Feb. 14, 1933. F. P. ROESCH 1,897,510

LOCOMOTIVE STOKER

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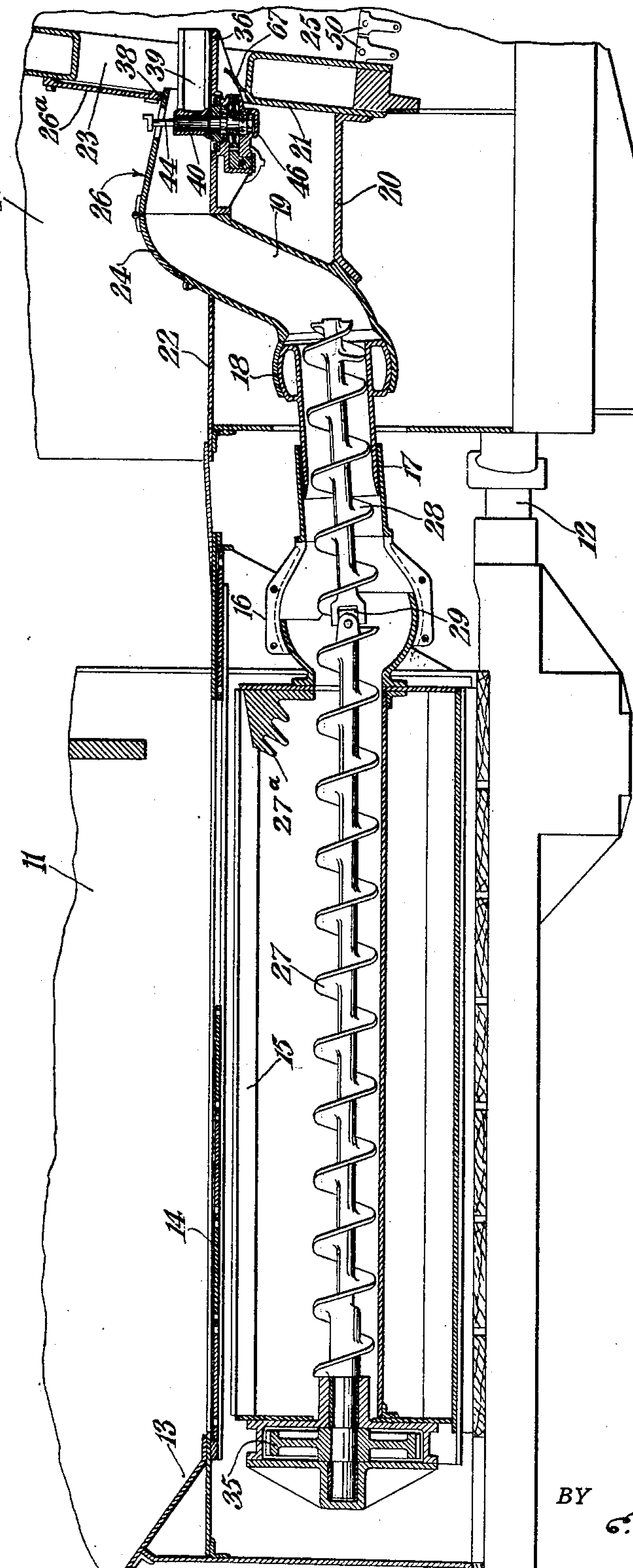

Fig. 1.

