July 5, 1938. P. A. KETCHPEL ET AL. 2,122,425

FUEL FEEDING SYSTEM

Filed Aug. 6, 1934 3 Sheets-Sheet 1

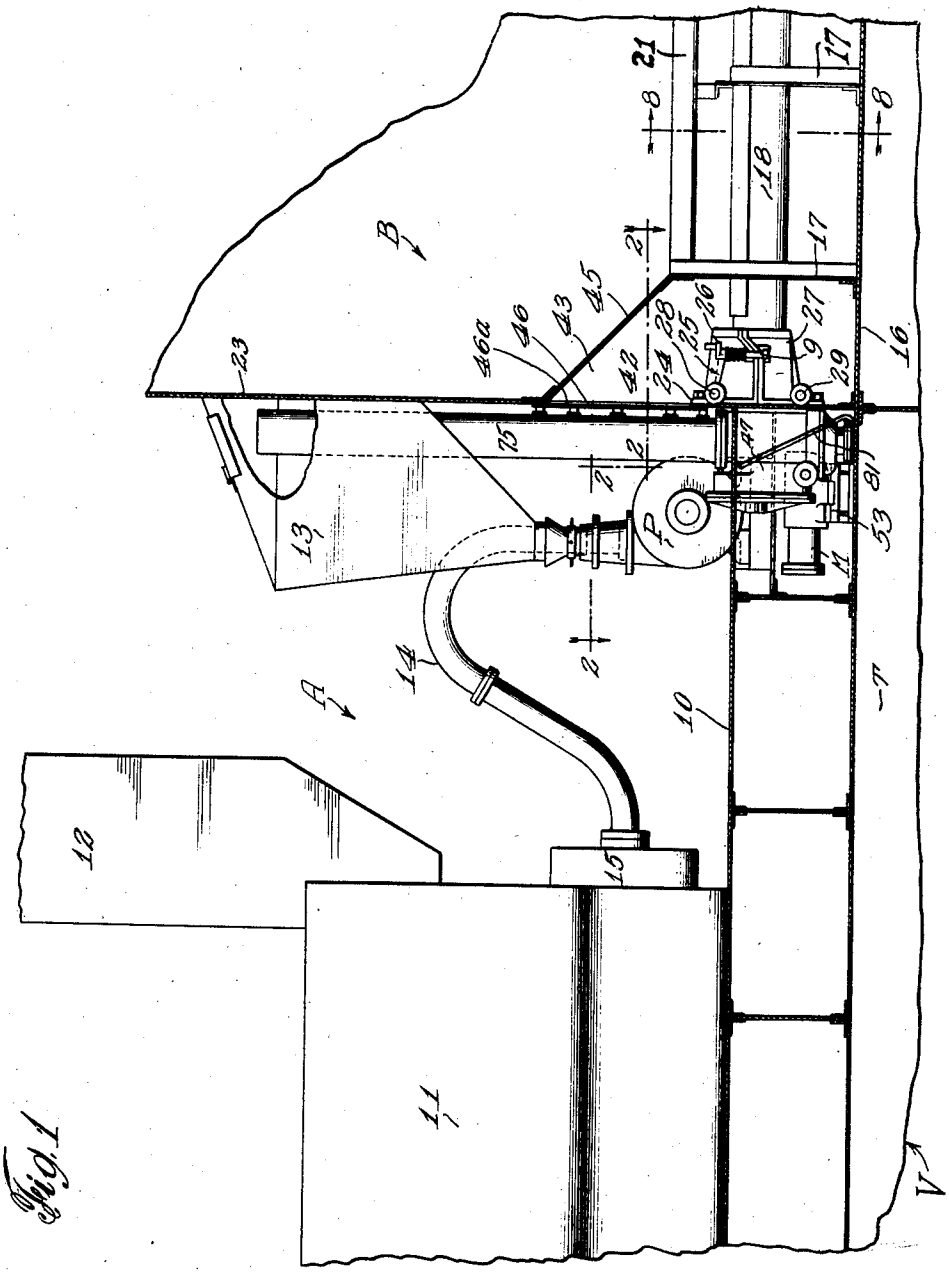


Fig. 1

INVENTORS.
Paul A. Ketchpel,
Edwin B. Sadtler.

