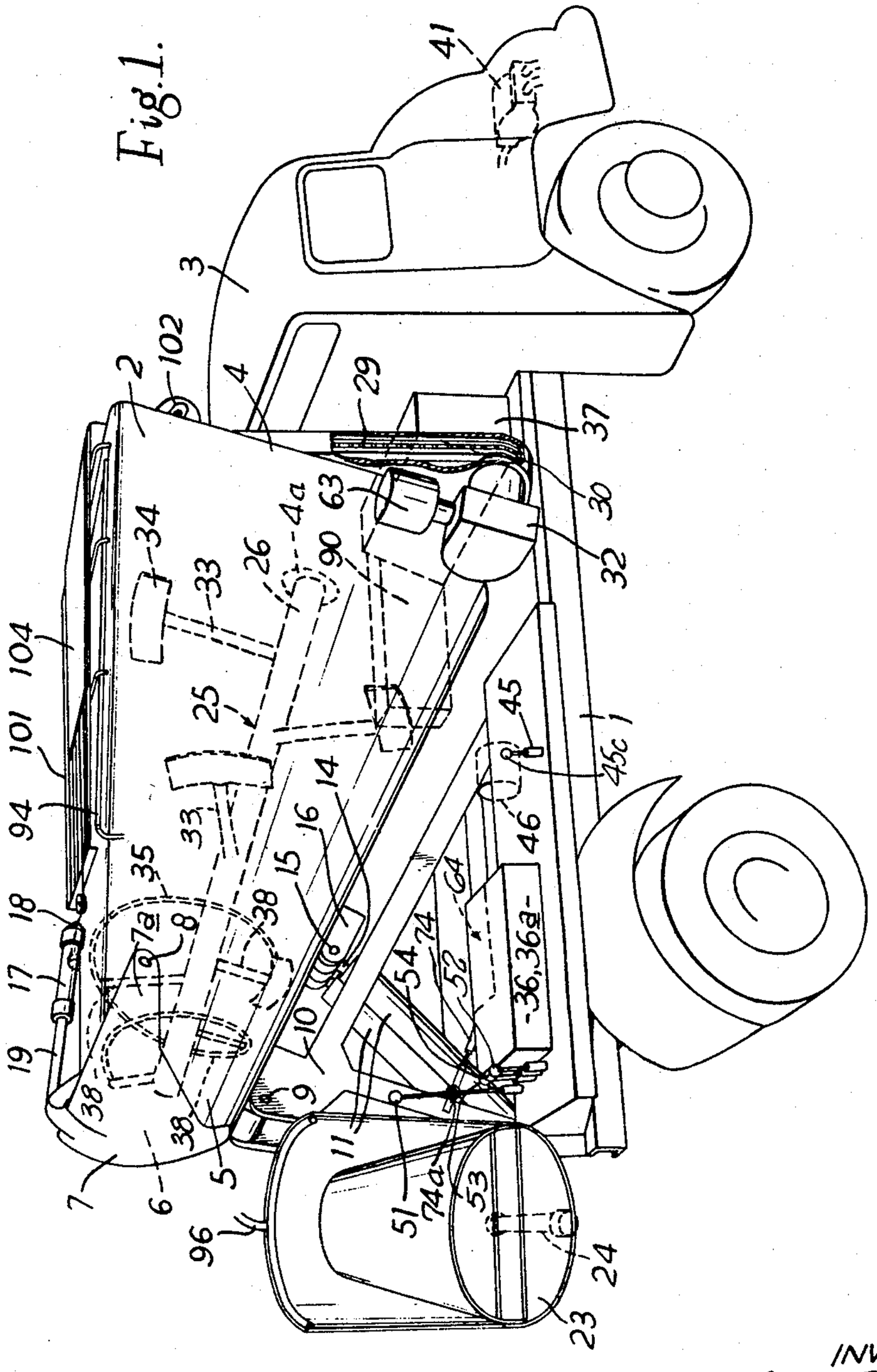
April 27, 1965 C. G. PULLIN 3,180,628

AGITATOR DUMP TRUCK FOR CONCRETE AND OTHER SEMI-LIQUID MATERIALS

Filed Oct. 22, 1962 5 Sheets-Sheet 1

Fig. 1.



