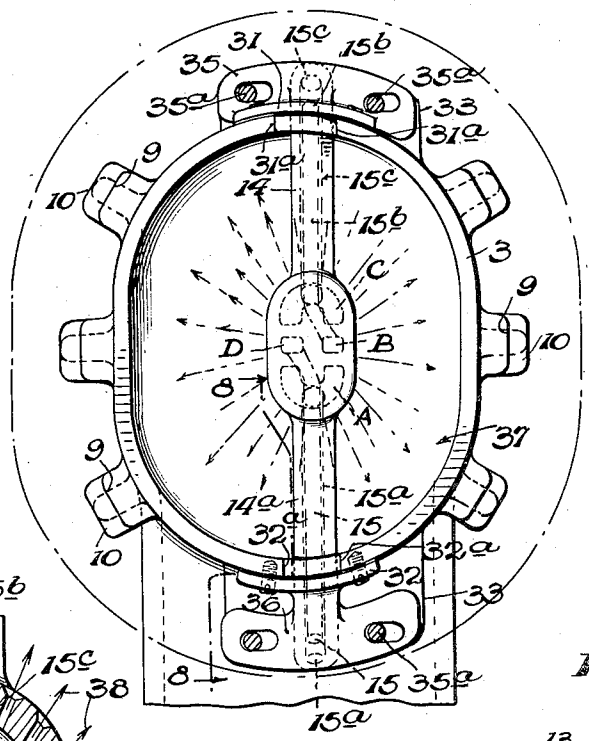


Fig. 7.

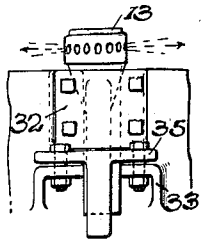


Fig. 6.

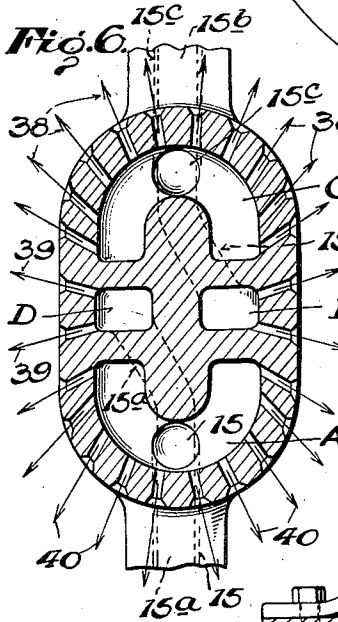


Fig. 3.

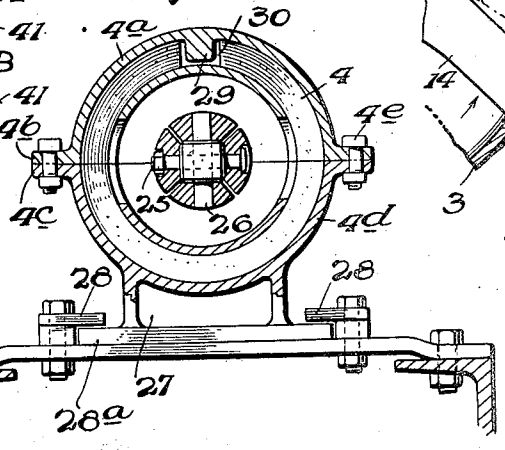


Fig. 8.

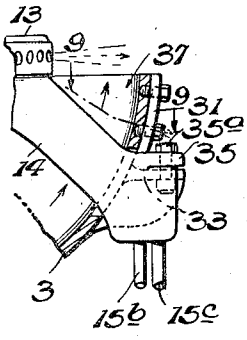
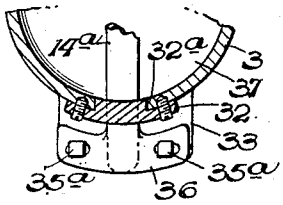


Fig. 9.



Inventor

William B. Whitsitt.