By C. Archer Turner

ATTORNEY.

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FUEL FEEDING SYSTEM

Filed Aug. 6, 1934 3 Sheets-Sheet 2

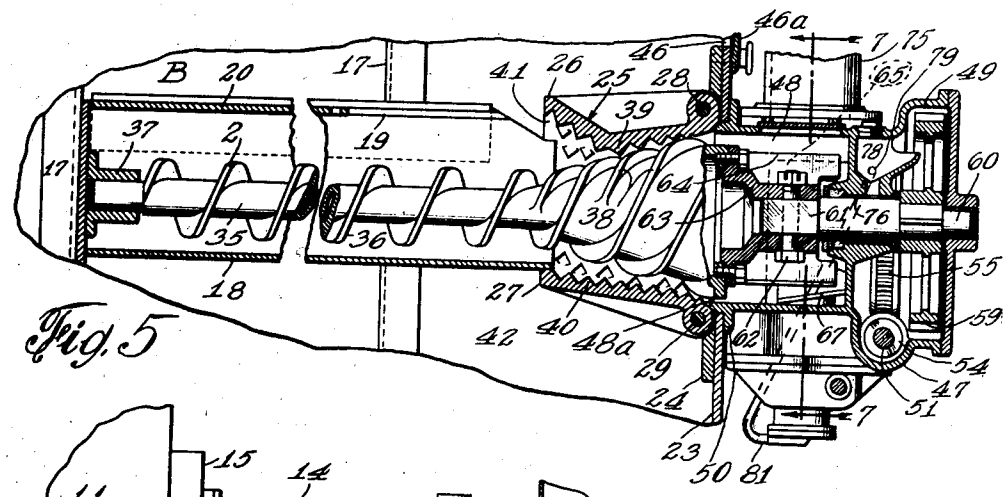


Fig. 5

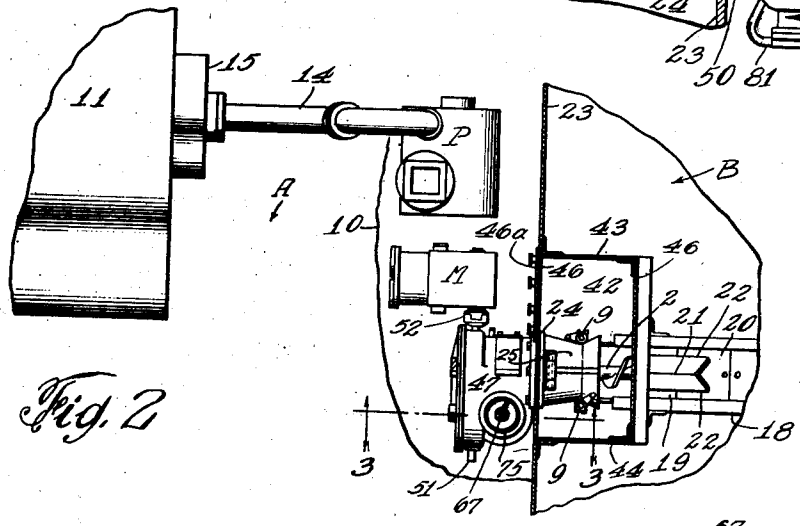


Fig. 2

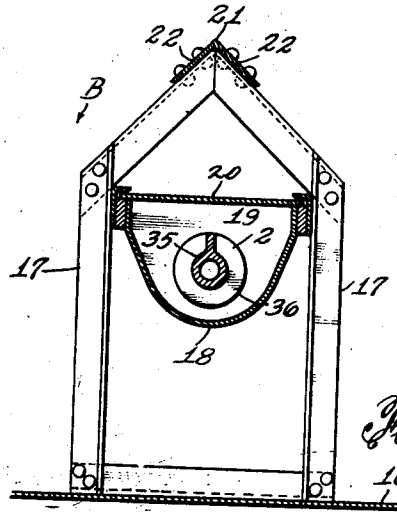


Fig. 8

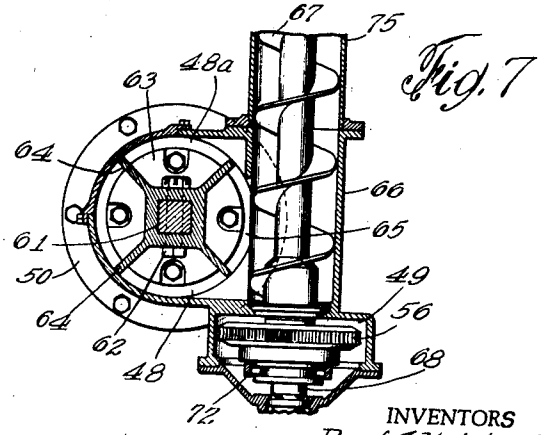


Fig. 7

INVENTORS
Paul A. Ketchpel
Edwin B. Sadtler

BY

E. Archer Turner
ATTORNEY.

July 5, 1938. P. A. KETCHPEL ET AL 2,122,425

FUEL FEEDING SYSTEM

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Fig. 3

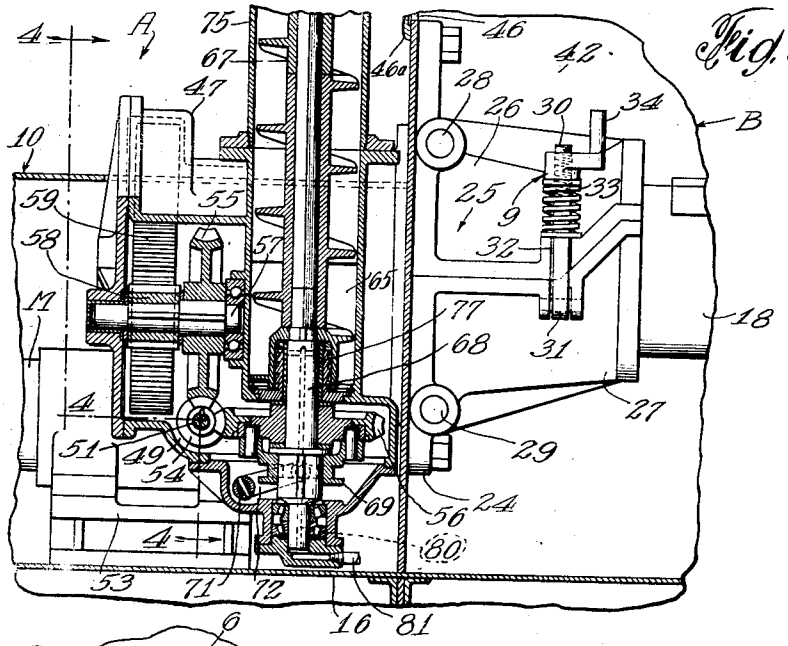


Fig. 6

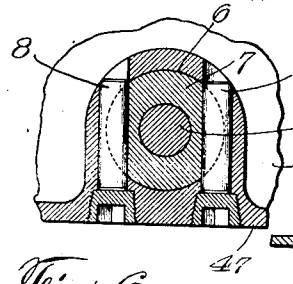


Fig. 4

INVENTORS
Paul A. Ketchpel
Edwin B. Sadtler

BY

E. Archer Turner
ATTORNEY.

Patented July 5, 1938 2,122,425

UNITED STATES PATENT OFFICE

2,122,425

FUEL FEEDING SYSTEM

Paul A. Ketchpel, West Englewood, N. J., and Edwin B. Sadtler, New York, N. Y.; said Ketchpel assignor, by mesne assignments, to The Standard Stoker Company, Inc., (1922), a corporation of Delaware

Application August 6, 1934, Serial No. 738,572

4 Claims. (Cl. 198—82)

Our invention relates to certain novel improvements in fuel feeding systems and more particularly to the embodiment of such an improved system for installation in maritime service.

It is an object of our invention to provide a fuel feed system of the character specified, and in which a conveyor trough receives fuel from a bunker and is provided with a conveyor screw for urging fuel forwardly to an elevator disposed outside of the bunker forward of the conveyor screw and at one side of its axis, the conveyor screw being driven from its forward end and being provided at such end with a plurality of radial blades which push the fuel laterally into the elevator.