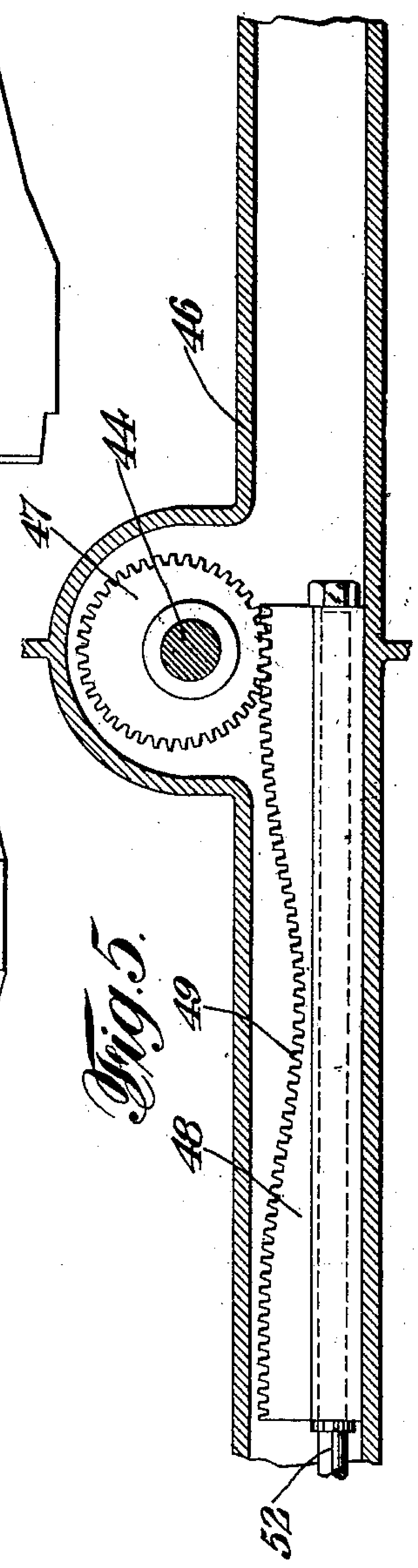

Fig. 5.

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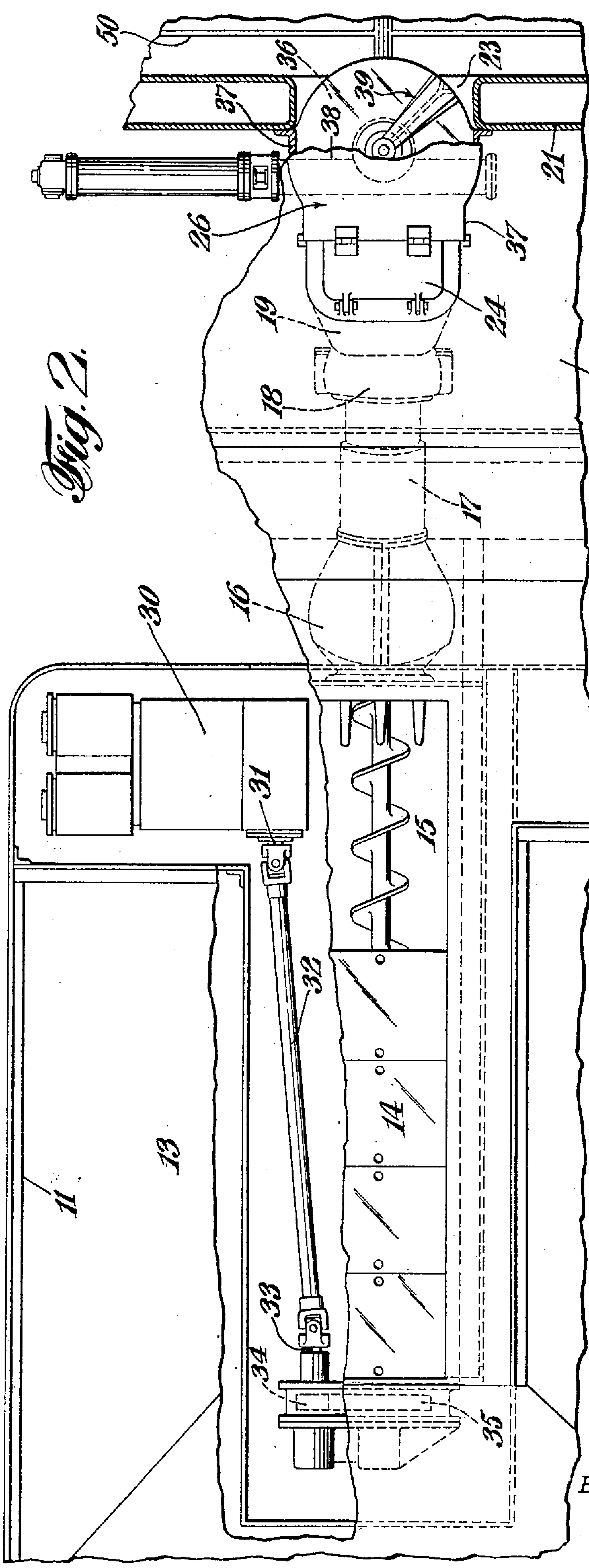