INVENTOR

Cyril George Pullin

BY

Louis P. Hatton

ATTORNEY

April 27, 1965 C. G. PULLIN 3,180,628

AGITATOR DUMP TRUCK FOR CONCRETE AND OTHER SEMI-LIQUID MATERIALS

Filed Oct. 22, 1962 5 Sheets-Sheet 2

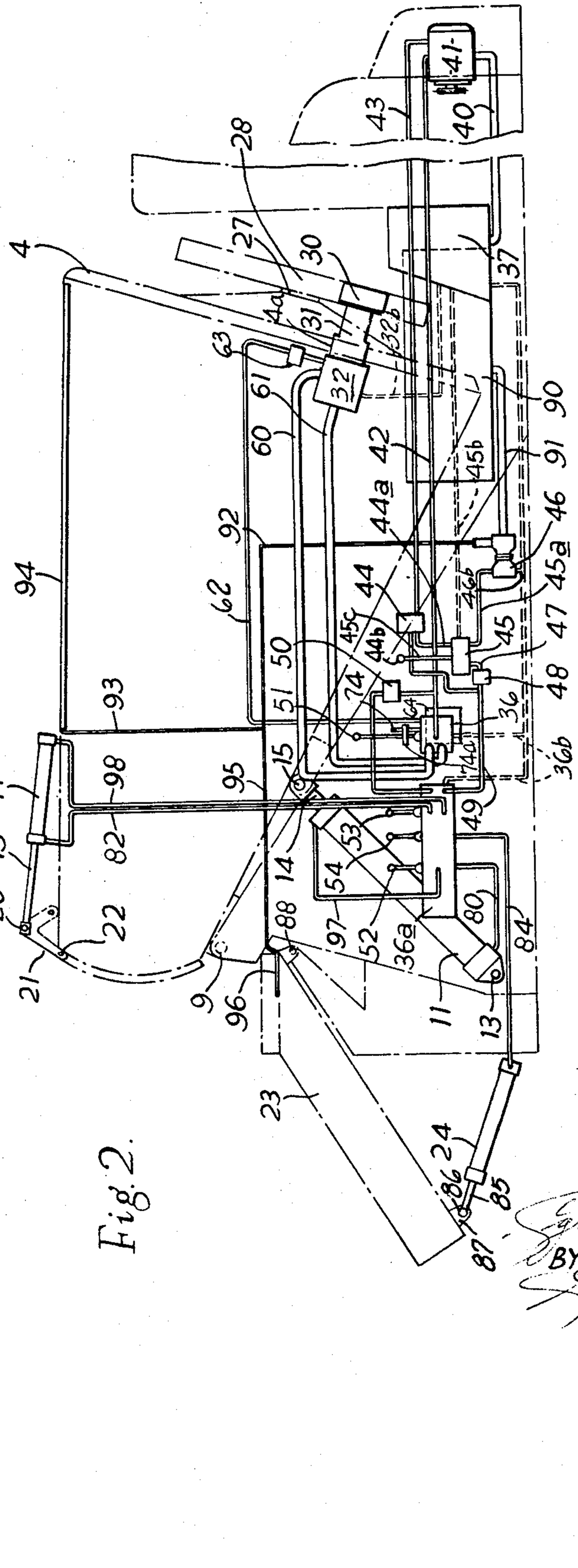


Fig. 2.

