MECHANISM FOR DISCHARGING CONCRETE

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This invention relates to a mechanism for discharging concrete at a selected place for pouring and, more particularly, it relates to the combination of such a discharge mechanism with a self-propelled concrete mixer.

It has become a widespread practice to mount a bowl or drum onto the chassis of a vehicle in order that concrete can be mixed enroute from the place of loading to the place where the concrete is going to be poured. The mobility offered by such practice produces substantial economy in the production of the concrete and also in speeding up construction time because the vehicle can be rapidly moved to the place of use and there discharged of its contents for building purposes. It is the present practice, at the place where the concrete is poured, to discharge the concrete from the mixing drum into a chute which can be manually directed horizontally by a contractor's assistant so that, with the help of the driver who can move the vehicle from one site to another, the two persons can together produce a distribution of the concrete minimizing further handling of the concrete by a concrete finisher. Obviously, to the extent that the concrete can be discharged and more generally distributed at the work site by the concrete mixer, there is a facilitating of the finishing operation. This combination of a driver and contractor's assistant who is necessary for manually directing the discharge chute horizontally is a standard practice in the art and is frequently a two-man operation.

In order to facilitate discharge of the concrete at the point of use, it has become an established practice to dispose the discharge chute at the forward end of the vehicle so that the driver can be in full view of the pouring site and thereby more accurately maneuver the vehicle to the proper point of discharge. In this manner the discharging or pouring of the concrete can take place more rapidly, as well as more accurately, and there is minimized the possibility of spillage and of pouring of the concrete at any location other than the correct one.

It is one of the objects of the present invention to provide an improved discharge mechanism in the form of a readily operable chute which can be operated from the cab of the vehicle or other convenient location so that the concrete can be more conveniently poured at the desired point by horizontally power-actuating the chute to the desired location where the pour is intended.

It is a further object of the present invention to provide a chute or other cement discharge guide means which can be remotely power actuated both vertically and accurately so that, taking into account the mobility of the vehicle, it is possible to discharge the concrete at any of various locations and levels at the exact point of use. Thus, assuming that the concrete is to be discharged within a form located above ground level, the chute needs only to be raised the necessary amount, then swung accurately in a horizontal plane and, if need be, thereafter and/or concurrently moved by the self-transporting mixer; the drum is then discharged. The vehicle thus transports the concrete to the approximate location of use and the chute is then operated similarly to a boom on a derrick, receiving the flow from the mixing drum and directing it to the proper place, i.e., within a form constituting a floor, column, beam or other portion of a building structure.

In the present invention we provide a controlled volume of hydraulic fluid flow so that when the chute is moved, such movement is not excessively accelerated and the order of speed is within a range not likely to produce damage to the apparatus. Moreover, the hydraulic actuating system includes a free floating condition in which no resistance is offered, or relatively little resistance is offered for manually operative movements of the chute.

In translating movement of the hydraulic motor to mechanical movement, there is included a novel pulley arrangement in which only slight movement of the motor components will produce substantial movement in the mechanically operated component, thus making possible a substantially shorter stroke of the fluid motor actuator. If desired, there can also be incorporated into the fluid actuating system, a "metering" action in which the control valve gradually increases and decreases the rate of fluid pressure buildup so that the system is not subjected to forceful abrupt movements which may be dangerous to workers or cause damage to the equipment.

It is an important feature of the present invention that we can effect discharge of the concrete at a faster and more convenient rate and the operation of discharging can be done by remotely controlled power means used in conjunction with a maneuvering of the vehicle. The operation therefore is much more economical by eliminating the previously required helper who manually adjusted the chute, moving it to whatever location is needed for discharge. In the present invention, however, the vehicle operator simply drives the vehicle to the approximate point of use and then operates the chute either from within the cab or other convenient location by power-actuated means to the proper point where the concrete will discharge at the precise location of use. The vehicle can, of course, be maneuvered while the concrete is discharging in order to effect a spreading action which reduces the manual spreading effort of the concrete finisher. The entire operation is accurate, convenient and more economical and the structure for effecting this operation is relatively inexpensive both to manufacture, assemble and service.