By Lewis S. Clarkson

Attorney

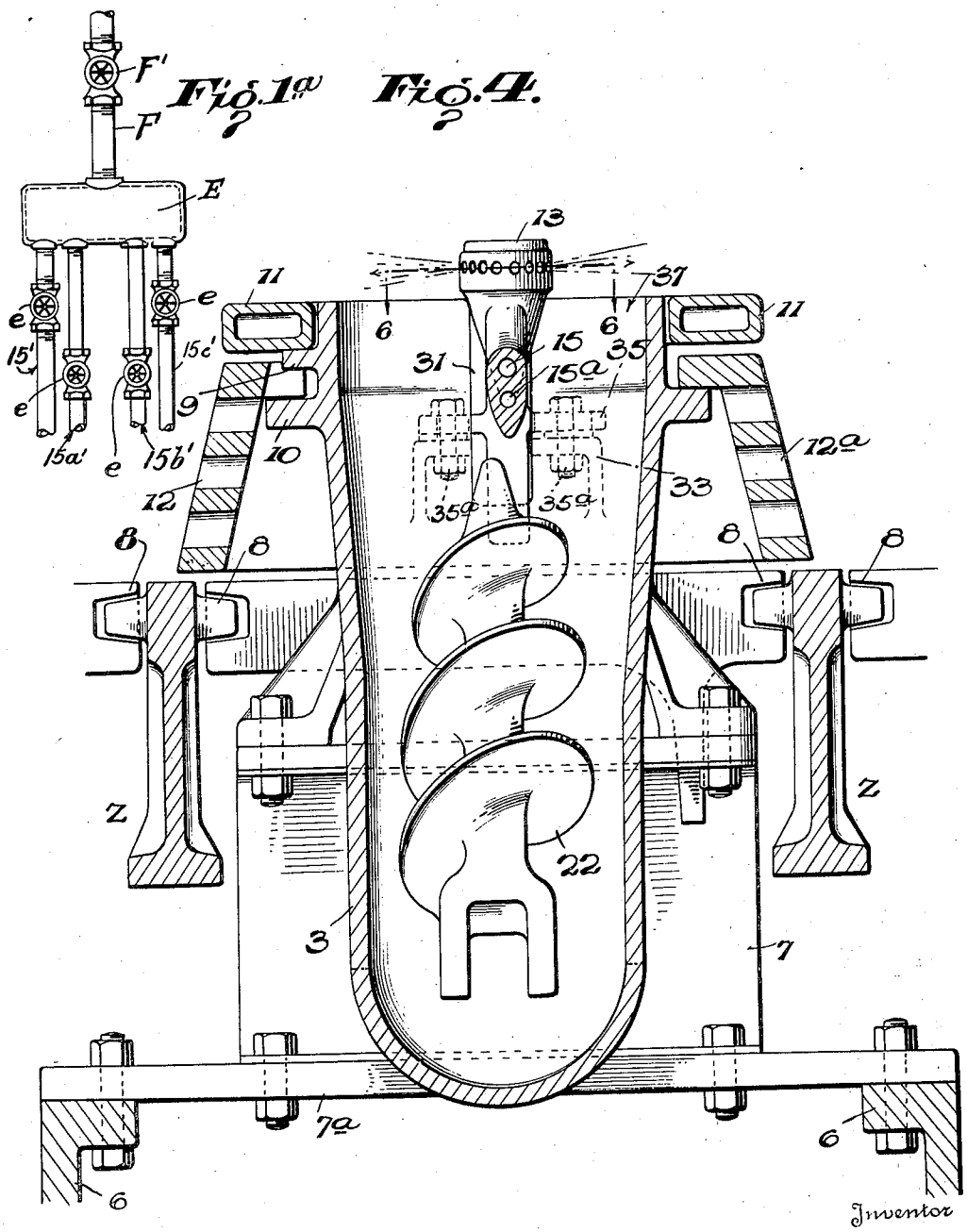
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STOKER

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Fig. 1a

Fig. 4.



Inventor

William B. Whitsitt.

By Lewis S. Clarkson

Attorney

Patented Nov. 17, 1942

2,302,485

UNITED STATES PATENT OFFICE

2,302,485

STOKER

William B. Whitsitt, Baltimore, Md., assignor to The Standard Stoker Company, Incorporated, a corporation of Delaware

Application August 25, 1939, Serial No. 291,976

20 Claims. (Cl. 110—105.6)

The stokers in general use on locomotives fire either through the boiler backhead or the fire door, or just inside of the fire door next to the backhead, and more recently from a point just below the brick wall, or brick arch, adjacent the front wall or flue sheet of the furnace, in which case the fuel is fired in the general direction of the fire door.

On stokers in general use that fire through the boiler head, or through the fire door, or from a point just inside the fire door, the finer particles of the fuel are drawn over the brick arch through the excessive draft and are wasted along with the unburned gases which are discharged out through the smoke stack.