A further object of this invention resides in the provision in the above described fuel feeding system, of means arranged whereby the run-of-mine coal in the bunker is crushed to a suitable size during conveyance by the screw, the crushed coal being then elevated to a storage bin of ample capacity from where the crushed coal is conducted to a pulverizer and impeller for consumption in the boiler furnaces.

Another object resides in the provision of a novel drive mechanism for operating the conveyor and elevator. In carrying out this object of our invention we have constructed a casing which is divided into a fuel receiving portion and a mechanism housing, and in which a novel relation exists between the various parts thereof.

Still another object of our invention is to provide a novel crusher for our improved fuel feeding system and to so construct the conveyor screw that it coacts with the crusher of our invention to efficiently reduce the coal to a suitable size for pulverizing.

It is also an object of our invention to make our novel crusher in two sections which embrace the screw, to provide means for quick release of these sections from each other, and to dispose this novel crusher in an alcove which is in the bunker compartment but shielded from the coal therein.

Other objects are to construct our fuel feeding device in a manner so that the conveyor trough unit is within one compartment, the elevator and driving units in the boiler room compartment beneath the floor thereof, and to relate these units in a manner so that a water tight connection is produced between.

On the drawings which accompany the specifications of our invention,

Figure 1 is a sectional view through adjacent portions of the coal bunker compartment and the boiler room compartment, with the novel fuel feeding system of our invention in elevation;

Figure 2 is a plan view partly in section of the structure shown in Figure 1 taken on the line 2—2 thereof;

Figure 3 is a sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a sectional view taken on the line 4—4 of Figure 3;

Figure 5 is a sectional view taken on the line 5—5 of Figure 4;

Figure 6 is a sectional view taken on the line 6—6 of Figure 4;

Figure 7 is a sectional view taken on the line 7—7 of Figure 5; and

Figure 8 is a sectional view taken on the line 8—8 of Figure 1.

On these drawings the vessel is indicated generally by V, the boiler room by A and the coal bunker by B, the boiler room and bunker each being within separate water tight compartments. Mounted above the floor 10 of the boiler room is a boiler 11, which is preferably of the Scotch Marine type, and of which there may be several. Products of combustion pass from the boiler furnaces into the breeching 12 and thence outward through a stack (not shown).

Pulverized fuel is utilized to fire the furnaces of each boiler and for this purpose a fuel pulverizer and impeller P is employed. The fuel pulverizer and impeller P, which is of the usual construction, receives crushed fuel from a storage bin 13 disposed a suitable distance above the floor 10, and after pulverization, the fuel is impelled through a tube 14 to a burner 15 mounted on a wall of the boiler 11. Lump fuel in the bunker B is crushed and then elevated into the storage bin 13 by a novel fuel feeding system which will be hereinafter described in detail. The term "forward" in the specification is used to denote the general direction of the flow of fuel from the bunker B to the burner 15.

Supported from the bunker floor 16 by the upright legs 17 is a trough 18 which receives fuel from the bunker B through an open mouth 19, the size of which is controlled by slidable plates such as 20. The bunker floor 16 is the top wall of a tank T within which the water ballast is stored. Above the trough 18 and the slidable plates 20 there is an angle member 21 which extends longitudinally of the trough with the legs 22 thereof sloping downwardly. Transverse members connect the trough supporting legs 17 and the angle member 21. By the construction set forth, the entire weight of the fuel in the bunker B immediately above the trough 18 is not imposed upon the slidable plates 20, and thereby permits

these plates to be moved with greater ease than would otherwise be possible. Furthermore, the trough 18 thus formed is of a very rigid and substantial construction, and one which will withstand the constant shifting of the fuel supply at the sides of the trough and thereabove. It will be understood that the supply of fuel at each side of the trough is not used normally, but forms a reserve necessary to meet emergencies and the requirements of insurance underwriters.