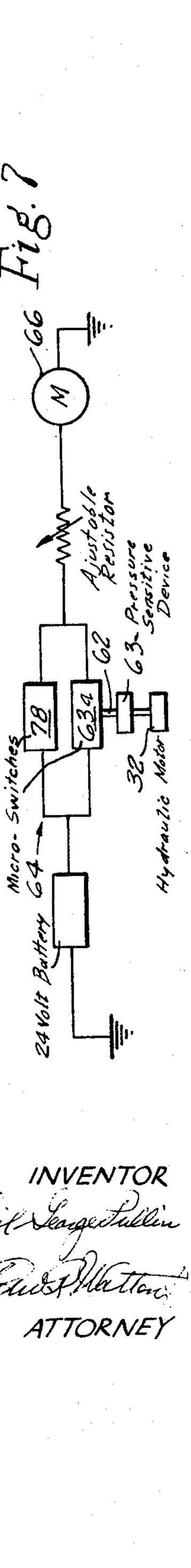


Fig. 7

INVENTOR
Carl George Pullin
BY
Edwin P. Wheeler
ATTORNEY

April 27, 1965 C. G. PULLIN 3,180,628

AGITATOR DUMP TRUCK FOR CONCRETE AND OTHER SEMI-LIQUID MATERIALS

Filed Oct. 22, 1962 5 Sheets-Sheet 3

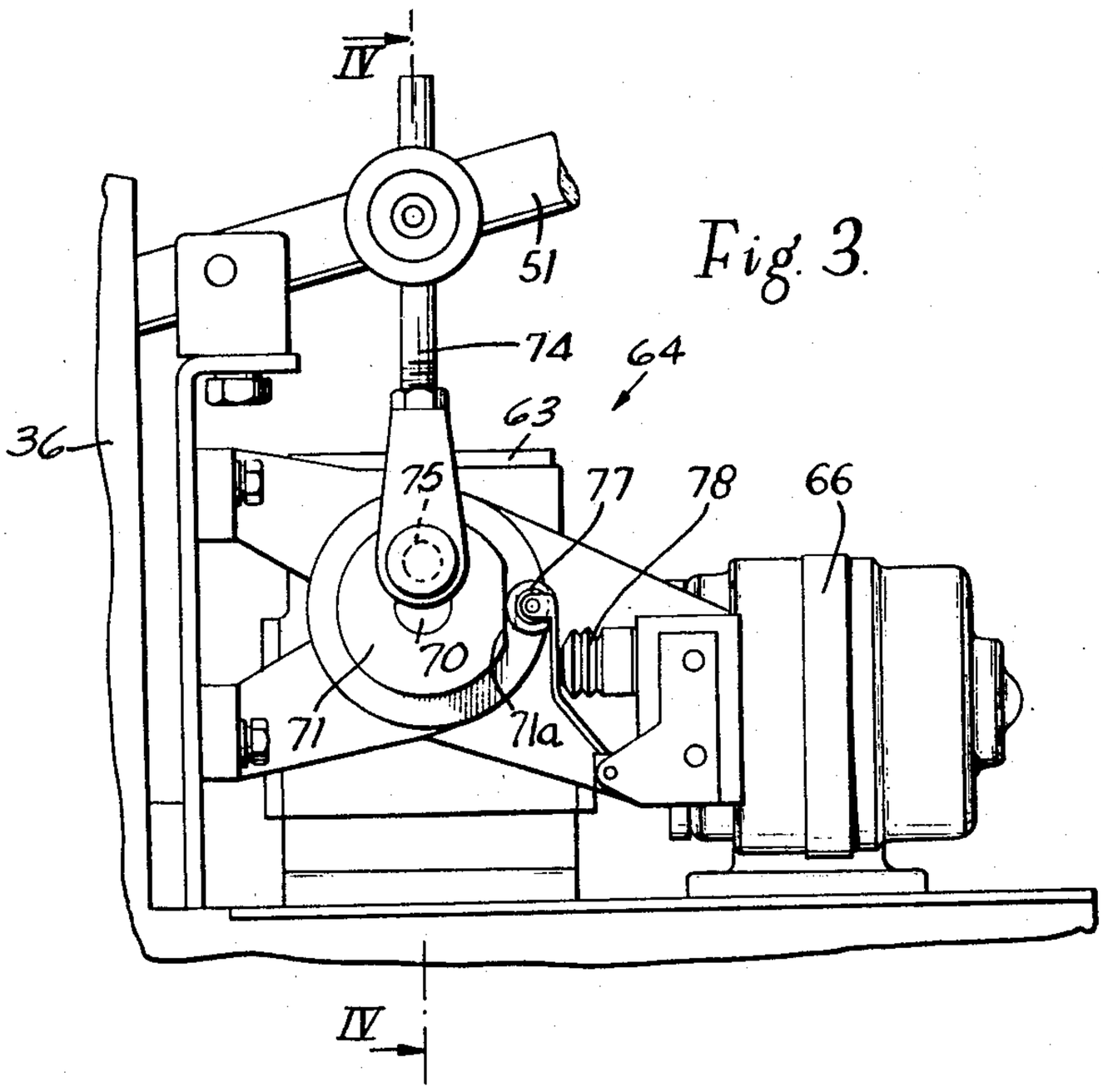
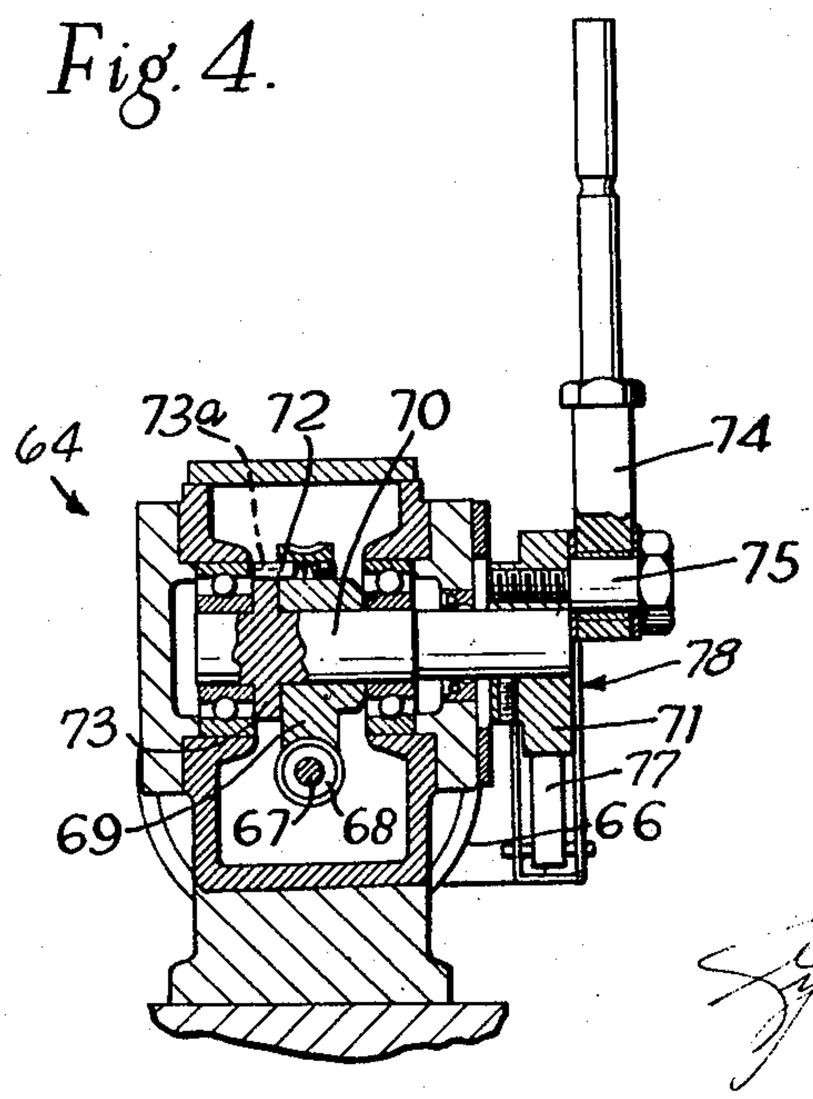


Fig. 3.

Fig. 4.