My invention relates to stokers broadly but more particularly to locomotive stokers, and has for its general object to provide a new and improved stoker which results in more complete burning of the fuel than other stokers now in general use.

The driving engine or motor and conveyor trough located beneath the coal bin are not shown, as various types of both are available for public use and may be adopted with the stoker mechanism shown in the drawings described later.

Among the objects of my invention are adaptability to locomotive fireboxes and other furnaces now in existence with little if any alteration to furnace walls, fire door openings, et cetera.

Fuel is delivered preferably to a central point in the furnace and evenly distributed from its hottest point horizontally over the fire bed. The point of delivery however can be on either side or front of, or back of the central point of the furnace with equal efficiency as shown in the drawings, from which point the fuel is distributed to all points over the grate surfaces and I, therefore, reserve the right to locate the delivery point as desired or found most efficient.

The fuel can be distributed over the entire grate area with a minimum of fluid pressure.

The fuel is delivered from a point nearest the fire bed in or near the central part of the furnace and just above the fire bed to obtain more complete combustion, which is a decided improvement over existing stokers in general use.

Tests have already been made with this stoker on a locomotive from which great economies have been derived; as much as 20% saving in fuel has been shown as compared to other popular stokers now in use. Also, the smoke and cinder loss have been greatly reduced due to the fuel being fired just above the fire bed horizontally over the entire grate area and below the brick arch or firebrick wall, thus consuming the finer particles of fuel.

The fuel is delivered in a loose state to a height just above the average firebed and is distributed without the fine particles of fuel separating from the heavier or coarser fuel, which separation occurs in stokers firing from one end or the other of the furnace. My stoker will fire heavier to the sides of the furnace and lighter at the center if properly manipulated, which is a decided improvement over all other types of stokers heretofore used, and this feature is of great importance as it will insure fire at all times at the sides and corners of the furnace which it has been very difficult to obtain at all times with stokers that fire through the fire door openings or back wall of the furnace, or just inside of the back wall, or from the front wall of the furnace.

The fuel is delivered to the furnace with a minimum breakage, resulting in less fine particles and through which a higher degree of efficiency is obtained from the fuel along with the reduction in cinder loss from the smokestack.

The firing door is not changed, is unobstructed by my invention and, therefore, the fireman is in no way handicapped by the stoker mechanism in the cab when preparing the fire or using firing tools whenever necessary.

A complete stoker is not shown in the drawings, the engine or motor and conveyor conduit below the floor of the coal bin have been omitted as various types of each are available and can be adapted to this stoker.

In the drawings:

Figure 1 is a vertical longitudinal sectional view of a locomotive firebox with my improved stoker in position, parts being in elevation.

Fig. 1*a* is a view of the header and connecting ends of the pipes for supplying steam or other fluid pressure to the distributing means.

Figure 2 is a top plan view of the firebox and grate arrangement with my improved stoker in position.

Figure 3 is a detail vertical sectional view of the ball and telescopic conduit between the locomotive and tender coal conduit on the line 3—3 at the locomotive end.

Figure 4 is an enlarged detail vertical sectional view of the delivery end assembly of the coal conduit.

Figure 5 is a top plan view of the delivery end of the coal conduit firing table and jet nozzle in position.

Figure 6 is a horizontal sectional view through the jet nozzle.

Figure 7 is an enlarged detail view of the mounting of the jet nozzle.

Figure 8 is an enlarged detail sectional view of the mounting of the inverted V member.

Figure 9 is a detailed sectional view of the plates 31 and 32.

The tender conveyor is flexibly connected with the conduit 1. The conduit 1 has a flexible and telescoping connection with the rear end of the rigid conduit 2 which permits flexibility between the locomotive and tender. A support 5 is located at the rear end of the conduit 2 and is mounted on the locomotive frame or foundation 6, and may be secured rigidly, but in some cases I prefer to have this mounting flexible, in which latter case guideways 28 are provided, in which the flanges 28a of the support 5 are adapted to move as shown in Figure 3.

The rear end of the conduit 2 is provided with a spherical cover 4a having flanges 4b, which flanges are connected to the flanges 4c of the spherical portion 4d at the rear end of the conduit 2, said flanges being secured together by means of the bolts 4e, as clearly shown in Figure 3.

A screw conveyor 20 is mounted in the conduit 1 and a conveyor screw 21 is mounted in the conduit 2, said conveyors being connected by a flexible joint 23.

