June 25, 1940. N. M. LOWER 2,205,596

STOKER

Filed April 22, 1937 2 Sheets-Sheet 1

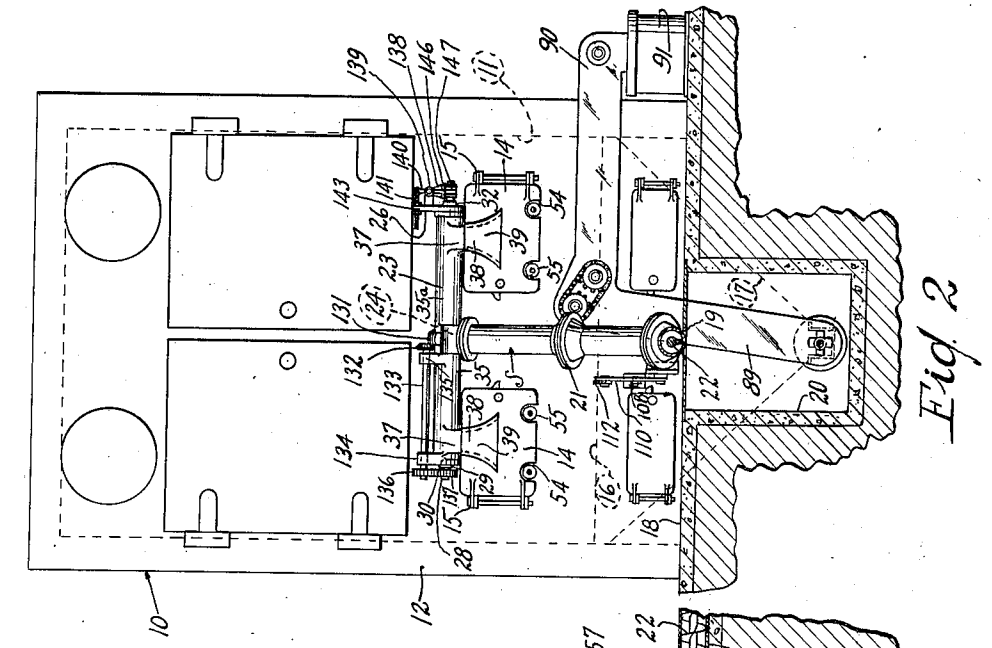


Fig. 2

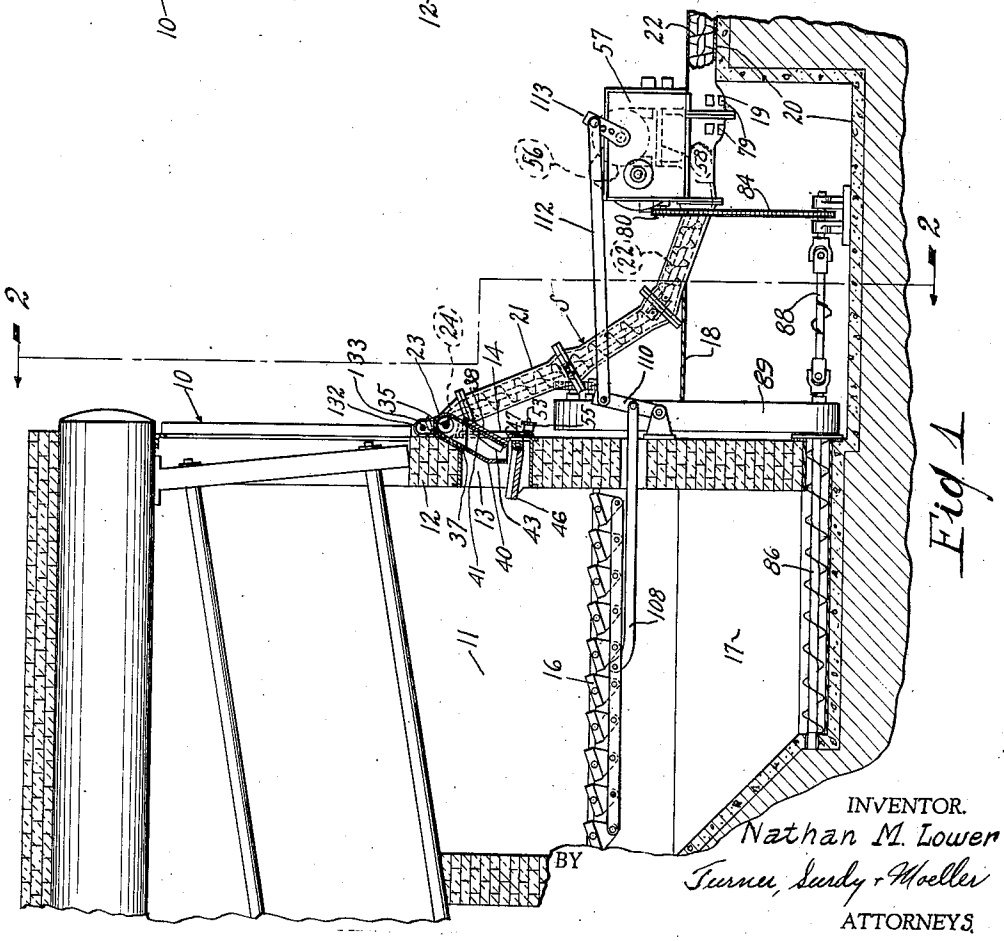


Fig. 1

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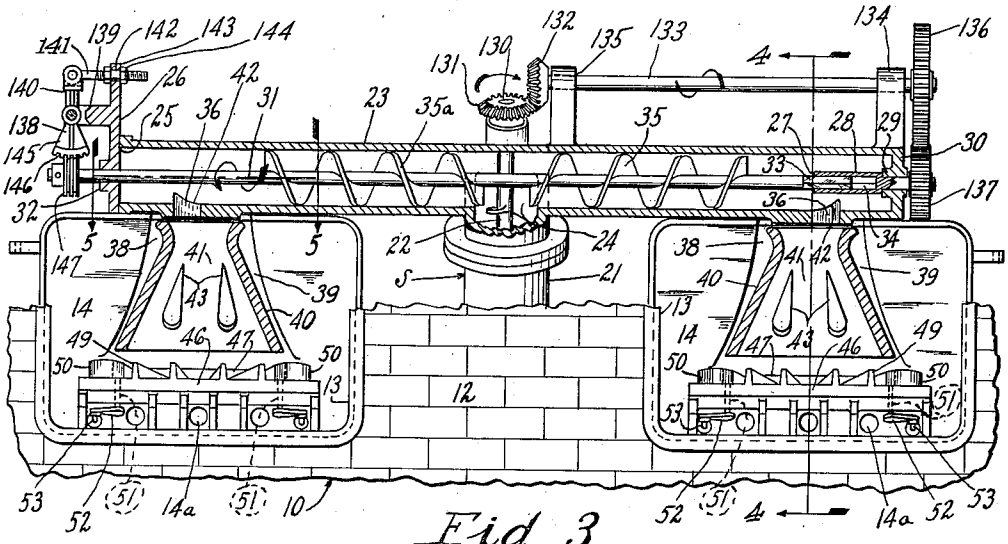