INVENTOR
Cyril George Pullin
BY
Ernest P. Walton
ATTORNEY

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AGITATOR DUMP TRUCK FOR CONCRETE AND OTHER SEMI-LIQUID MATERIALS

Filed Oct. 22, 1962 5 Sheets-Sheet 4

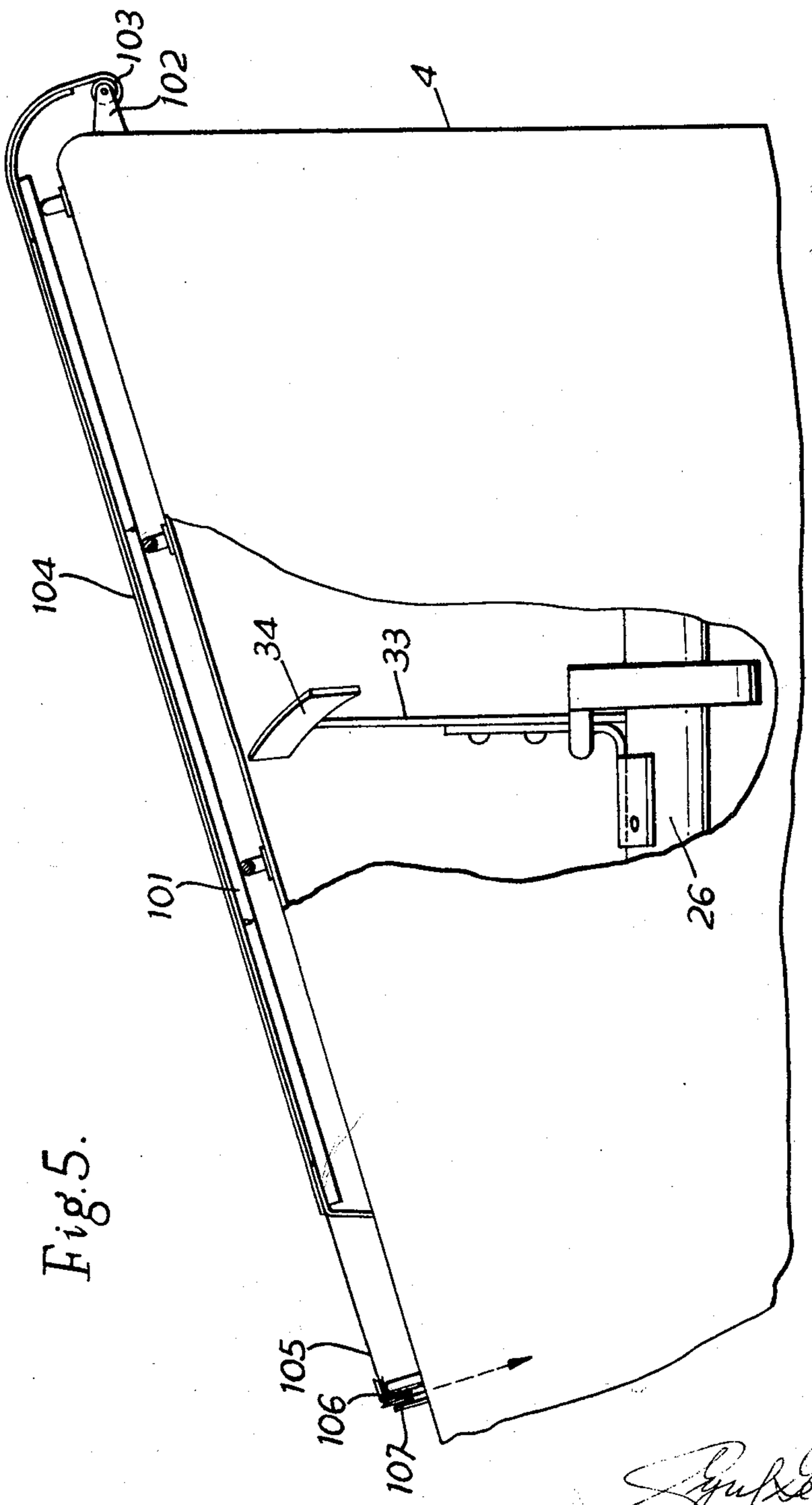

Fig. 5.

INVENTOR
Cyril George Pullin
BY
Edward Walton
ATTORNEY

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AGITATOR DUMP TRUCK FOR CONCRETE AND OTHER SEMI-LIQUID MATERIALS

Filed Oct. 22, 1962 5 Sheets-Sheet 5

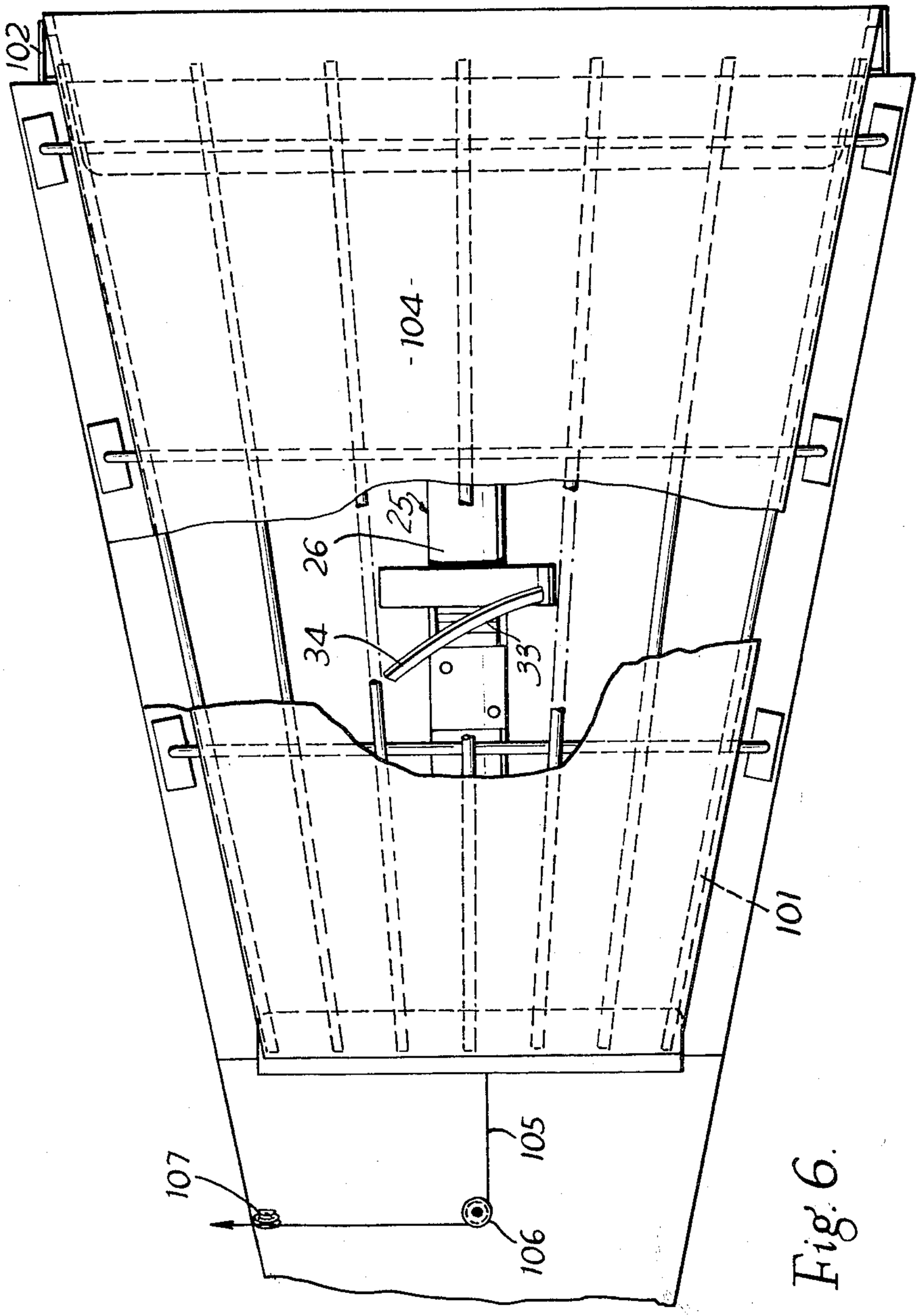

Fig. 6.