A curved or upwardly inclined conduit 3 is supported rigidly by the bracket 7, mounted on brace 7a secured to the frame 6, said conduit extending from the inner end of the conduit 2 below the grate bars 8 and curved upwardly to a point of sufficient height above the grate bars to permit the proper distribution of fuel over the grate bars. A conveyor screw 22 has a universal joint 24 with the conveyor screw 21.

The upper end of the curved conduit 3 is fitted with supporting lugs 9 and 10 which support the firing table 11 and a protecting grated housing or guard 12, thus the protecting housing 12 and firing table 11 are supported by the curved conduit and spaced above the grates 8, to permit the boiler, grates, et cetera, to expand without interfering with the stoker mechanism below the level of the grate bars, that portion of the stoker being rigidly secured to the locomotive frame or foundation 6 at all times.

As will be seen from the large view in Figure 4, the conduit section 3 is mounted in such manner as to induce currents of air upwardly between and around the parts, and this current of air is materially assisted by means of the grated housing or guard 12 whereby the parts are protected against injury due to intense heat, the air passing through the openings in said grates to assist in cooling the parts and aid in combustion.

The distributor jet or nozzle 13 is especially designed to distribute fuel over the grate area from a point just above the opening in the top of the curved conduit 3 which is located substantially in the center thereof.

The under portion of the distributor jet or nozzle is substantially inverted V-shaped as at 14 and 14a, and the legs of the said V-shape portion are provided with cored passages or their equivalent 15, 15a, 15b and 15c, which extend below the lower ends of the said legs leading from outside of the curved elbow or conduit 3, said passages extending upwardly and forwardly to a point near the top of the discharge mouth 37 of the conduit 3, in which the jet 13 is located. The under faces of the legs of the V-shaped element cooperatively form a deflector which functions to evenly divide the fuel as it is delivered to the firing plate 11 for distribution over the grate.

As will be seen from Figure 5, the curved conduit 3 is provided in its upper edge with diametrically opposite slots 31a and 32a into which the ends of the inverted V-shaped members 14 and 14a are operatively positioned, said ends of members 14 and 14a being provided with lugs 35 secured to lugs 33 on the housing 12 by bolts 35a. The slot above the ends of the inverted members 14, 14a, is closed by the plates 31 and 32.

Referring now to Figure 6 which is a horizontal transverse section of the jet or nozzle 13, it will be seen that the jet has four separated chambers A, B, C, D. The two end chambers A and C being arcuate while the intermediate chambers B and D are substantially rectangular. The chamber A is connected to the passage 15, the chamber B is connected to the passage 15b, while the chamber C is connected to the passage 15c, and the chamber D is connected to the passage 15a. Each of the chambers A, B, C and D are provided with a series of jet openings, the jets from chamber C being indicated by the arrows 38, the jets from chamber D by the arrows 39, the jets from chamber A by the arrows 40, and the jets from chamber B by the arrows 41. In practice pipes 15', 15b', 15c', 15a' lead to these respective passages from a header E, suitably positioned on the locomotive, and supplied with steam or other fluid under pressure through a pipe F having a controlling and cut off valve F'. In each pipe 15', 15b', 15c', 15a' is a valve e whereby the flow of fluid pressure to the passages may be independently controlled.

The stoker is operated normally with all of the jets in use to distribute fuel to all parts of the grate area. They may be independently controlled, however, should the operator desire to fire one side of the fire box lighter than the opposite side, or some other portion of the fire box.

From the above, it will be seen that the feeding of fuel to the fire bed at any or all points of the same is under absolute control of the operator.

In Figure 7 I have illustrated in enlarged scale the detail mounting of the distributor jet 13, while in Figure 8 I have shown in detail enlarged scale the mounting of the inverted V member 14, 14a. Figure 9 is a detail enlarged view of the plates 31 and 32.

The grates 8 are mounted on the supports 42. 43 designates the ash pan.

The conveyor screws are driven by a suitable flexible drive shaft to the driving engine or motor which are not shown herein, as several types are available to the public.

Referring to the screw conveyor 22, it will be noted that the spiral of this screw greatly decreases in diameter from its bottom end to the top end which facilitates the delivery of fuel. It will be noted that the delivery end of the conveyor 22 and its spiral terminates at its upper end above the grate bars.