Fig 3

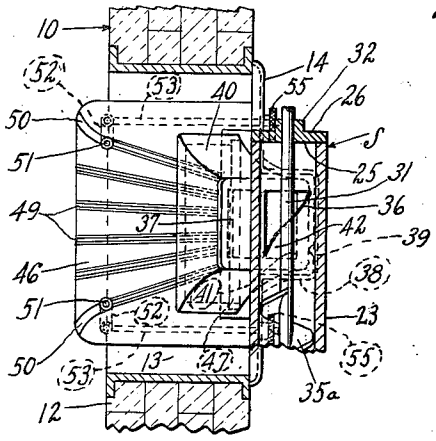


Fig 5

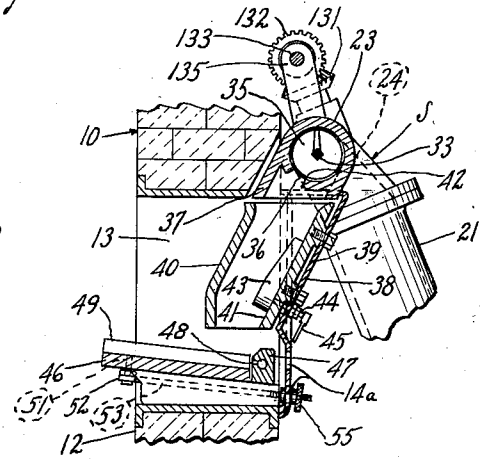


Fig 4

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2,205,596

STOKER

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Application April 22, 1937, Serial No. 138,281