To the fuel bunker side of the bulkhead 23 a frame member 24 is secured for supporting a fuel crusher 25 which is of novel construction. This crusher is split horizontally into an upper portion 26 and a lower portion 27, each being pivotally carried by the frame member 24 on the horizontal transverse shafts 28 and 29, respectively. The upper and lower crusher portions are maintained in their operative relation by a quick release locking device 9, one at each side of the crusher 25. This locking device consists of a threaded bolt 30 hinged as at 31 to the lower crusher portion 27 and engaging a slot 32 of the upper portion 26. A spring 33 passes over the bolt 30 and seats above the slot 32. This spring is compressed by turning a handle 34 which engages the threaded portion of the bolt 30. Compression of this spring causes the adjacent faces of the upper and lower crusher portions to contact firmly.

Within the trough 18 a conveyor screw 2 is rotatably mounted and includes a shaft 35 having a spiral thread 36 wound therearound. At its end remote from the bulkhead 23, the conveyor screw 2 is journalled in a bearing 37, while at its opposite end, the hub of the screw is conic in shape, increasing in diameter as it extends through the crusher 25. This portion of the screw is provided with multiple spiral flights 38, which in conjunction with the teeth 39, 40 of the upper crusher 26 and the lower crusher 27, respectively, reduce the lump fuel to a size suitable for pulverization. In order that large lumps of coal may enter the crusher 25, the upper portion 26 thereof is arched upwardly as at 41.

The multiple flights on the conic end of the conveyor screw 2 extend outwardly but a short distance beyond the conic hub and are spaced very closely to the crusher teeth. If desired, these multiple flights may increase in pitch as they progress forwardly to insure that the fuel is carried away faster than advanced toward the crusher. It will be observed that by the particular relation of the crusher portions 26 and 27 to the conic hub and flights of the conveyor screw, the largest lump of coal which will be passed through the crusher will be no greater than the least distance between the conic hub and the teeth of the crusher. In actual practice, it will be desirable to deliver no coal greater than one inch nuggets in order that the work of the pulverizer may be reduced to a minimum.

The crusher 25 and a portion of the open mouth trough 18 are shielded from the coal in the bunker B by an alcove 42, formed in part by the side walls 43, 44 and the sloping roof 45 which extends from the bulkhead 23 downwardly to the foremost trough supporting leg 17. This alcove is of sufficient size to accommodate a workman, entrance to the alcove being had through a manhole 46 which is normally closed by a water tight cover 46a.

Drive mechanism for the fuel feed system is disposed in the boiler room compartment on one side of the bulkhead 23 and preferably below the floor 10. The casing 47 for the drive mechanism is in the form of a drum-like casting which is divided into a fuel receiving portion 48 and the mechanism housing 49. The fuel receiving portion 48 of the casting 47 is in direct communication with the bunker B and trough 18 through the opening 48a, and is secured to the bulkhead 23 by means of bolts passing through the flange 50 which bounds this opening.

Within the mechanism housing 49, there is the main or power shaft 51 which is connected by a coupling 52 to a drive motor M mounted on a bracket 53 above the tank top 16 and below the boiler room floor 10. The power shaft is supported on the end bearings 3 and 4 and on the intermediate bearing 5, which is of the roller thrust type. This bearing 5 is received in a bore 6 in which a thrust collar 7 is secured against movement longitudinally of the power shaft by means of pins 8. Between the roller bearings 4 and 5, the power shaft 51 carries a worm 54 which is engaged by teeth of the vertically disposed worm wheel 55 and the horizontally disposed worm wheel 56. The worm wheel 55 is rotatable with a countershaft 57 which carries a spur pinion 58 in engagement with the gear 59. This last named gear operates the conveyor screw drive shaft 60 which is provided with a polygonal portion 61 extending into the fuel receiving portion 48 of the casing 47 and having secured thereto by the bolt 62 a coupling member 63 which serves to operatively connect the shaft 60 with the conic portion of the conveyor screw 2.

Formed with the connecting member 63 are the radial blades 64 which are arranged to push the fuel delivered into the receiving portion 48 by the conveyor screw 2 laterally through an opening 65 into the base of an upright tube 66 formed with the drum-like casting 47. Within the tube 66 a vertical elevating screw 67 is mounted with the shaft 68 thereof extending downwardly into the mechanism housing 49 and passing freely through the horizontally disposed worm wheel 56. Immediately below the worm wheel 56, a clutch member 69 is slidably keyed to the shaft 68. Movement of the clutch member 69 is effected by manipulation of the lever 70 which operates the rod 71, causing angular movement of the shifting yoke 72. In the position shown in Figure 3, the clutch member 69 is engaging the worm wheel 56, thereby transmitting power for operating the elevating screw 67. Downward movement of the clutch member will permit the worm wheel 56 to idle about the shaft 68 during continued operation of the power shaft 51.