The organization including the inverted V arms 14 and 14a and the nozzle 13 embodies a combined deflector and jet nozzle, the arms 14 and 14a functioning as deflectors below the firing table and the distributor jet nozzle positioned at a point above the firing table.

What I claim is:

1. In combination, a locomotive frame, a fire-

box above said frame, a fuel supporting grate in said firebox, a feed conduit extending to a point below the firebox and fuel grate and including a riser section rigidly mounted on the locomotive frame and having its discharge end extending upwardly into the firebox between adjacent fuel grate bars and situated substantially centrally of the firebox, the said riser section having lugs, and a protecting grate or housing and a firing table surrounding said riser section and supported by said lugs, said protecting grate being arranged to overlie said adjacent fuel grate bars and being vertically spaced therefrom, said protecting grate or housing and firing table being supported by the riser section free from the firebox and grate to permit free longitudinal movement between said fuel grate and protecting grate.

2. In combination, a locomotive frame, a firebox above said frame, a fuel supporting grate in said firebox, a feed conduit extending below the firebox and fuel grate and including a curved riser section rigidly mounted on the locomotive frame and having its discharge end extending upwardly into the firebox between adjacent fuel grate bars and situated substantially centrally of the firebox, a protecting grate surrounding the riser section and supported thereby, a firing table supported by the riser section above the protecting grate and arranged substantially flush with the upper edge of the riser section, said riser section, protecting grate and firing table being free from connection with the firebox and fuel grate to permit free longitudinal movement between the fuel grate and protecting grate, and a distributor jet head disposed in the upper portion of the riser section and having supporting arms projecting downwardly and outwardly therethrough and attached to the riser section, said distributor jet head having outlets extending around its circumference above the discharge end of the riser conduit and the firing table and fluid pressure passages leading to said jet outlets for discharging fluid pressure to distribute fuel over the entire grate area.

3. In combination, a locomotive frame, a firebox above said frame, a fuel supporting grate in said firebox, a fuel feed conduit including a riser section mounted rigidly on said frame below the level of the fuel supporting grate and extending upwardly between adjacent grate bars positioned substantially centrally of the firebox, a protecting grate and a firing table mounted on the riser section, and a distributor jet head disposed in the upper discharge end of the riser section and having fuel distributing means arranged above the upper discharge end of said riser section and also having outwardly and downwardly diverging supporting arms depending into and extending outwardly through the front and back walls of the riser section and secured thereto, said arms being wedge-shaped at their bottom edges to divide the coal evenly over the firing table, and said fuel distributing means being provided with jet outlets for the discharge of fluid pressure laterally to distribute fuel evenly over the firing table and over the entire grate surface and said arms being cored to form fluid supply passages leading to the jet orifices.

4. In combination, a locomotive firebox having a fuel supporting grate therein, a fuel conduit disposed below said fire-box and terminating at its forward end in a riser section extending upwardly between adjacent grate bars into the firebox above said grate and situated substantially at the center of the firebox, a firing table at the upper end of the riser section, a protecting grate supported with the firing table from the riser section, and a distributor means situated substantially at the horizontal center of the upper end of the riser conduit and having a distributor jet head projecting above the discharge end of said riser conduit, said distributor jet head having jet orifices for discharging fluid pressure to distribute the fuel uniformly over the grate area.

5. In combination, a locomotive firebox having a fuel supporting grate therein, a feed conduit located below the firebox and fuel grate having a curved riser section extending upwardly through the grate substantially centrally of the firebox above the grate level, a protecting grate and a firing table supported by the riser section above the level of the fuel supporting grate, and a distributing means positioned in the riser conduit and including a distributor jet head extending above the level of the firing table, said distributor jet head being provided around its circumference with fluid passages for discharge of fluid pressure to distribute the fuel in all directions over the entire grate area.

6. In a locomotive stoker, the combination with the locomotive frame, firebox and fuel supporting grate in the firebox, of a fuel conduit extending beneath the fuel grate and having a riser section rigidly supported by the locomotive frame and projecting upwardly through said grate and into the firebox above the level of the grate, said riser section being provided with supporting lugs, a protecting grate and a firing table surrounding the upper portion of the riser section within the firebox above the level of the grate and supported from the riser section by said lugs, and distributing means disposed within said upper portion of the riser section and provided with a distributor jet head located adjacent to but above the level of the firing table for discharging fluid pressure to distribute fuel from the riser section over said firing table to the fuel grate, said riser section and protecting grate being free from connection with the fire-box and fuel grate and said protecting grate being spaced from the fuel grate to permit relative longitudinal movement between the protecting grate and the fuel grate.