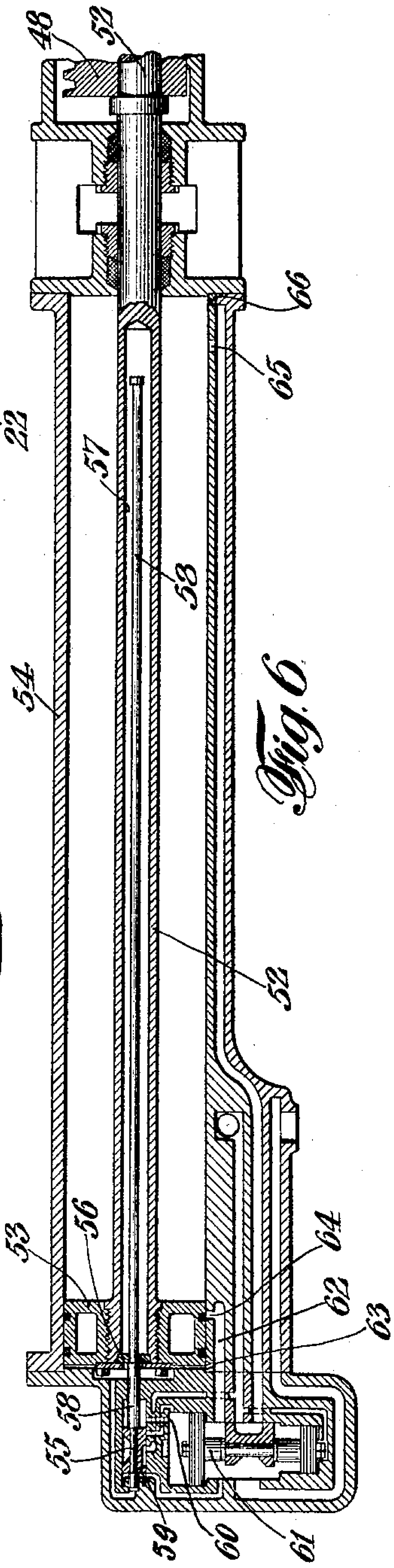

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3 Sheets-Sheet 3