17 Claims. (Cl. 110—104)

My invention relates to improvements in furnaces and has for its main object the provision of an improved automatic furnace including automatic fuel feeding, grate shaking and ash removing means.

A more specific object of the invention is to provide an improved stoker mechanism for delivering fuel to a furnace having a plurality of fuel feed openings.

Another object of the invention is to provide a fuel feed conduit, having a screw conveyor for advancing fuel therethrough, with a discharge opening in its lower wall portion so formed that fuel will drop therethrough in a stream spreading lengthwise of the conduit.

A further object of the invention is to provide a stoker, having a conduit leading from a source of fuel supply and laterally extending branches delivering to a plurality of openings in the furnace, with means for conveying fuel through the branches and varying the relative amounts of fuel delivered by the branches.

A further object of the invention is to provide a furnace with a novel door for the firing opening of the furnace and a novel combination and arrangement thereof with the delivery end of a stoker adapted to feed fuel through the firing opening.

With the above and other objects in view, the invention consists of the novel details of construction, and the novel combination and relation of parts, hereinafter more fully described and illustrated in the accompanying drawings, wherein:

Fig. 1 is a vertical longitudinal section through a portion of a furnace room and a furnace, with a stoker, grate shaking and ash conveying mechanism applied to the furnace and shown partly in section and partly in elevation;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view of the furnace from within showing the firing openings with the novel stoker mechanism applied thereto and shown partly in section and partly in elevation;

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 3; and

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 3.

In the drawings there is shown a furnace 10, provided with a firebox 11 and a furnace front 12 having a pair of fire door openings 13, one opening at each side of a vertical plane passing through the longitudinal center of the furnace front 12. The openings 13 are provided with the doors 14 hinged to the furnace front, as at 15, to swing laterally away from each other. The doors 14 are provided with air admission openings 14a. The firebox 11 is provided with a grate 16, beneath which is a pit 17 for receiving ash, formed in the furnace room floor 18.

Fuel is delivered to the furnace from a suitable source of supply (not shown) by a mechanical stoker, designated generally by the letter S. The stoker comprises a plurality of end to end related conduits, including a horizontally extending conduit 19 leading from the source of fuel supply and preferably disposed in a depression 20 in the furnace room floor 18, and a riser conduit 21 comprising a plurality of sections at successively greater angles with respect to the horizontal. In this manner the path of the fuel is changed fom a horizontal to an almost vertical direction through a series of moderate angles, thereby avoiding any abrupt bends in the conduit system.

The riser conduit 21 is shown in the drawings as comprising three sections, but it will be apparent that the number of sections and the angularity therebetween may be altered to suit the requirements of the particular installation. The riser conduit 21 extends in a general forward and upward direction from the horizontal conduit 19 to a point adjacent the furnace front 12, between the fire door openings 13 and at about the level of the upper marginal edges thereof. Fuel is advanced through the conduits 19 and 21 by screw conveying means 22, formed of a plurality of sections universally connected adjacent the bends between the conduit sections.

A conduit 23 extends horizontally along the furnace front 12 immediately above the level of the upper marginal edge of the firing openings 13. Intermediate its ends, the conduit 23 is provided with a downwardly opening spout 24 communicating with the upper end of the riser conduit 21. The conduit 23 is open at one end, as indicated in Fig. 3 at 25, and a removable cover plate 26 forms a closure therefor.