7. In a locomotive stoker, the combination with the locomotive frame, firebox and fuel supporting grate in the firebox, of a fuel conduit extending beneath the fuel grate and having a riser section rigidly supported by the locomotive frame and projecting upwardly through said grate and into the firebox above the level of the grate, a protecting grate and a firing table surrounding the upper portion of the riser section and supported thereby within the firebox above the level of the fuel grate and free from connection with the firebox and fuel grate, and distributing means disposed within said upper portion of the riser section and provided with a distributor jet head located above the level of the firing table and having fluid pressure jets to distribute fuel from the riser section over said firing table to the fuel grate, and said distributing means having branching arms depending from the distributor jet head and extending outward through opposite sides of the riser section and secured thereto, said arms being provided with fluid supply passages leading to the distributor jet head.

8. In a locomotive stoker, the combination with a locomotive frame and firebox, of a fuel supporting grate in the firebox including grate bars lo-

cated substantially at the center of the grate and spaced to provide an opening therebetween, a fuel conduit having a delivery end extending beneath the grate and terminating in a riser section projecting upwardly through said opening into the firebox to a point above the level of the fuel grate, said riser section being fixed to and supported rigidly from the locomotive frame and provided with supporting lugs, a protecting grate and a firing table surrounding the upper portion of the riser section above the level of the fuel grate and supported therefrom by said lugs, said protecting grate being arranged to overhang the space between the riser section and spaced grate bars and being free from connection with the firebox and fuel grate and spaced from the latter to permit relative longitudinal movement between said fuel grate and protecting grate, and distributing means disposed within said riser section and having jet openings arranged to discharge jets of fluid pressure to distribute fuel over the firing table toward all sides of the firebox.

9. In a locomotive stoker, the combination with a locomotive frame and firebox, of a fuel supporting grate in the firebox including grate bars located substantially at the center of the grate and spaced to provide an opening therebetween, a fuel conduit having a delivery end extending beneath the grate and terminating in a riser section projecting upwardly through said opening into the firebox to a point above the level of the fuel grate, said riser section being fixed to and supported rigidly from the locomotive frame and provided with supporting lugs, a protecting grate and a firing table surrounding the upper portion of the riser section above the level of the fuel grate and supported therefrom by said lugs, said protecting grate being arranged to overhang the space between the riser section and spaced grate bars and being free from connection with the firebox and fuel grate and spaced from the latter to permit relative longitudinal movement between said fuel grate and protecting grate, and a distributing means disposed within said riser section and supported thereby and comprising a distributor jet head having a plurality of fluid chambers and sets of openings leading therefrom to different areas around the surface of the distributor jet head and branching arms depending from the distributor jet head and extending outwardly through the sides of the riser section, said arms being provided with passages for fluid pressure communicating with the respective chambers, and means for controlling the supply of fluid pressure to said passages.

10. In a locomotive stoker, the combination with a locomotive frame and firebox, of a fuel supporting grate in the firebox, a fuel conduit having a delivery end extending beneath the grate and terminating in a riser section projecting upwardly through said opening into the firebox to a point above the level of the fuel grate, said riser section being fixed to and supported rigidly from the locomotive frame, a protecting grate and a firing table surrounding the upper portion of the riser section above the level of the fuel grate and supported therefrom, said protecting grate being arranged to overhang the space between the riser section and spaced grate bars and being free from connection with the firebox and fuel grate and spaced from the latter to permit relative lonigtudinal movement between said fuel grate and protecting grate, and distributing means disposed within said riser section and comprising a distributor jet head having blast openings arranged to discharge fluid pressure jets to distribute fuel over the entire grate area, and provided with branching arms projecting outwardly and downwardly at opposite sides of the riser section and secured thereto, said arms having fluid supply passages communicating with the distributor jet-head and beveled reflecting surfaces to divide the fuel evenly over the firing table, and grate area.

11. In a locomotive stoker, the combination with the locomotive frame, firebox and a fuel supporting grate in the firebox, of a fuel conduit extending beneath the fuel grate and having a riser section rigidly supported by the locomotive frame and projecting upwardly through said grate and into the firebox above the level of the grate, a protecting grate and a firing table surrounding the upper portion of the riser section and supported thereby within the firebox above the level of the fuel grate and free from connection with the firebox and fuel grate, and distributing means disposed within said upper portion of the riser section and supported thereby and comprising a distributor jet head having a plurality of fluid pressure chambers and sets of jet holes leading therefrom to different areas about the surfaces of the distributor jet head and branching arms depending from the jet head and extending outwardly and downwardly through the sides of the riser section, said arms being provided with fluid pressure passages communicating with the respective chambers, and means for controlling the supply of fluid pressure to said passages.