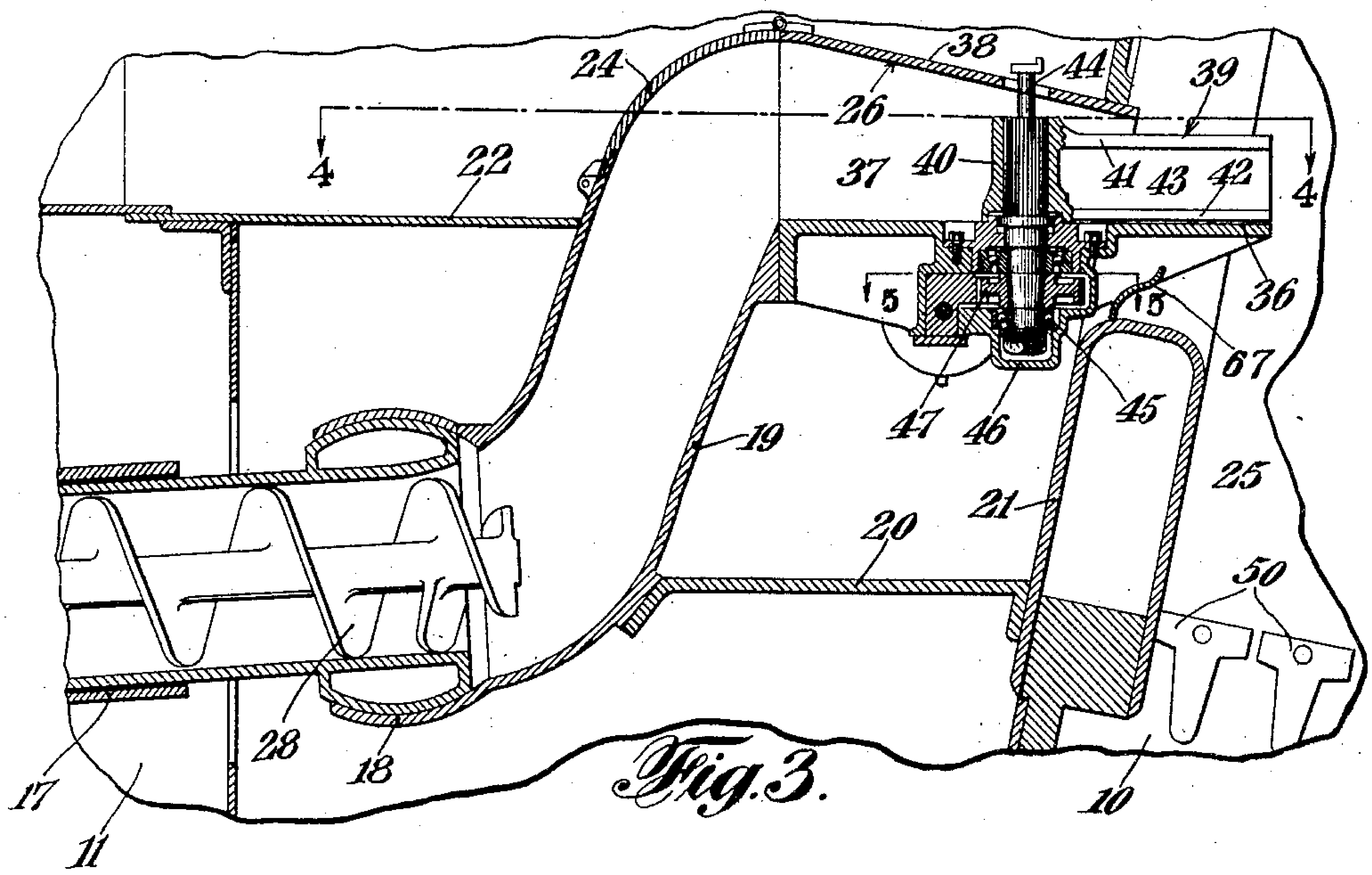

Fig. 3.

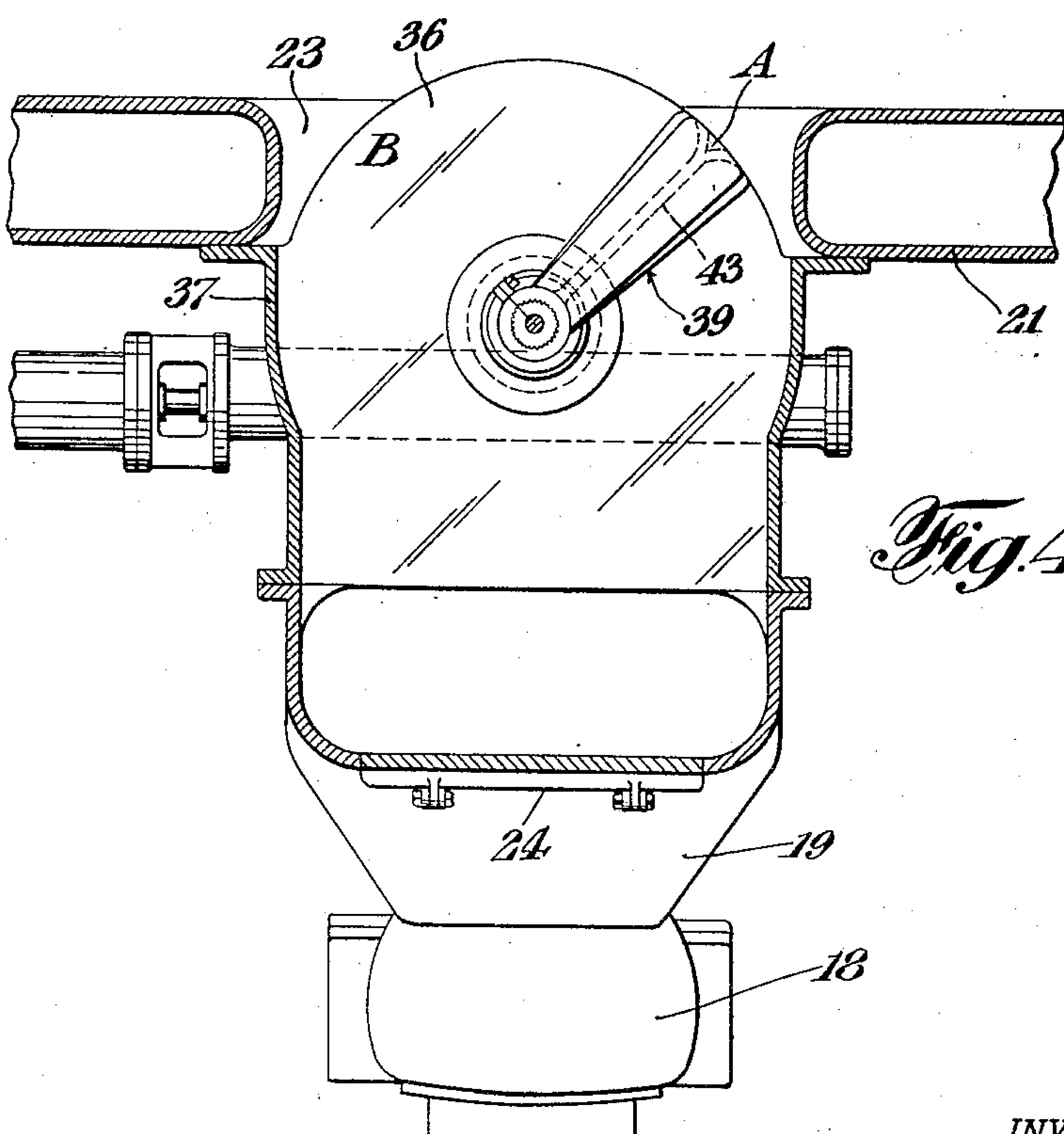

Fig. 4.