A horizontal telescopic shaft 27 extends through the conduit 23 and comprises a short shaft section 28 journaled in a bearing 29 formed in the end wall 30 of the conduit 23, and a long shaft section 31 journaled in a bearing 32 formed in the cover plate 26. The long shaft section 31 is provided with a squared end 33 arranged to be received in a square opening 34 in the short shaft section 28, thereby permitting relative longitudinal movement between the shaft sections 28 and 31, so that the shaft section 31 can be removed from the conduit 23 through its open end 25, and also preventing relative rotational motion

between the shaft sections 28 and 31. The long shaft section 31 is provided with the oppositely wound helicoid conveyors 35 and 35a, at each side of the spout 24.

The helicoid conveyors 35 and 35a terminate short of the ends of the conduit 23 and between the ends of the conduit 23 and the ends of the helicoid conveyors 35 and 35a, the conduit 23 is provided with the discharge openings 36. Formed with the conduit 23 and embracing the openings 36 are chutes 37 that extend downwardly and inwardly from the conduit 23 toward the firing openings 13. The doors 14 are bulged outwardly as best shown in Figures 1, 3 and 4, at 38, and secured to the inner side of the sloping walls 39 thereof are the nozzles 40. The bulged portions 38 of the doors 14 open upwardly and receive the lower ends of the chutes 37. The open lower ends of the chutes 37 are in registering communication with the open upper ends of the nozzles 40 and are spaced a slight distance apart so that the doors 14 may be swung open.

The nozzles 40, as best illustrated in Figures 3 and 5, flare laterally and the inner surfaces of the sloping rear walls 41 of the nozzles 40 are flat. When the conveyor screws of the stoker are operating to advance fuel through the conduit system, fuel drops by gravity through the discharge openings 36 of the conduit 23 into the chutes 37 and thence onto the sloping rear walls 41 of the nozzles 40, along which it descends and discharges from the bottom of the nozzles.

The openings 36 in the conduit 23 are so designed that the fuel will spill therethrough in a ribbon-like stream spreading laterally across the surface of the rear walls 41 of the nozzles 40. The edges 42 of the openings 36 over which the fuel spills are formed on a diagonal, providing helical spill edges extending circumferentially of the conduit 23, see Figures 3, 4 and 5, so that the fuel dropping through the openings 36 is spread out lengthwise of the conduit 23.

It is known that a helicoid screw will convey more fuel along one side of a conduit than the other. With the flights of the helicoid conveyors 35 and 35a wound in the directions as shown in Fig. 3 and the direction of rotation of the conveyors as indicated in the same figure by the arrows, fuel will be conveyed toward the openings 36, most of it being carried along that side of the conduit 23 farthest from the furnace front 12. Now, since most of the fuel is carried along that side of the conduit 23 farthest from the furnace front 12, the spill edges 42 of the conduit 23 at the openings 36 must be on a diagonal extending from that side of the conduit 23 nearest the furnace front 12 and nearest the helicoid conveyors 35 and 35a to that side of the conduit 23 more remote from the furnace front 12 and more remote from the helicoid conveyors 35 and 35a, so that the fuel will spread lengthwise of the conduit 23 in dropping through the openings 36.

On the sloping rear walls 41 of the nozzles 40 are mounted the wedge-shaped deflecting vanes 43, two being shown in each of the nozzles. The vanes 43 spread the fuel laterally and are preferably made adjustable to vary the amount of fuel on different areas of the rear walls 41. For ease and convenience in adjusting the vanes 43, stems 44 extend through the doors 14 and the nozzle rear walls 41 and are threaded at one end into the vanes 43 and at their other ends, exterior of the doors 14, are provided with the handles 45.

As explained above, the fuel drops onto the nozzle rear walls 41 in a laterally spread stream and as it passes down along the sloping surfaces of the rear walls 41, it is further spread by the deflector vanes 43. The fuel falls from the nozzles 40 onto the rearward portion of the fuel distributor plates 46 which are mounted in the lower portion of the firing openings 13. At the rear of the distributor plates 46 and beneath the nozzle rear walls 41 are located the fluid pressure distributor heads 47, provided with jet openings 48 directed across the plates 46 and from which issue pressure fluid blasts for projecting fuel across the plates 46 into the firebox. The top surfaces of the plates 46 are provided with longitudinally extending ribs 49 diverging slightly as they extend forward.