12. In a locomotive having a boiler with a firebox therein, a grate for said firebox, said firebox comprising a back wall, side walls and a front wall, a stoker for feeding fuel into the firebox comprising, in combination, a discharge conduit extending through the grate of said firebox to a point approximately midway between the front and back walls and said side walls, means for urging fuel through said discharge conduit, and fuel distributing means at the upper end of said discharge conduit for projecting fuel radially over all parts of said grate.

13. In combination with a firebox having a grate, a stoker fuel discharge conduit extending upwardly through and above the level of said grate into said firebox to a point approximately centrally disposed with respect to the perimeter of said grate, means disposed in said discharge conduit for conveying fuel therethrough and fuel distributing means at the upper end of said discharge conduit for projecting fuel radially over all parts of said grate.

14. In a locomotive having a boiler with a firebox therein, a grate for said firebox, said firebox comprising a back wall, side walls and a front wall, and an arch extending upwardly and rearwardly from said front wall toward said back wall, said arch terminating short of said back wall to provide an opening along said back wall for the passage of the products of combustion, a stoker for feeding fuel into the firebox comprising, in combination, a discharge conduit extending through the grate of said firebox to a point beneath said arch and approximately midway between the front and back walls and said side walls, means for urging fuel through said discharge conduit, and fuel distributing means at the upper end of said discharge conduit for projecting fuel radially over all parts of said grate.

15. In combination with a firebox having a

grate, a stoker fuel discharge conduit extending upwardly through the central portion of said grate and terminating in said firebox above the level of said grate, a screw conveyor in said discharge conduit for conveying fuel therethrough and fuel distributing means at the upper end of said discharge conduit for projecting fuel radially over all parts of said grate.

16. In combination with a firebox having a grate, a stoker fuel discharge conduit extending upwardly through and above the level of said grate into said firebox to a point approximately centrally disposed with respect to the perimeter of said grate, means for urging fuel through said discharge conduit, and fuel distributing means at the upper end of said discharge conduit for projecting fuel radially over all parts of said grate.

17. In combination with a firebox having a fuel supporting grate, a stoker fuel discharge conduit extending upwardly through said fuel supporting grate into the firebox substantially centrally thereof, a protecting grate surrounding said discharge conduit and supported thereby, said protecting grate being arranged to overlie said fuel supporting grate and being vertically spaced therefrom, and fuel distributing means at the upper end of said discharge conduit for projecting fuel over said fuel supporting grate.

18. In combination with a firebox having a fuel supporting grate, a stoker fuel discharge conduit extending upwardly through said fuel supporting grate into the firebox substantially centrally thereof, and a distributor jethead in the upper portion of the discharge conduit, said jet head having supporting arms projecting downwardly and outwardly through and attached to said discharge conduit, a portion of said jet head extending above the plane of the upper end of said discharge conduit and being provided with radially directed jet orifices for the emission of pressure fluid against the fuel emerging from said discharge conduit and distributing it over the entire grate area.

19. In combination with a firebox having a fuel supporting grate, a stoker fuel discharge conduit extending upwardly through said fuel supporting grate into the firebox substantially centrally thereof, and a distributor jet head in the upper portion of the discharge conduit, said jet head having supporting arms projecting downwardly and outwardly through and attached to said discharge conduit, a portion of said jet head extending above the plane of the upper end of said discharge conduit and being provided with radially directed jet orifices for the emission of pressure fluid against the fuel emerging from said discharge conduit and distributing it over the entire grate area, said supporting arms being cored to form fluid supply passages leading to said jet orifices.

20. In combination with a firebox having a fuel supporting grate, a stoker fuel discharge conduit extending upwardly through said fuel supporting grate into the firebox substantially centrally thereof, and a distributor jet head in the upper portion of the discharge conduit, a portion of said jet head extending above the plane of the upper end of said discharge conduit and being provided with radially directed jet orifices for the emission of pressure fluid against the fuel emerging from said discharge conduit and distributing it over the entire grate area.

WILLIAM B. WHITSITT.