INVENTOR
Cyril George Pullin
BY
Edward Haffner
ATTORNEY

United States Patent Office

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3,180,628
AGITATOR DUMP TRUCK FOR CONCRETE AND OTHER SEMI-LIQUID MATERIALS

Cyril George Pullin, Shire Edge, Three Legged Cross, near Wimborne, England, assignor to Winget Limited, Kent, England

Filed Oct. 22, 1962, Ser. No. 232,119
Claims priority, application Great Britain, Oct. 24, 1961, 38,072/61
11 Claims. (Cl. 259—161)

This invention relates to agitator dump trucks and more particularly to dump trucks of the type having rotatable agitator means for maintaining the concrete mixture therein homogenous during the transport of freshly mixed concrete from a central mixing plant to a place of use.

As applied to the transport of mixed concrete, one such dump truck herein shown and described by way of example, comprises a tiltable body having a rounded bottom comprising an upwardly and rearwardly sloping portion which diminishes in radius towards a discharge opening at the upper rear end portion of the body. The agitator mechanism comprises a shaft which is turnable in the body concentric to the rounded bottom of the body and is provided with blades or paddles which sweep closely along the rounded interior surface of the body during the rotation of the shaft.

With known dump trucks, it is quite common, under certain loads of material such as zero slump concrete or the like, that agitation is not possible by continuous rotation of the agitator and its associated blades or paddles. Mixtures of materials that are so viscous which prevents them from flowing after contact by the blades or paddles introduces cavitation into the mixture and, in certain instances, the mixture becomes compacted against one end of the body, and rotation of the agitator and its associated paddles is therefore stopped. Also, with such trucks the discharge body or drum is always open at the top, with the result that moisture, due to rain, for example, can enter the body and cause the contents of the body to be brought to an undesirable consistency.

It is the object of the present invention to overcome these disadvantages.

According to one feature of the present invention means are provided for automatically alternating the direction of rotation of the agitator whereby mixture that has become compacted at one end of the body may be moved towards the opposite end of the body.

The rotation of the agitator may have an automatic control that will give a predetermined number of revolutions or part of revolution of the shaft and its associated blades or paddles in one direction, for example a clockwise direction which may be instantaneously reversed to an anti-clockwise direction again for a predetermined number of revolutions or part of a revolution.

Preferably, a chute is located adjacent the discharge opening and may be provided at its upper end with one or more spray nozzles. Also, one or more spray nozzles may be mounted adjacent the open top of the body.

The top of the body may be provided with closure means which is movable from an operative position, in which the closure means acts to close the opening in the top of the body, to an inoperative position in which the opening is opened.

The closure means may, for example, consist of a cover in the form of a roller blind made of flexible material and shaped to the shape of the opening in the top of the body and, when not in use, it may be wound upon a roller arranged at the front of the body and fitted with a tensator or spring device which may act to wind the cover on the roller when the rearward pull on the cover is released.

The cover may be pulled rearwards to close the opening in the top of the body by a pull-rope wound upon a winch drum, which latter may be manually, mechanically or hydraulically operated.

A preferred construction will now be described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic perspective side view of an agitator dump truck.

FIGURE 2 is a diagrammatic layout of the hydraulic and water supply connections.

FIGURE 3 is a side view of a reversing drive unit.

FIGURE 4 is a sectional view on the line IV—IV of FIGURE 3.

FIGURE 5 is a partial side view of the dump body with its central part broken away to show an agitator blade.

FIGURE 6 is a top view of the dump body showing a roller blind with part broken away to show the agitator blade shown in FIGURE 5, and

FIGURE 7 is a diagram of the electrical circuit for actuating the reversing-drive unit shown in FIGS. 3 and 4.

The drawings show a truck having a chassis 1 upon which a dump body or drum 2 is mounted, the body 2 being disposed rearwardly of a truck cab 3 and over the rear portion of the chassis 1 in a generally horizontal position.

The body is provided with a conical bottom portion 4 which slopes upwardly and rearwardly towards the discharge end 5 of the body 2, the larger end portion of the body being at the front of the truck and being closed by an end wall 4. With this construction when viewed from the side, the body 2 has the appearance of a truncated cone.

The top of the body 2 is open and at its rear discharge end 5 has a discharge opening 6 which is normally closed by a gate 7. The gate 7 has arms 7*a* which extend forwardly at both sides of the body 2 and are hinged at 8 near to the rear end of the body 2 so that the gate 7 may open and close the discharge opening 6. Near the bottom of its rear end, the body 2 is tiltable about two transversely-spaced pivot pins 9, each of which is mounted in a bracket 10 rising from and forming part of the main frame of the chassis 1. The body may be tilted out of its normal transit position by hydraulic means, and the discharge gate 7 may be power-operated.

In the construction shown in the drawings, the body 2 is tiltable upwards and downwards about the pivot-pins 9 by two hydraulic rams 11, the ram cylinders being pivoted at 13 (FIG. 2) to two spaced brackets (not shown) forming part of the main frame of the chassis 1. The upper end of the piston rod 14 of each hydraulic ram 11 is mounted upon a pivot 15 carried by a lug 16 mounted upon the body 2 forwardly of the pivot pin 9.

The gate 7 is also opened and closed by a hydraulic ram 17, the forward end of the cylinder of which is pivotally attached at 18 to the top of the body 2. The rear end of the piston rod 19 of the ram 17 is pivotally connected by a pivot pin 20 (FIG. 2) to a bell-crank lever 21 which is connected to the gate 7 by a pivot pin 22. The operation of the hydraulic rams 11 and 17 will be described later.