During operation of the fuel feed mechanism, oftentimes foreign material such as tramp iron will become lodged between the multiple flights of the screw 2 and the teeth of the crusher 25, thereby stalling the mechanism. The rotation of the driving motor M is then reversed, but before this is done, the operator first manipulates the lever 70 for disconnecting the clutch member 69 from the elevating worm wheel 56. This procedure is necessary because upon reverse operation of the elevating screw 67, fuel would pack at the base of the upright tube 66 and eventually stall the fuel feed mechanism during reversal thereof.

A few reverse revolutions of the conveyor screw 2 will usually be sufficient to dislodge the foreign material from the crusher 25; the operator then removes the water tight cover 46a for

entry into the alcove 42 through the manhole 46, whereby the foreign material may be removed. If repeated reversals of the conveyor screw fail to dislodge the obstruction, the upper and lower crusher portions 26, 27 may be hinged about their respective axes by releasing the locking device 9, permitting the obstruction to drop onto the tank top 16 which forms the floor of the alcove 42.

When normal operation of the feed mechanism is resumed, the crushed coal is then elevated by the screw 67 through an upright tubular casing 75 which is secured in a water tight manner to the upright tube 66 and extends into the storage bin 13, terminating at the upper portion thereof. The storage bin 13 is of a size sufficient to carry an ample supply of crushed fuel, thereby insuring uninterrupted firing of the boiler 11 at times when the fuel feed mechanism is out of order, which condition may be caused by obstructions lodging in the crusher 25.

Since the trough 18 and the crusher 25 are on one side of the bulkhead 23, and the fuel elevator and drive mechanism are at the other side of this bulkhead, it is essential that the fuel feeding system be constructed in a manner such that when one compartment becomes flooded because of a damaged hull, the water will not seep into an adjoining compartment through the fuel feeding mechanism. Accordingly, the flange 50 of the drum casting 47 forms a water tight joint between the boiler room A and the fuel bunker B. Thus if the fuel bunker compartment becomes flooded up to the level of the trough 18, water would not flow into the boiler room A. It is possible that a certain amount of water may seep into the mechanism housing 49 through the bearings 76, 77 of the conveyor screw drive shaft 60 and the elevating screw shaft 68. However, the mechanism housing 49 is of an oil tight construction and would therefore prevent any excessive amounts of water from passing therethrough into the boiler room. Usually the presence of water in one compartment is detected before the condition becomes serious.

The drive mechanism is effectively lubricated in the following manner. Oil within the mechanism housing 49 is maintained at a level slightly above the lowermost point of the conveyor screw drive gear 59, thereby insuring that the worm 54, worm wheels 55, 56 and the gear 59 run in a bath of oil. As the gear 59 is rotated, it carries oil upwardly for lubricating the intermeshed pinion 58 and also for supplying oil to a reservoir 78. This reservoir feeds oil to the bearing 76 of the drive shaft 60 and is also provided with an opening 79 which is above the level of the elevating screw shaft bearing 77. Extending axially of the shaft 68 (Figure 3) is a passage 80 which leads to the bearing 77. A pipe 81 connects this axial passage 80 with the opening 79 of the reservoir 78, and since the oil in the reservoir will always seek its level, oil will be forced upwardly through the passage 80 and thus lubricate the bearing 77.

From the foregoing description, it will be apparent to those familiar with the problems set forth herein, that we have provided a novel fuel feed mechanism which is especially suited for maritime service. We claim the following as our invention.