Other objects and features of the present invention will become apparent from a consideration of the following description which proceeds with reference to the accompanying drawings, wherein:

FIGURE 1 is an isometric view of a self-propelled concrete mixer having the discharge mechanism of the present invention incorporated therein.

FIGURE 2 is a top view of the loading hopper and discharge mechanism, illustrating in full and dotted views the various positions at which the chute can be moved during the discharge operation.

FIGURE 3 illustrates the actuating mechanism for moving the chute together with the control valve and associated hydraulic actuating structure.

FIGURE 4 is a fragmentary view of the hopper and depending structure including a portion of the chute and bearing.

FIGURE 5 is an enlarged isometric view of the bearing with a portion broken away to illustrate the complementary bearing sections; and,

FIGURE 6 is a detail view of the spool valve located within control valve housing indicated in FIGURE 3 for controlling the ports which establish fluid pressure communication between the fluid motor and the chute and the pump producing such actuating pressure.

Referring now to the drawings, and particularly to FIGURE 1, there is provided a bowl or mixing drum 10 mounted on a self-propelled vehicle 12 having ground engaging wheels 14 which adapt the vehicle for moving over rough terrain which is often encountered at building sites. The vehicle is driven from a cab 16 and the drum is adapted for turning on spaced Trunnion Rollers 18 which support turning movement of the drum through a trunnion tire 20.
The concrete which is mixed within the mixing drum 10 is discharged at the forward end of the drum into a discharge hopper 22 after it has been thoroughly mixed en route to or at the worksite and the charge in the mixing drum was added to the mixing drum through a charging hopper 24.

The present invention is primarily directed to the convenience of efficiency with which the concrete can be removed from the mixing drum and directed to the point of use. The discharge hopper 22 is supported at the over head position on the cab by means of a column-and-brace assembly 25 supported at its bottom on the chassis 26. An apron 30 which projects forwardly of the cab serves as a platform on which an operator can stand and also serves as a shield. The discharge hopper 22 has secured to it a mounting ring 31 defining a discharge opening 34 at the approximate center thereof through which the concrete is discharged. Surrounding the discharge opening 34, and bolted to ring 31, is a bearing ring 36 secured in a suitable manner, so as by a ring of spaced bolts 38 securing the bearing ring to said mounting ring 31. The bearing ring provides a flat annular bearing surface 33 on which, for pivotable movement, a complementary bearing 48 having a flange 50 which slidesably moves on the external surface of the bearing ring 36. The annular movable bearing includes a groove 51 with a cable 52 passed into the groove and positively driving the movable bearing 48 on its associated annular bearing surface. There depends from the annular bearing ring 48 and secured to flange 50 thereof by bolts 53, a rubber vertical chute section 62 which guides the outflow of concrete and a boom chute section 62 having pivot pin connections 61 with lugs 56 of the rotatable bearing 48 (FIGURES 4, 5) whereby the vertical chute section 56 and boom chute section 62 are arcually movable in the direction of the double arrow-headed line 64 (FIGURE 4) when the movable bearing 48 is actuated by cable 52.

In order to confine all of the discharge of the concrete under the boom chute section 62 as it passes out of the opening 34 there is included a flap apron 69 which is also attached to the bearing 48 and moves therewith. As the coupler is withdrawn from the boom chute section 62, the apron is lifted and offers no resistance to the discharge movement of the concrete.

The vertical plane angular position of the boom chute 62 on its mounting lugs is determined by a power cylinder 68 pivotally connected by an articulated connection 73 (FIGURE 1) at the forward end of the chassis 26 having a piston rod 70 which can be moved in an extending direction to pivot the boom chute 62 upwardly in the direction of the arrow 72 and retracted in the direction of the arrow 74 to lower the boom chute 62 on its support lugs. At the end 80 of the boom chute is a chute extension 82 which extends the reach of the boom, this section 82 being normally folded upwardly in the direction of the arrow 84 to rest within section 62 of the boom chute. During transit, the extension section 82 is pivoted back onto chute 62 and both interconnected chute sections are pivoted aside to the dotted line position 86 (FIGURE 2) so as to give the vehicle driver a full unobstructed view ahead of the vehicle.