The two end ribs on each of the plates 46 are provided with adjustable outwardly curving end portions 50. The end portions 50 are mounted on pins 51 for pivotal movement in the plane of the top surface of the plates 46. The pins 51 project beneath the surface of the plates 46, and on the projecting portions thereof are mounted the arms 52 which in turn are movably connected at their free ends with links 53 that extend rearwardly through the recesses 54 in the lower edge of the fire doors 14. Handwheels 55 threaded on the exteriorly projecting ends of the links 53 are provided for adjusting the movable vane portions 50 to control the delivery of fuel to the corners of the firebox adjacent the furnace front 12.

The stoker conveyor screws are operated by a motor 56, shown in dotted lines in Figure 1. A gear box 57 is secured in any suitable manner to the horizontal conduit 19 and is provided with a bracket 58 for supporting the motor 56.

The helicoid conveyors 35 and 35a are operated from the motor 56 through the stoker conveyor screw 22 in the manner now to be described. An extension 130 of the shaft of the conveyor screw 22 projects through the horizontal conduit 23 and has secured thereon a bevel gear 131. The bevel gear 131 meshes with a bevel gear 132 secured on one end of a shaft 133, which is journaled in bearings 134 and 135, preferably formed with the horizontal conduit 23. The shaft 133 extends from a point adjacent the projecting shaft extension 130 to a point adjacent and exterior of the closed end 30 of the conduit 23. That end of the shaft 133 adjacent the closed end 30 of the conduit 23 has secured thereon a spur gear 136 meshing with a gear 137 which is secured on that end of the shaft section 28 projecting exteriorly of the conduit 23. Motion is thus imparted to the shaft section 28 by the conveyor screw 22 through the systems of shafts and gears described, and consequently to the helicoid conveyors 35 and 35a through the operative connection between the shaft sections 28 and 31.

The helicoid conveyors 35 and 35a are arranged to be shifted axially of the conduit 23, so that one of them will receive and convey more of the fuel delivered through the chute 24 by the stoker conveyor screw 22 than the other of said conveyors. The shifting of these helicoid conveyors is accomplished through a shifter lever 138 pivotally mounted intermediate its ends on a support member 139 formed with the cover 26 of the conduit 23. An arm 140 of the shifter lever 138 is pivotally connected with rod 141, threaded at its free end and passing through an opening 142 in an extension 143 of the cover 26. By turning nuts 144, threaded on the free end of the rod 141, the shifter lever 138 is caused to move about its

pivot. The other arm 145 of the shifter lever 138 is provided at its free end with a toothed quadrant 146 which engages the serrated member 147 keyed on an extension of the shaft 31. It is clear then, that by turning the nuts 144, the shifter lever 138 turns about its pivot, moving the toothed quadrant 146 which, by reason of its engagement with member 147, shifts the shaft 31 and consequently shifts the helicoid conveyors 35 and 35a axially of the conduit 23.

Ash is conveyed from the pit 17 by the ash conveyor screw 86 to the base of an upright casing 89 which extends upwardly to a point above the level of the furnace room floor 18. The casing 89 communicates at its upper end with a casing 90 extending horizontally along the furnace front 12 to one side thereof and opens downwardly into the ash receptacle 91. The ash conveyor screw 86 is operated by the motor 56 through the sprocket chain 84 and shaft 88.

The grates 16 are shaken by the motor 56 through a crank and lever arrangement including a rod 108 operatively connected at one end with the grates 16 and pivotally connected at its other end intermediate the ends of a lever 110, which is pivotally mounted at one end in any suitable manner to the furnace front 12. A rod 112 is pivotally connected at one end to the free end of the lever 110 and pivotally connected at its other end to the free end of a crank arm 113 which in turn is operatively connected to the motor 56.

I claim:

1. The combination with a material receiving chamber having a wall provided with an opening, of mechanism comprising a device at said opening for feeding material into the chamber, a feed conduit extending transversely along said wall and having its delivery end above said feed device, said feed conduit being provided at its delivery end with a discharge opening communicating with said feed device, said discharge opening being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby material will drop over said spill edge to said feed device in a stream spreading lengthwise of the conduit.