We claim:

1. Drive mechanism for a fuel feeding system including a casing having a fuel receiving portion and a mechanism housing, said first named portion including a horizontal tubular member open at one end to receive fuel, an upright tubular member at one side of said horizontal tubular member, said members communicating with each other through a common opening, a bearing formed in a wall of said casing opposite the fuel receiving opening of said horizontal tubular member and in substantial axial alignment therewith, a shaft journalled in said bearing, said shaft having a portion extending into said horizontal tubular member and another portion into said mechanism housing, a coupling operatively connected to the first named portion of said shaft, said coupling having radial blades for urging fuel laterally into said vertical tubular member through said common opening, a gear in said mechanism housing keyed on the last named portion of said shaft, a bearing at the bottom of said vertical tubular member, a vertical shaft journalled in said bearing, an elevator screw in said vertical tubular member operatively connected to the vertical shaft, a horizontally disposed worm gear in said mechanism housing below said bearing, said worm gear being freely mounted upon said vertical shaft, a clutch member below said worm gear slidably keyed upon said shaft, means for slidably moving said clutch member along said shaft for selective engagement and disengagement of said worm gear, a power shaft journalled in said housing, a worm upon said shaft in driving relation therewith, said horizontally disposed worm gear meshing said worm, a second worm gear disposed at substantially right angles with respect to said first worm gear and meshing said worm, a shaft journalled in said housing and upon which the second named worm gear is operatively mounted, and a pinion operatively mounted on said last named shaft and meshing with the gear on the first named shaft.

2. Drive mechanism for a fuel feeding system including a casing having a fuel receiving portion and a mechanism housing, said first named portion including a horizontal tubular member open at one end to receive fuel, an upright tubular member at one side of said horizontal tubular member, said members communicating with each other through a common opening, a bearing formed in a wall of said casing opposite the fuel receiving opening of said horizontal tubular member and in substantial axial alignment therewith, a shaft journalled in said bearing, said shaft having a portion extending into said horizontal tubular member and another portion into said mechanism housing, a coupling operatively connected to the first named portion of said shaft, said coupling having radial blades for urging fuel laterally into said vertical tubular member through said common opening, a gear in said mechanism housing keyed on the last named portion of said shaft, a bearing at the bottom of said vertical tubular member, a vertical shaft journalled in said bearing, an elevator screw in said vertical tubular member operatively connected to the vertical shaft, a horizontally disposed gear in said mechanism housing below said bearing, said gear being freely mounted upon said vertical shaft, a clutch member below said gear slidably keyed upon said shaft, means for slidably moving said clutch member along said shaft for selective engagement and disengagement of said gear, a power shaft journalled in said housing, and a gear on said power shaft operatively connected with the gear on said horizontal shaft and the gear on said vertical shaft.

3. Drive mechanism for a fuel feeding system including a casing having a fuel receiving portion and a mechanism housing, said first named portion including a horizontal tubular member open at one end to receive fuel, an upright tubular member at one side of said horizontal tubular member, said members communicating with each other through a common opening, a bearing formed in a wall of said casing opposite the fuel receiving portion of said horizontal tubular member and in substantial axial alignment therewith, a shaft journalled in said bearing, a coupling in the fuel receiving portion of said casing operatively connected to said shaft, said coupling having radial blades for urging fuel laterally into said vertical tubular member through said common opening, a bearing at the bottom of said vertical tubular member, a vertical shaft journalled in said bearing, an elevator screw in said vertical tubular member operatively connected to the vertical shaft, a power shaft journalled in said housing, and means for operatively connecting said horizontal and vertical shafts with said power shaft.

4. Drive mechanism for a fuel feeding system including a casing having a fuel receiving portion and a mechanism housing, said first named portion including a horizontal tubular member open at one end to receive fuel, an upright tubular member at one side of said horizontal tubular member, said members communicating with each other through a common opening, a bearing formed in a wall of said casing opposite the fuel receiving portion of said horizontal tubular member and in substantial axial alignment therewith, a shaft journalled in said bearing, a coupling in the fuel receiving portion of said casing operatively connected to said shaft, said coupling having radial blades for urging fuel laterally into said vertical tubular member through said common opening, a bearing at the bottom of said vertical tubular member, a vertical shaft journalled in said bearing, an elevator screw in said vertical tubular member operatively connected to the vertical shaft, a power shaft journalled in said housing, and means for operatively connecting said horizontal and vertical shafts with said power shaft, said means including a clutch member arranged to selectively connect and disconnect said vertical shaft with said power shaft.

PAUL A. KETCHPEL.
EDWIN B. SADTLER.