The stroke of the power cylinder 68 is sufficient so that the vehicle driver has a substantial vertical range within which the concrete can be discharged. For example, at some power stroke, it is desirable to make the power cylinder directing the boom chute move directly within the column or beam or whatever other structure is undergoing fabrication. The feature is that the vehicle operator can easily and conveniently pivot the chute to whatever position is desired by the operation of the power cylinder.

The articulated connection 73 with the vehicle not only permits the chute to move angularly in a vertical plane but also, by reason of its universal connection with the chassis, permits the chute to be concurrently swung arcuately by means of the coacting annular bearings 48 and 56. In this way the operator has conveniently available to him a means for not only raising and lowering the chute but of swinging it within the purview of about 180° with respect to the vehicle. Thus, referring to FIGURE 2, the cable 52 is capable of moving the bearings and therefore the chute through approximately 180°. It is so provided, however, that the limit of angular movement in a horizontal plane is limited such movement is so provided that the chute cannot move into contact with a part of the vehicle and its transmission damage to either the vehicle or the discharging mechanism.

The angular movement which is produced by the cable 52 is produced by double-acting, double-ended power cylinder 90 (FIGURE 3). The double-acting, double-ended power cylinder 90 has a piston (not shown) therein adapted to effect extended and retracted movements of the righthand end 92 and lefthand end 94 of piston rod 93. The piston rod has respectively secured to ends 92, 94 pulleys 95 and 96 with cable ends 98 and 100 passed over the respective pulleys. Each cable end is secured to lugs 102 on the channel member 103 and is passed over the pulleys 95, 96, thence over change-direction pulleys 108 and 110. The cable 52 is wrapped over the groove 51 in the rotatable bearing 48 and is secured thereto by lugs 112 and 114.

When a spoon 127 within valve housing 120 (FIGURE 6) is positioned so that fluid pressure is admitted through line 122 so that fluid moves in the direction of the arrow 124 and the piston within cylinder 90 is moved to the left, fluid is exhausted from the lefthand side of piston (not shown) within cylinder 90 through line 126 in the direction of the arrow 128 and such fluid is transmitted through reservoir line 130 to the reservoir 132. Conversely, when the spoon is moved in a direction so that fluid under pressure from pump 134 and supply line 136 is admitted to line 126 so that fluid under pressure is communicated in the direction of the arrow 140, the piston (not shown) within cylinder 90 is moved toward the right and fluid is exhausted through line 122 in the direction of the arrow 142 such exhausting fluid is transmitted through line 130 to the reservoir 132. By thus positioning the spoon in housing 120 through a spoon stem 150 and hand the forward end of a cylinder 90 is moved in the direction of the arrow 150, the boom within the cabin of the vehicle, it is possible to pivot the rod end 92 and pulley 95 in the direction of the arrow 180 thus pulling its cable section 186 so that the bearing 48 and its attached vertical chute and boom chute 62 is swung clockwise (FIGURE 2). Conversely, when the handle 152 is operated so as to position the spoon valve in the valve housing 120 to connect the pressure line 136 with line 122 causing fluid to move in the direction of the arrow 124 and the piston within cylinder 90 is moved toward the left, the piston rod 94 and pulley 96 are moved in the direction of the arrow 190 and the cable length 100 which is wrapped over the bearing 48 within the groove 51, moves the bearing 48, the attached vertical chute and boom chute 62 counterclockwise (FIGURE 2). In this case the line 126 is connected to exhaust line 130 and exhausting fluid is moved in the direction of the arrow 192.

The handle 152 is moved to position D which is the free float position wherein both lines 122 and 126 are connected to reservoir 132 through line 130. The chute can then be freely moved.

Once the desired angular position of the boom is reached, the handle 152 can be positioned so as to lock off communication of either of the lines 122 or 126 with pressure line 136 and exhaust line 130. Thus the piston within cylinder 90 is locked in position and the boom chute 62 is similarly locked in position.
There is thus available to the operator power means through the handle 152 to lock the chute and to rotate the chute angularly in one direction or the other to direct the location of the discharge of concrete during the pour.