2. The combination with a material receiving chamber, of feeding mechanism comprising a pair of laterally spaced devices for feeding material into the chamber, a feed conduit above the level of said feeding devices, said feed conduit having a discharge opening in the lower half thereof adjacent each of its ends communicating with a respective feed device and a receiving opening between said discharge openings, means in said feed conduit for conveying material toward said discharge openings, each of said discharge openings being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby material will drop over said spill edge to said feed devices in a stream spreading lengthwise of the conduit.

3. The combination with a material receiving chamber, of feeding mechanism comprising a pair of laterally spaced devices for feeding material into the chamber, a feed conduit above the level of said feeding devices, said feed conduit having a discharge opening in the lower half thereof adjacent each of its ends communicating with a respective feed device and a receiving opening between said discharge openings, screw conveying means in said feed conduit at each side of said receiving opening for conveying material to said discharge openings, each of said discharge openings being formed to provide a helicoid spill edge extending circumferentially of the conduit, the portion of said spill edge on that side of the conduit along which most of the material is conveyed being more remote from the end of the screw conveyor than the portion of said spill edge on the other side of said conduit whereby material will drop over said spill edge to said feed devices in a stream spreading lengthwise of the conduit.

4. In a furnace provided with a firebox and an upright wall having a pair of laterally spaced openings therein, a door for each of said openings, each of said doors having a bulging upper central portion, the bulging portion of said doors opening upwardly exteriorly of the furnace, a fuel feed conduit extending horizontally along said furnace wall immediately above the level of the upper marginal edge of said openings, said fuel feed conduit having a discharge opening in the lower half thereof adjacent each of its ends communicating with the open upper end of the bulged portion of a respective door, each of the discharge openings in said conduit being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby fuel will spill over said spill edges into said bulging door portion in streams spreading lengthwise of the conduit, and means in said fuel feed conduit for conveying fuel toward said discharge openings.

5. In a furnace provided with a firebox and an upright wall having a pair of laterally spaced openings therein, a door for each of said openings, each of said doors having a bulging upper central portion, the bulging portion of said doors opening upwardly exteriorly of the furnace, a fuel feed conduit extending horizontally along said furnace wall immediately above the level of the upper marginal edge of said openings, said fuel feed conduit having a discharge opening in the lower half thereof adjacent each of its ends communicating with the open upper end of the bulged portion of a respective door, each of the discharge openings in said conduit being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby fuel will spill over said spill edges into said bulging door portion in streams spreading lengthwise of the conduit, screw conveying means in said fuel feed conduit conveying fuel to each of said discharge openings and means for shifting said conveying means axially of said conduit for varying the relative amounts of fuel delivered to each of said discharge openings.

6. In a furnace provided with a firebox and an upright wall having a pair of laterally spaced openings therein, a door for each of said openings, each of said doors having a bulging upper central portion, the bulging portion of said doors opening upwardly exteriorly of the furnace, a nozzle mounted in the bulged portion of said door, said nozle being open at its respective upper and lower ends, a fuel feed conduit extending horizontally along said furnace wall immediately above the level of the upper marginal edge of said openings, said fuel feed conduit having a discharge opening in the lower half thereof adjacent each of its ends and above the open upper end of said bulged door portion and a fuel receiving opening between said discharge openings, a chute depending from each end of said fuel feed conduit embracing a respective discharge opening in said conduit, the lower ends of said chutes being in substantial register with and spaced immediately above the openings in the

upper ends of said nozzles, each of the discharge openings in said conduit being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby fuel will spill over said spill edges into said nozzles in streams spreading lengthwise of the conduit, means in said fuel feed conduit for conveying fuel toward said discharge openings and a fuel distributing plate in each of said firing openings receiving fuel from said nozzles.

7. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, means in said conduit between said receiving opening and each of said discharge openings for conveying material toward said discharge openings, and means for shifting said conveying means axially of said conduit to any one of a number of positions for varying the relative amounts of material conveyed to each of said discharge openings.

8. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, screw conveying means in said conduit between said receiving opening and each of said discharge openings for conveying material toward said discharge openings, and means for shifting said screw conveying means axially of said conduit to any one of a number of positions for varying the relative amounts of material conveyed to each of said discharge openings.

9. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, a screw conveyor including a shaft extending longitudinally through said conduit, oppositely wound screw flights on said shaft between said receiving opening and each of said discharge openings for conveying material from said receiving opening to each of said discharge openings, and means operatively connected with said screw conveyor shaft for shifting the conveyor axially of said conduit to any one of a number of positions for varying the relative amounts of material conveyed to each of said discharge openings.

10. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, means in said conduit between said receiving opening and each of said discharge openings for conveying material toward said discharge openings, drive mechanism at one end of said conduit operatively connected with said conveying means and means at the other end of said conduit for shifting said conveying means axially of said conduit to any one of a number of positions for varying the relative amounts of material conveyed to each of said discharge openings.

11. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, a screw conveyor including a shaft extending longitudinally through said conduit, oppositely wound screw flights on said shaft between said receiving opening and each of said discharge openings for conveying material from said receiving opening to each of said discharge openings, drive mechanism operatively connected with one end of said screw conveyor shaft and means operatively connected with the other end of said screw conveyor shaft for shifting said screw conveyor axially of said conduit to any one of a number of positions for varying the relative amounts of material conveyed to each of said discharge openings.

12. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, and means in said conduit between said receiving opening and each of said discharge openings for conveying material toward said discharge openings, each of said discharge openings being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby material will drop over said spill edges through said discharge openings in streams spreading lengthwise of the conduit.

13. A feeding device including a tubular conduit, said conduit having a pair of spaced material discharge openings and a material receiving opening between said discharge openings, means in said conduit between said receiving opening and each of said discharge openings for conveying material toward said discharge openings, each of said discharge openings being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby material will drop over said spill edges through said discharge openings in streams spreading lengthwise of the conduit, and means for shifting said conveying means axially of said conduit to any one of a number of positions for varying the relative amounts of material conveyed to each of said discharge openings.

14. A feeding device including a horizontally disposed tubular conduit, said conduit having a pair of spaced material discharge openings in the lower portion thereof and a material receiving opening between said discharge openings, and screw conveying means in said conduit between said receiving opening and each of said discharge openings, each of said discharge openings being formed to provide a helicoid spill edge extending circumferentially of the conduit, the portion of said spill edges on that side of the conduit along which most of the material is conveyed being more remote from the end of the screw conveying means than the portion of said spill edges on the other side of said conduit whereby material will drop over said spill edges through said discharge openings in streams spreading lengthwise of the conduit.

15. A feeding device including a horizontally disposed tubular conduit, said conduit having a pair of spaced material discharge openings in the lower portion thereof and a material receiving opening between said discharge openings, screw conveying means in said conduit between said receiving opening and each of said discharge openings, each of said discharge openings being formed to provide a helicoid spill edge extending circumferentially of the conduit, the portion of said spill edges on that side of the conduit along which most of the material is conveyed being more remote from the end of the screw conveying means than the portion of said spill edges on the other side of said conduit whereby material will drop over said spill edges through said discharge openings in streams spreading lengthwise of the conduit, and means for shifting said screw conveying means axially of said conduit to any one of a number of positions for varying the rela-

tive amounts of material conveyed to each of said discharge openings.

16. A feeding device including a tubular conduit, said conduit having a material discharge opening and a material receiving opening and means in said conduit between said receiving opening and said discharge opening for conveying material toward said discharge opening, said discharge opening being formed to provide a helicoid spill edge extending circumferentially of the conduit whereby material will drop over said spill edge through said discharge opening in a stream spreading lengthwise of the conduit.

17. A feeding device including a tubular conduit, said conduit having a material discharge opening and a material receiving opening, and screw conveying means in said conduit between said receiving opening and said discharge opening for conveying material toward said discharge opening, said discharge opening being formed to provide a helicoid spill edge extending circumferentially of the conduit, the portion of said spill edge on that side of the conduit along which most of the material is conveyed being more remote from the end of the screw conveying means than the portion of said spill edge on the other side of said conduit whereby material will drop over said spill edge through said discharge opening in a stream spreading lengthwise of the conduit.

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