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LOCOMOTIVE STOKER

Application filed August 22, 1928. Serial No. 301,226.

This invention relates to locomotive stokers of the type in which the fuel is conveyed from a fuel bin to a fuel throwing or projecting member which acts directly to project the fuel into the firebox.

The principal object of the invention is to provide a highly efficient, compact, simplified form of stoker of this type.

A further object of the invention is to provide such a stoker in which a mechanically operating distributor and the feed means therefor have independently timed drives so that each may be controlled separately to give a most efficient distribution of the fuel.

Another object of the invention is to provide fuel distributing means which will shovel or pick up the fuel from the feed with a relatively slow movement and then more quickly move to project and distribute the fuel over the fire.

For convenience and for the purpose of best illustrating the invention, it will be described as applied to a locomotive. It is understood, however, that its use is not to be limited to locomotives or confined to any particular type of firebox.

The rate of combustion in a locomotive firebox, as in many other engines, varies widely as the load imposed varies due to changes in the grade of the track, the tonnage of the train and the efficiency of the locomotive. Therefore, in the firing of a locomotive it is essential that provision be made for varying the amount of fuel delivered to the firebox in proportion to the changing rate of combustion.

In stokers of the type to which this invention relates, it is both desirable and important that the mechanical distributing mechanism be normally driven at uniform throwing speed regardless of the amount of fuel being delivered, for the reason that this speed must be such as to properly scatter the fuel evenly over the entire grate surface which, in existing types of stoker fired locomotives, is of large area. At times it is necessary to trim the fire by delivering more fuel to the front end of the firebox or to deliver it all in the rear portion thereof, and this is done by operating the shovel or other distributing member at velocities, greater or less than normal. Regardless of the speed at which the fuel throwing shovel is operated, the volume of fuel delivered per minute should be under independent and complete control, either remaining uniform or being increased or decreased as the rate of combustion and the condition of the fire may require; and to this end it is important that the rate of delivery of the fuel into the zone of the action of the fuel throwing member be capable of independent regulation.

In the stoker of this invention the continuous controllable delivery of coal to the independently timed distributor not only permits this desired cooperation of feed and distribution to attain increased efficiency in stoking but at the same time results in a simplification in structure and operation in contrast with prior practice where the feed and distributor mechanisms have been relatively synchronized by necessarily complicated mechanism consisting of many working parts and resulting in costly maintenance of apparatus.

The invention will be described in detail in connection wtih the accompanying drawings, wherein

Fig. 1 is a fragmentary vertical longitudinal sectional view showing the improved stoker mechanism and associate parts including elements of the locomotive and its tender.

Fig. 2 is a fragmentary plan view corresponding with Fig. 1.

Fig. 3 is a fragmentary vertical sectional view on an enlarged scale showing certain of the parts of Fig. 1.

Fig. 4 is a horizontal sectional view taken on a plane indicated by the section line 4, 4 in Fig. 3 and looking in the direction of the arrows at said line.

Fig. 5 is an enlarged fragmentary sectional view taken on a plane indicated by the section line 5, 5 in Fig. 3 and looking downward as indicated by the arrows at said line; and

Fig. 6 is a longitudinal sectional view of the actuating means or motor for the fuel projecting or distributing member.

Referring to the drawings and particularly to Figs. 1 and 2, 10 indicates the locomotive generally and 11 the tender thereof, the two being connected by a coupling 12. The coal or other fuel is carried in a receptacle or bin 13 on the tender, the bottom of said bin comprising movable sections 14 whereby the fuel is allowed to drop down into the rear portion or trough 15 of the conduit system which is suitably secured to the tender and is connected by a universal joint 16 with a forward tubular conduit section indicated generally at 17 which has its opposite end connected by the universal joint 18 with an upwardly extending housing or riser element 19 which is angularly disposed with relation to the part 17 resulting in the provision of an elbow in the conduit. The riser is suitably supported on the locomotive, as by bracket 20 from the backhead or waterleg 21 of the locomotive boiler. Said riser extends upward above the cab deck or locomotive floor 22, flaring outwardly as it rises so that while its lower end is circular its upper end portion is generally elliptical in shape as will be best understood from Figs. 2 and 4. The upper end of the riser is curved forward and terminates some distance to the rear of the fire door opening 23 and in substantial register with the lower portion thereof.

The top portion of the riser may be provided with a hinged cover plate or door 24. Attached to the riser and extending horizontally forward to and somewhat within the fire door opening 23 of firebox 25 is a hood or fuel casing 26, hereinafter referred to more in detail. The fire door opening above said hood may be closed by a cover or door 26[a] which may be opened for inspection or hand-supply to the distributor if, for instance, the automatic feed is disabled.