Within housing 120 the control ports 129 are regulated by spaced lands 131 of spool valve 127, said lands having chamfered shoulders 135 (FIGURE 6A) so that when pressure line 136 or exhaust line 130 are connected to lines 122 and 126 the rate of pressure buildup and the rate of fluid exhausting is moderated thereby preventing sudden movements of the equipment.

The operator also has available him a second handle 160 which operates through a valve stem 162, which valve is movable by pivoting the lever 160 on its pivot pin 164, thereby connecting fluid line 168 with pressure line 136 or exhaust line 130. When the line 168 is connected to the pressure line 136 the piston rod 70 is moved upwardly in the direction of the arrow 170, thereby raising the boom chute 62 by pivoting it on pin 61 of mounting lugs 58, which, as previously described, are secured to the bearing 48. Conversely, when line 168 is connected to exhaust line 130 the piston rod 70 is moved downwardly within the cylinder 68 in the direction of the arrow 172, thus lowering the chute. By a combination of movements of the handles 152 and 160, and also by maneuvering the steerable mobile vehicle from the cab, the operator can, without additional assistance locate the pour, however desired.

It should be noted that there is a two-strand pulley connection between each pulley wheel 95, 96, and its associated cable 98, 100, which means that for each increment of movement of the piston and piston rod end 92, 94 there is twice that movement of the associated cable and hence movement of the chute. As a result, the stroke length of the piston, and the length of the cylinder 60 does not have to be excessive in order to provide for the proper range of movement for the chute.

In addition, the operator can move the vehicle while the pour is occurring in order to better distribute the pour and make the job of finishing as easy as possible. The location, distribution and accuracy of pouring is thus substantially improved and with a single operator rather than an operator-and-helper combination.

Operation

In operation the chute extension 82 is first pivoted out of its nested position within the chute section 62, the extension being fully in position when a sector portion 180 contacts the undersurface of the end chute 62 and is thus spool rod 150 to communicate pressure line 136 with line 122, causing the fluid to move in the direction of the arrow 124 and the piston rod 94 together with pulley 96 is moved to the left (FIGURE 3), that is, in the direction of the arrow 200. To permit this movement fluid is exhausted from line 126, said line 126 being connected with the exhaust line 130 to the reservoir 132. The pulley 96 is moved to the left (arrow 200, FIGURE 3), pulling cable length within the groove 51 and the bearing 48 and its attached boom chute is pivoted counterclockwise (FIGURE 2).

In the manner described, the operator can by means of lever 152 move the chute clockwise or counterclockwise is a horizontal plane and then pivot the chute upwardly or downwardly by means of lever 160; both these actions together, with the movement obtainable by steering the vehicle, make it possible to accurately control the place of making a pour. Also, during the pour the chute and vehicle are movable in order to better distribute the pour and in the case that a concrete pour is being made for a floor, reducing the distributing of the concrete necessary by the finisher.

Another important advantage of the invention is that from the same bowl or drum several pours can be made at different building sites. The invention makes it possible to produce a pour in a shorter period of time and therefore the vehicle can move more rapidly from one building site to the next in completing the appointed round without the concrete setting or hardening.

The boom chute section 62 and its chute extension 82 nested therein are pivoted to one side as indicated in FIGURE 2 and raised so that the vehicle driver has unobstructed vision during transit.

Referring to the hydraulic system (FIGURE 3) the line 136 includes a bypass line 180 having a return connection with reservoir 132. The control valve 184 which is located adjacent to control valve 134, is operated so that a controlled fluid flow is communicated through line 136 to the power cylinder 90 through either line 126 or line 122. The bypass line 180 receives the overflow so that the rate of movement of the chute by the power cylinder 90 will not be in excess of a predetermined rate of actuation.

Although the present invention has been illustrated and described in connection with a single example embodiment, it will be understood that this is illustrative of the invention and is by no means restrictive thereof. It is reasonably to be expected that those skilled in this art can make numerous revisions and adaptations of the invention, and it is intended that such revisions and adaptations will be included within the scope of the following claims as equivalents of the invention.