A chute 23 is connected to the brackets 10 and raised or lowered by a ram 24 as described later.

An agitator, generally indicated by the reference numeral 25, is mounted inside the body 2 upon a shaft 26, the rear end being rotatable in a bearing (not shown) carried by the body side walls and the front end 27 of which projects through a journal-bearing 4*a* in the front wall 4 of the body 2 (FIG. 2). Attached to the front end 27 of the shaft 26 is a wheel 28 which is connected by a chain 29 to a pinion 30. The pinion 30 is mounted on the out-

put shaft of a reduction transmission unit driven by a hydraulic motor 32, the whole being carried on body 2.

The agitator comprises a series of radial arms 33 (FIG. 5) each having a blade or paddle 34 at its outer end, the arms 33 being of such lengths that the outer edges of the paddles 34 sweep along and close to the rounded interior surface of the bottom of the body 2 during the rotation of the agitator shaft 26. The radial arms 33 are preferably of resilient material, such as spring steel, to allow deformation of the blades in the event of an obstruction building upon the internal wall of the body 2.

A spiral agitator blade 35 is also arranged near the rear end of the body 2 and is carried by arms 38 which are connected to and are spaced longitudinally along the shaft 26.

The motor 32 for driving the shaft 26 incorporates automatic control mechanism that will give a predetermined number of revolutions or part of a revolution of the shaft 26 and its associated blades or paddles in one direction, for example, a clockwise direction which may be instantaneously reversed to an anti-clockwise direction again for a predetermined number of revolutions or part of a revolution as described later.

Mounted on the chassis 1 are two hydraulic control valves 36 and 36*a* which are supplied with hydraulic fluid from a hydraulic reservoir 37 mounted behind the cab 3. The fluid is drawn from the hydraulic reservoir 37 through a conduit 40 (FIG. 2) by a tandem hydraulic pump 41 which is operated preferably by the engine of the truck-vehicle and is connectible and dis-connectible therewith. This pump 41 supplies the fluid through a conduit 42 to the control valve 36, and through a conduit 43 to a flow regulating valve 44. The fluid then passes through a conduit 44*a*, a fluid control valve 45 and a conduit 45*a* to a hydraulically operated water pump 46. Should the pump 46 not be in use, the fluid passes through a conduit 47 to a non-return valve 48, to combine with the non-regulated supply from the flow regulating valve 44 and passes through a conduit 49 to the control valve 36*a*.

The control valves 36 and 36*a* have a number of slide valves (not shown) therein, the valve 36 being operated by lever 51, which regulates the supply of the hydraulic fluid to the hydraulic motor 32, and the valve 36*a* being operated by levers 52, 53 and 54 which regulate the supply to the rams 11, 17 and 24 respectively. Should none of the rams 11, 17 or 24 be in use, the fluid to control valve 36*a* is passed through a non-return valve 50 to combine with the fiuid supply to control valve 36.

When the pump 41 (FIGS. 1 and 2) is inoperative the fluid may return by lines 32*b*, 36*b*, 45*b* and 46*b* (indicated by dotted outline) to the reservoir 37 from the motor 32, the control valves 36 and 36*a*, the valve 45 and the pump 46, respectively.

In use, when it is required to drive the agitator blades or paddles mounted on the shaft 26, the lever 51 of the hydraulic control valve 36 is moved to allow hydraulic fluid, under pressure, to pass to the hydraulically operated motor 32 through conduit 60 or conduit 61 depending on the direction of rotation to be imparted to the shaft 26. The motor 32 drives the pinion 30 which in turn by way of the chain 29 drives the wheel 28 mounted on the end of the shaft 26.

In the event of build-up of pressure of the mixture within the body 2, a resistance is imparted to the blades or paddles therein and this resistance is transmitted by way of the chain drive to the motor 32, so that the hydraulic fluid pressure being supplied thereto builds up to a predetermined pressure within the hydraulic motor 32, which affects an adjustable (or regulatable) pressure sensitive device of well known design 63 on the motor 32. A conduit 62 leads from the pressure sensitive device 63 to a micro-switch 63*a* of a reverse drive unit generally indicated at 64 in FIGURES 2, 3, 4 and 7. When the pressure of the hydraulic fluid in the conduit 62 exceeds a certain amount, it actuates the switch 63*a* which in turn initiates

the operation of an electric motor 66 (FIGS. 3 and 4) which drives a shaft 67 (FIG. 4) on which is mounted a worm 68 of the reversing-drive unit 64. The worm 68 drives a worm wheel 69, which is freely mounted on a shaft 70, and carries a spring loaded pin 72 which engages a cam wheel 73 rigidly carried by the shaft 70 and provided with two spaced lugs or stop abutments 73*a* on its periphery (see FIG. 4). Keyed to the shaft 70 is a second cam 71 to one side of which is attached an operating rod 74 by way of a crank pin 75. The rod 74 is connected, at 74*a*, to the control lever 51 as shown in FIG. 3. On actuation of the motor 66 the shaft 67 is driven and, when the spring loaded pin 72 engages one of the abutment stops 73*a* on the cam 73, the cam 73 and the associated shaft 70 are rotated.

A cam-follower 77 bears against the surface of the disc cam 71 having a flat or land 71*a* and, when the cam 71 has rotated one revolution, acts on a micro switch 78 to break the supply of current to stop the motor 66, when said follower 77 rides upon or is in contact with the land 71*a*.

When the agitators 34 and 35 have been set in rotation by operating the lever-handle 51 to proper position for this purpose, the pressure sensitive device 63 will detect increasing resistance of the concrete mixture, within the body 2, to the movement of the agitator therein; and, when a particular fluid back pressure in the motor 32 has been attained (for an example 1200 pounds per square inch), the device 63 will operate the micro-switch 63*a* to complete an electrical circuit to the motor 66. Previously, the motor 66 had remained de-energized because the micro-switch 78 was also open due to the fact that the cam-follower 77 was bearing upon the flat or land 71*a* of the cam 77. The pin 72 is so related to the abutment stops 73*a* (on the wheel 73) and said stops are so positioned to allow the lever 51 to be moved to one end position, when the rotation of the agitators 34 and 35 is first commenced by the operation of the lever handle 51.