Within the conduit system is disposed a fuel conveyor or feeding system comprising conveyor screw sections 27 and 28, the section 27 being disposed within the trough portion of the conduit and the section 28 within the tubular portion 17 of the conduit and terminating at or in the vicinity of the elbow thereof. The two sections 27 and 28 are connected by a universal joint 29; and the conveyor screw as a whole is adapted to be automatically actuated as by power actuated means such as the engine shown in Fig. 2 and designated generally by the numeral 30. Said engine is supported on the locomotive tender and is operatively connected with the screw conveyor system by means comprising a sectional or jointed shaft composed of parts 31, 32 and 33, said shaft actuating a pinion 34 which meshes with a spur gear 35 operatively connected to the rear end portion of the screw section 27. The usual crusher 27[a] is disposed at the forward end of the trough 15.

From the riser 19 the fuel passes into and is received by the hood or receptacle 26 which preferably but not necessarily comprises a floor portion 36, side walls 37 and a top portion or cover 38. The side portions are flanged as shown in Figs. 2 and 4 and the flanged portions preferably receive bolts whereby the casing is detachably secured to the backhead 21 and the riser 19. The top 38 of the casing 26 inclines downward and forward and terminates within the rear wall or plane of the backhead or waterleg 21, while the floor 36 extends inward through the fire door opening and is shaped at its forward end to provide a semi-circular table portion from which the fuel as it is advanced forward through the casing from the riser, due to the action of the fuel conveying means, is distributed by the distributing or fuel throwing means.

The fuel distributing means includes an oscillatory device or sweeper designated as a whole by the numeral 39 and comprising a hub portion 40 from which radially project top and bottom horizontally disposed portions numbered respectively 41 and 42, said portions being connected by a central web 43. The hub is bored out to receive a vertical shaft 44 to which it is fixed, said shaft being supported on radial and thrust bearings 45, the bearings and the shaft, together with the actuating devices therefor, being enclosed and supported within a housing indicated generally at 46 at the lower part of the fuel casing 26. Below the sweeper 39 and between the bearings 45 the shaft 44 carries a pinion 47 which, as best shown in Fig. 5, is eccentric on the shaft.

Said pinion 47 is comprised in means for reciprocating or oscillating the sweeper 39, said means further including a horizontally disposed rack member 48 which constantly meshes through its teeth 49 with the pinion, said teeth being so developed that in cooperation with the pinion a variable swinging movement will be communicated to the sweeper 39 when the rack member is reciprocated in the casing 46 by the motor hereinafter described.

The pivotal axis of the sweeper or distributor 39 is just outside the backhead and about central of the floor 36 of the casing 26. In Fig. 4 the sweeper is shown at one limit or extreme A of one of its oscillatory movements and the parts are so proportioned and arranged that each movement is about 450° in extent, carrying the sweeper forward a little from each extreme and then backward to pick up the fuel and then forward again to sweep and throw the fuel over the fuel bed, the movement from A stopping with the shovel at the opposite extreme position B from which it repeats its movement in a reverse direction and returns through 450° to the point A. During these oscillating movements the coal or fuel from the riser collects on the floor 36 in the path of the sweeper 39 to be picked up thereby. As the sweeper approaches the fuel on its pick up movement in either direction it is slowed down and its minimum speed is reached at a point near the extreme rear point of its path. After this the sweeper movement is in the direction of the fuel feed and is accelerated to reach its maximum as it flips or throws the fuel over the fire.

The motor or engine by which the sweeper mechanism is automatically actuated independently of the fuel conveyor engine 30, may be of any suitable construction. As herein shown (Figs. 3, 5 and 6) the actuating rack 48, 49 is suitably secured to the end of a piston rod 52 which carries at its opposite end a piston 53, said piston reciprocating in the cylinder 54 of a fluid pressure motor designated generally by the numeral 55 having a known valve construction.

As shown in Figs. 5 and 6 the piston 53 is at the end of its leftward stroke or its stroke inward toward the valve-chest end of the cylinder. At this time the rack bar will be in the Fig. 5 position and the sweeper 39 in the position A shown in Figs. 2 and 4. As it nears the end of the leftward stroke the ring washer 56 of the piston rod 52 engages the elongated left end of the valve rod 58 disposed within said bore and pushes the connected operating valve 59 to the position shown in Fig. 6, thereby opening the port 60 and admitting steam pressure to the larger end of the differential distributing valve 61, moving it to the position shown. Thus the port 62 receives steam which will gain access to the outer face of the piston 53 through the vent 63 resulting in starting a slow movement of the piston rightward or in the opposite direction, the slow movement continuing until the piston clears the large vent 64 which, when clear, admits a full volume of steam into the cylinder through substantially the full stroke of the piston. As the piston approaches the opposite end of the cylinder it passes over and closes the port 65, thereby restricting the escape of the steam ahead of the piston to the small vent 66. This results, in effect, in forming a cushioning chamber ahead of the piston offering resistance to its movement, reducing its speed and cushioning the action of the connected parts up to and including the sweeper 39.