We claim:

1. A self-propelled concrete mixer, comprising a rotatable drum, a discharge hopper for receiving an outflow of the concrete received in said drum, said hopper having a central opening providing a discharge outlet for said discharge hopper, rotatable means supported on said bearing means, an articulated support, a chute supported on said articulated support for angular movement in a vertical plane whereby the end of said chute is raised and lowered on said articulated support, operated by a first actuator means operatively connected with said chute to effect movement in a raising and lowering direction on its associated articulated support, second actuator means operatively combined with said rotatable means to effect operation thereof, said second actuator means-
including a power cylinder, actuable piston means within said power cylinder and having a pulley wheel respectively disposed at each end of said power cylinder, an elongated flexible force transmitting means to effect operation of said rotatable means, each of said pulleys having an operative connection with said flexible force transmitting means to communicate actuating torque on said rotatable means responsive to movement of said piston means, and an operator-controlled valve means for operating said second actuator means whereby said chute is movable accurately in a horizontal plane to direct the discharge end of said chute.

2. A self-propelled concrete mixer in accordance with claim 1 wherein said second actuator means is comprised of a double-ended double-acting fluid motor actuator, and means for selectively energizing said second actuator means to control the accurate direction of operation of said chute.

3. A self-propelled concrete mixer in accordance with claim 1 wherein said second actuator means is comprised of a double-ended double-acting fluid motor actuator, and means for selectively energizing said second actuator means to control the accurate direction of operation of said chute.

4. A self-propelled concrete mixer in accordance with claim 1 wherein said bearing means provides a flat annular bearing surface and the rotatable means is disposed in sliding relation thereon.

5. A self-propelled concrete mixer in accordance with claim 1 wherein said actuator means includes a surrounding groove and a cable received in said groove and driving said bearing means.

6. A self-propelled concrete mixer in accordance with claim 1 wherein said operator-controlled valve means includes a spool valve having spaced lands with chamfered edges, and control port means controlled by said lands to effect a gradual buildup of fluid pressure for operating said actuator means.

7. A self-propelled concrete mixer in accordance with claim 1, including hydraulic fluid means having an internal flow regulating valve whereby said rotatable means is actuated at a controlled rate together with the chute supported thereon.

8. A discharging mechanism for soft concrete and like material comprising:

(a) a drum mounted for rotation, said drum having an opening for discharging material therefrom;

(b) a discharge hopper positioned for receiving material discharged from said drum opening, said discharge hopper having an opening for discharging material therefrom;

(c) bearing means positioned generally beneath said discharge hopper, said bearing means having an opening therethrough that is substantially aligned with said hopper opening, said bearing means further having a portion that rotates in a generally horizontal direction around said hopper opening and said bearing means opening;

(d) an elongated chute having an intake end and a discharge end;

(e) means fastening said intake end of said chute to said rotatable portion of said bearing means so that said chute can be pivoted in a generally vertical direction about said fastened intake end, said intake end of said chute being positioned generally beneath said hopper opening and said bearing means opening for receiving material that is discharged from said drum opening and that passes through said hopper opening and said bearing means opening, said chute extending away from said fastened intake end so that said discharge end is spaced from said discharge hopper;

(f) a chute support having an operator-controlled element for changing the effective length of said chute support;

(g) means fastening one end of said chute support to a fixed location to permit said chute support to be pivoted horizontally and vertically about said fixed location;

(h) means fastening the other end of said chute support to said chute at a location between the ends of said chute to permit said chute and said chute support to pivot relative to each other whereby the position of said chute is in a generally horizontal direction can be varied by the effective length of said chute support;

(i) first and second flexible cables each having one end fastened to said rotatable bearing means portion and each having the other end fastened to a fixed location;

(j) and operator-controlled pulley means interposed between said ends of said cables for simultaneously pulling on one of said cables between its ends and for permitting the other of said cables to be pulled between its ends, whereby said bearing means portion and said chute can be moved in a generally horizontal direction.

9. The discharging mechanism of claim 8, wherein said operator-controlled pulley means comprises a hydraulic system and a spool valve having means for effecting throttling flow whereby the initial actuation of said chute is dampened.

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