Upon actuation of the motor 66, the wheel 69 is rotated and the pin 72 eventually engages one of two stops 73*a* on the cam 73. This draws the shaft 70 around with the wheel 69 and the crank 75 moves the rod 74 and the lever 51 from one end position, through the neutral position, to the other end position, so reversing the hydraulic motor 32.

The motor 66 continues to rotate and, after a short period in the reverse direction, the lever 51 is moved back to the original position and the agitator continues rotation in the first direction. When the lever 51 reaches its initial position, the flat 71*a* will have reached the cam-follower 77 again and will cause the release of the micro-switch 78. Then, provided the pressure sensitive device 63 is also released by a reduction in back-pressure in the motor 32, the electric motor will be switched off and the agitator will continue rotating. If, however, the agitator wheel meets an obstruction or resistance beyond predetermined amount, then the motor 32 will be reversed again by the pressure sensitive device 63, and this cycle will continue indefinitely until the obstructive resistance is cleared.

By changing the relationship of cams 71 and 73 and by varying the speed of rotation of the motor 66 by a rheostat 66*a*, it is possible for the reverse drive 64 to be set to give a clockwise rotation of 180° followed by an anti-clockwise rotation, also of 180°; alternatively the control mechanism may be set to give a clockwise rotation of 210° and an anti-clockwise angle of rotation of 170°. In other words, the number of revolutions or part of a revolution can be arranged to any specific requirement. It will be appreciated that with such a construction it is possible to arrange that the shaft may be set to turn, for example 2½ revolutions in a clockwise direction, and, for example 3½ revolutions in the anti-clockwise direction.

The control mechanism 36 may be operated alternately by a hydraulic motor which is supplied with hydraulic fluid by means of a shuttle valve of known design which

can be set to open for clockwise rotation of the shaft **26** with a time base cut-off unit prior to opening a port for an anti-clockwise rotation of the shaft. The shuttle valve controlling the ports for clockwise and anti-clockwise rotation may be reciprocated by any known means such as by solenoid valves, hydraulically-operated rams or shafts, cam shafts, crank shafts or any other suitable arrangement which produces the desired effect.

When it is desired to discharge the mixture from the body **2**, the control lever **52** is moved so that a slide valve (not shown) within the control valve **36***a* supplies pressurized hydraulic fluid by way of a conduit **80** to the lower end of rams **11** thus exerting a pressure behind the piston rods **14** with the result that the rods **14** extend from the rams **11** to lift the forward position of the body **2** about the pivot points **9**. At the same time, the lever **53** is moved to slide a valve (not shown) within the control valve **36***a* to direct pressurized hydraulic fluid by a conduit **82** to the rear end of the ram **17** thereby exerting a pressure on the rear face of the piston rod **19** to retract the rod **19** into the ram **17**. In this way the bell-crank lever **21** is pivoted about the pivot pin **22** and thus moves the gate **7** to pivot about pins **8** to open the discharge opening **6** of the body **2**. Also at the same time, the chute **23** is raised by fluid supplied by a valve controlled by lever **54** from the control valve **36***a* by a conduit **84** to the lower end of the hydraulic ram **24**. A fluid pressure is thus exerted behind a piston rod **85**, the rear end of which is pivotally attached at **86** to a bracket **87** mounted on the lower end by the chute **23**. The upper end of the chute is pivotally attached by a pivot pin **88** (FIG. 2) to the bracket **10**. In this way the chute **23** is moved into a position below the discharge opening **6** and guides the mixture being discharged to the desired location where the mixture is to be deposited.

When the discharge of the concrete, or other contents, from the body **2** takes place, to ease the flow of mixture from the body **2** and down the chute **23**, water or any desired fluid may be supplied to the body **2** and to the upper end of the chute **23** by the water pump **46**. In use, the manual control **45***c* is moved to a position which allows part of the pressurized hydraulic fluid from valve **44** to flow through conduit **44***a* control **45** and conduit **45***a* to drive the water pump **46**. The water is supplied from a tank **90** mounted on the chassis **1** through a pipe **91** to the water pump **46** which pumps the water by way of conduits **92** and **93** to a perforated spray pipe **94** mounted on the upper top-side of the body **2** and by way of conduits **92** and **95** to a spray nozzle **96** at the upper end of the chute, **23**.

When discharge has taken place and it is desired to lower the body **2**, the control lever **52** is moved so that the slide valve within control valve **36***a* supplies fluid by way of a conduit **97** to the upper end of the rams **11** so that the pressure moves the piston rods **14** into the rams and so lowers the body **2**.

The gate **7** is closed by the lever **53** operating the valve supplying fluid to conduit **82** being moved so that fluid is supplied by a conduit **98** to the forward end of ram **17** thus exerting a pressure on the forward face of piston rod **19** thereby moving the piston rod **19** rearward and forcing any fluid on the rear face of piston rod **19** to return by way of conduit **82** to the control valve assembly **36**. The extension of piston rod **19** moves the bell crank lever **21** about pivot **22** thereby enclosing the gate **7**.

The chute **23** is lowered by moving the control **54** to move the associated slide valve so that the fluid may return under gravity through conduit **84** to the control valve **36**.

Mounted to the open top of the body **2** is a grill **101** which acts as a guard (FIGS. 1, 5 and 6). Attached to the forward end wall **4** and to the opposite sides of the body **2** are a pair of lugs **102** between which is located a roller **103** on which is mounted a roller blind or tarpaulin **104**. The roller **103** may be spring biased so that the

blind **104** tends to be wound on the roller **103**. To the rear end of the blind **104** is attached a cord **105** which passes round a roller **106** and over a jockey pulley **107** which may incorporate a locking device for retaining the cord **105** in any predetermined position. By pulling on the cord **105**, blind or tarpaulin **104** may be pulled over the grill **101** and provides a shield over the open door of the body **2**. The free end of the cord **105** may be connected to a motor or any convenient means whereby the cord is pulled or released depending on whether the top of the body is to be closed or open.