As the piston nears the end of the stroke to the right the ring washer 56 engages behind the end enlargement of the valve rod 58 drawing the rod to the right to shift the operating valve 59 to the right and change the port connections to admit steam first through vent 66 and then through port 65 to gradually accelerate the piston on its reverse stroke. In a similar manner upon the reverse stroke of the piston as it approaches the position shown in Fig. 6, the main vent 64 will be closed to form a cushion between it and the end of the cylinder with small vent 63 providing the only escape so that in each direction the moving parts will be gradually decelrated without shock.

In order to independently control the fuel feed and distribution, the drive of the fuel feed is separate from that of the distributing means and in the specific example shown involves the screw feed system previously referred to preferably having a continuous rotation when fuel is being delivered to the fire through suitable mechanism for giving a substantially constant flow of fuel to the distributor. In this way the delivery to the fire will be substantially in a continuous stream whenever the fireman turns the valve to actuate the fuel feed mechanism and he will regulate the amount of fuel by the speed at which this feed mechanism is driven. The fuel thus delivered to the distributing point in the fuel casing 26 will be gathered by the movable sweeper or thrower which under the actuation of its independent drive swings alternately in opposite directions to project or throw equal alternate discharges of fuel into the fire box or combustion chamber.

The volume of fuel delivered to the distributing means and swept up and distributed by the sweeper being thus determined by the rate of delivery of the feed is of course capable of regulation independently of the sweeper mechanism. Conversely the sweeper mechanism also being independently controlled in its rate of movement may be readily regulated for the purpose of trimming the fire or for other reasons without affecting the action of the screw conveyor system. The fireman may therefore throw various charges of coal to all parts of the fire box as desired.

That portion of the fuel casing 26 which extends or projects into the opening 23 of the boiler is protected from the heat generated in the firebox by a current of cooling air passing into the fire box below the bottom wall of the casing, and between it and the sill of the fire door opening, this current being direced against the casing by a curved flange or rib 67 which extends across the lower door of the opening. If for any reason the conveying means becomes inoperative, fuel may be supplied by hand stoking through the door 24 at the top of the riser.

From the foregoing description it will be seen that I have provided a highly efficient stoker giving a very effective control of the amount and distribution of the fuel and attaining these results in simple compact mechanism easily installed and operated and durable in use.

I claim:

1. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a fuel throwing member comprising a single sweeper member pivoted at one end to swing horizontally in opposite

directions in said casing and being arranged to discharge fuel therefrom when sweeping in either direction, feed means for feeding a continuous stream of fuel into said fuel casing in the plane of the path of said member, and a prime mover for actuating said feed means, said feed means being arranged with said prime mover to deliver and maintain a uniform quantity of fuel at all times in the plane of the path of said sweeper member for a given speed of said prime mover.

2. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox and having a substantially horizontal floor, a fuel throwing member mounted to swing horizontally in opposite directions in said casing and being arranged to discharge fuel therefrom when swinging in either direction, a fuel delivery conduit in communication with the rear portion of said casing and adapted to feed fuel horizontally onto the floor of said casing, feed means for advancing a continuous stream of fuel through said conduit onto the floor of said casing in the plane of the path of said member, and a prime mover for actuating said feed means, said feed means being arranged with said prime mover to deliver and maintain a uniform quantity of fuel at all times in the plane of the path of said member for a given speed of said prime mover.

3. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a fuel throwing member mounted to swing substantially horizontally in opposite directions in said casing and adapted to discharge fuel from said casing when swinging in either direction, and means for continuously delivering fuel in a horizontal plane to the rear of said casing.

4. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a fuel throwing member mounted on a vertical shaft to swing in opposite directions in said casing, means for delivering fuel in the plane of the path of said fuel throwing member to a point of collection in said casing, said fuel throwing member being arranged to sweep up fuel from said point of collection and discharge it from said casing, and power actuated mechanism for operating said member, said mechanism comprising means for decelerating the speed of the fuel throwing member as it sweeps up the fuel.

5. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a conveyor conduit delivering fuel into said casing, a fuel throwing member mounted to oscillate about a vertical shaft in alternately opposite directions in said casing, said fuel throwing member adapted to sweep up fuel from said conduit and to deliver increments of fuel from said casing, in each phase of its oscillation, and power actuated mechanism for operating said member, said mechanism comprising means for decelerating the velocity of said member as it sweeps up the fuel from said conduit, and accelerating its velocity as it delivers fuel from the casing.

6. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a conveyor conduit supplying fuel to said casing, a fuel throwing member mounted to oscillate in alternately opposite directions in said casing, means for operating said member, said member being arranged to sweep up fuel from said conduit and to deliver increments of fuel from said casing, in each phase of its oscillation, mechanism for decelerating the velocity of said member as it sweeps up the fuel from said conduit and accelerating its velocity as it delivers fuel from the casing, and a fluid pressure motor for actuating said mechanism.

7. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a conveyor conduit for supplying fuel to said casing, a fuel throwing member mounted to swing about a vertical shaft in opposite directions in said casing, means for operating said member, said member adapted to sweep up fuel from said conduit and to deliver increments of fuel from said casing, means for decelerating the velocity of said member as it sweeps up the fuel from said conduit and accelerating its velocity as it delivers fuel from the casing and cushioning means for checking the momentum of said member as it approaches the extremity of its impelling stroke.

8. In a locomotive stoker in combination, a locomotive having a firebox with a firing opening therein, a cab having a floor therefor, a tender having a fuel bin with an apertured floor rearward of said locomotive, a fuel casing attached to said firebox and adapted to communicate with said opening therein, a fuel throwing member mounted to swing horizontally in alternately opposite directions in said casing, a fuel conduit extending downwardly from the rear of said casing to a point below said cab floor, the upper end of said conduit being in communication with said casing, a screw conveying conduit universally connected to the lower end of said fuel conduit and projecting rearwardly beneath the floor of said tender and adapted to receive fuel through the aperture therein, means for imparting oscillating motion to said fuel throwing member through substantially 450°, and means for imparting continuous motion to said screw conveyor.

9. In a locomotive stoker, in combination with a locomotive firebox having a feeding opening therein and a cab with the usual floor therefor, a tender rearward of said locomotive provided with a fuel bin the floor of which is apertured, a fuel casing attached

to said firebox having an open forward end communicating with the feeding opening therein and an open rearward end opening horizontally, a transfer conduit located below said fuel bin and adapted to receive fuel through said apertured floor, said transfer conduit extending forwardly and its front end curved upwardly to and opening into said fuel casing through its open rearward end, means within said transfer conduit for delivering fuel therethrough and into said casing, and mechanically operated fuel projecting means within said casing mounted to swing horizontally in alternately opposite directions for delivering fuel into the firebox.

10. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a fuel throwing member mounted to swing in opposite directions in said casing, fed means for feeding a continuous stream of fuel to said casing in the plane of the path of said member, variable speed power actuated means for swinging said member in alternately opposite directions, and a variable speed motor controlled independently of said last named means for operating said feed means, said feed means being arranged with said motor to deliver and maintain a uniform quantity of fuel in the plane of the path of said member for a given speed of said motor.

11. In a mechanical stoker the combination of a fuel bin having a bottom delivery opening, a transfer conveyor being located below said opening, a fuel casing adapted to communicate with a firebox, a fuel throwing member mounted to swing in opposite directions in said casing and arranged to deliver fuel therefrom when swinging in either direction, a riser conduit extending from the forward end of said transfer conveyor to the rear end of said casing, feed means within said transferring conveyor only, for conveying fuel therethrough and forcing the fuel through said riser conduit into said casing in the plane of the path of said fuel throwing member, and a prime mover for actuating said feed means, said feed means being arranged with the prime mover to deliver and maintain a uniform quantity of fuel in the plane of the path of said fuel throwing member for any given speed of said prime mover.

12. In a mechanical stoker, the combination of a fuel casing adapted to communicate with a firebox, a fuel throwing member mounted in said casing, power actuated means for swinging said member in alternately opposite directions, feed means for delivering a continuous flow of fuel into said casing in the plane of the path of said member, and a prime mover for actuating said feed means, said feed means being arranged with said prime mover to deliver and maintain a uniform quantity of fuel at all times in the plane of the path of said member for any given speed of said prime mover.

13. In a mechanical stoker, the combination with a fuel feed and distributing means, of independently controlled mechanical distributing means receiving the fuel from said feed and comprising a single oscillating distributor device arranged to receive fuel and project the same in each phase of its oscillation, and means arranged to transmit relatively slow motion to said distributor device during its fuel receiving traverse and relatively rapid motion during its fuel projecting traverse for projecting the fuel.

In testimony whereof I affix my signature.

FRANK P. ROESCH.