I claim:

1. An agitator dump truck having a contents-retaining body thereon and means for discharging the contents of the body therefrom; an agitator mechanism having a shaft rotatably mounted in the body and positioned generally longitudinally thereof and provided with agitators thereon that agitate the contents within the body during rotation of said shaft; a power-driven means for rotating said shaft; and a reversing-drive control means operatively connected with said power-driven means and including instrumentalities responsive to a predetermined pressure-resistance of the contents in said body to the movement of said agitators for automatically reversing the direction of rotation of said shaft for a selected amount of angular movement of said shaft.

2. An agitator dump truck as set forth in claim 1, wherein the power-driven means is a hydraulically operated reversible motor connected in a pressurized hydraulic fluid supply line; and wherein said means for automatically changing the direction of rotation of said shaft includes a switch means in said fluid supply line which is pressure sensitive to the pressure in said supply line, when a predetermined pressure in said line is exceeded, and, further, includes instrumentalities set in motion by said switch means to cause said predetermined reverse rotation of said shaft.

3. An agitator dump truck, according to claim 1, wherein the body is tiltably mounted on the truck and provided with a discharge opening at its rear end portion, a chute located adjacent to the discharge opening for cooperating therewith when the body is tilted, at least one liquid spray-nozzle mounted at the upper end of the chute, a liquid supply tank mounted on the truck, a conduit connecting said tank and nozzle, a hydraulically operated pump mounted on the truck and connected in said conduit between said tank and nozzle and, further, connected to a hydraulic fluid pressure supply line to actuate said pump, and means for controlling the hydraulic fluid to the pump for controlling the operation of said pump.

4. An agitator dump truck according to claim 3 wherein there is at least one liquid spray nozzle mounted adjacent the top of the body connected with liquid discharge from said pump.

5. An agitator dump truck according to claim 1 wherethe agitators are mounted on deformable rods radiating from said shaft.

6. An agitator dump truck according to claim 5 wherein the deformable rods carrying said agitators are spring steel members.

7. An agitator dump truck according to claim 1 wherein certain of said agitators are blades in the form of spiral members mounted on deformable rods projecting from the shaft.

8. An agitator dump truck having a contents-retaining body thereon and means for discharging the contents of the body therefrom; an agitator mechanism having a shaft rotatably mounted in the body and provided with agitators positioned to agitate the contents within the body during rotation of the shaft; power-driven means for rotating said shaft; and a reversing-drive control means operatively connected with said power-driven means for causing said driven-means to actuate said shaft in either of opposite directions of rotation selectively, a regulat-

ing means for controlling the operation of said reversing-drive control means including an adjustable pressure sensitive device responsive to a predetermined pressure-resistance of the contents in the body to the movement of said agitators and, further, including means controlled by said pressure sensitive device for automatically actuating said reversing-drive control means to reverse the direction of rotation of said shaft for a selected amount of angular movement of said shaft and then move said reversing-drive control means to its initial operative position.

9. An agitator dump truck as set forth in claim 8, wherein the power-driven means is a reversible hydraulic motor; wherein the reversing-drive control means comprises a reversing valve, having two operative positions and a neutral shut-off position, connected in a pressurized hydraulic fluid line between the power-driven means and a source of pressurized hydraulic fluid, manual operable means for actuating said reversing-value control means to either of its three positions; and wherein the regulating means comprises a switch in an electrical circuit controlling an electric motor, a reduction transmission gearing actuated by said electric motor and including a time camming means and a crank at its output end, an operative connection between said crank and said manual operable means of said reversing-valve to operate the latter from one operative position to the other operative position, the pressure-sensitive device being connected between said power-driven means and said switch for actuating the electric motor, and a second switch in circuit with said electric motor and actuated by said camming means to de-energize said motor at a point in the movement of said camming means when said reversing drive control means is in its initial operative position, whereby the cycle may be repeated according to the detection of the pressure sensitive device.

10. An agitator dump truck having a tiltably mounted contents-retaining body thereon, provided with an open-top and a round bottom wall sloping upwardly and rearwardly with rearwardly diminishing radii and terminating in a discharge opening at its upper end portion; an agitator mechanism having a shaft which is rotatable in the body concentric to the rounded bottom of the body and provided with blades or paddles which sweep around the interior surfaces of the body during rotation of the shaft; a hydraulically operated motor for driving the agitator mechanism connected to a reversing-drive control means actuated by the hydraulic fluid supplying the motor, when a predetermined pressure of said hydraulic fluid is exceeded; and a micro-switch actuated by the exceeded pressure of said hydraulic fluid to initiate the operation of said reversing drive means for alternating the direction of rotation of the agitator shaft.

11. An agitator dump truck having a tiltably mounted contents-retaining body thereon, provided with an open-top and a round bottom wall sloping upwardly and rearwardly with rearwardly diminishing radii and terminating in a discharge opening at its upper end portion; an agitator mechanism having a shaft which is rotatable in the body concentric to the rounded bottom of the body and provided with blades or paddles which sweep around the interior surfaces of the body during rotation of the shaft; a hydraulically operated motor for driving the agitator mechanism connected to a reversing-drive control means actuated by the hydraulic fluid supplying the motor, when a predetermined pressure of said hydraulic fluid is exceeded; and a micro-switch actuated by the exceeded pressure of said hydraulic fluid to initiate the operation of said reversing drive control means; said reversing control drive means including an electric motor which indirectly drives a cam connected with said reversing means and which in turn, when moved to a predetermined position, actuates another micro-switch to stop the electric motor until again initiated from said first micro-switch.

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WALTER A. SCHEEL, *Primary Examiner.*