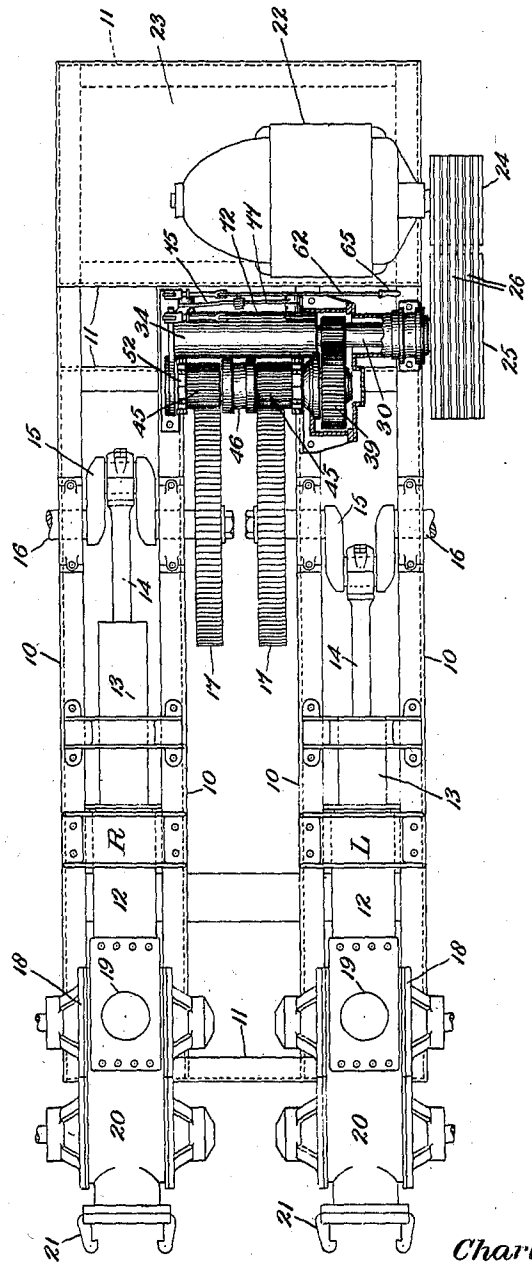
Nov. 16, 1943. C. F. BALL 2,334,375

MULTIPLE UNIT CONCRETE PUMP DRIVE

Filed Dec. 27, 1940 3 Sheets-Sheet 1

Fig. 1.



Inventor
Charles F. Ball,

By

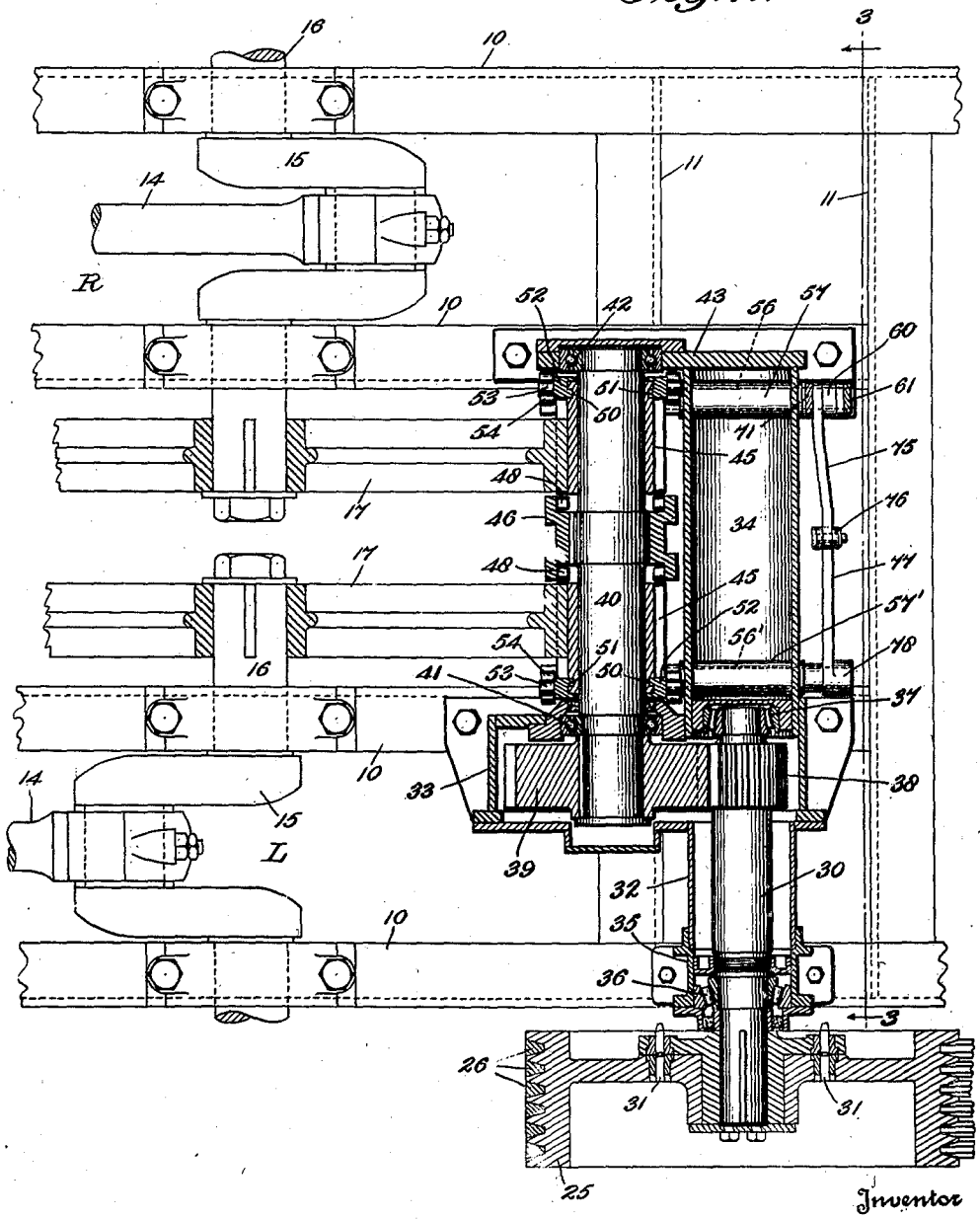
Attorney

Nov. 16, 1943. C. F. BALL 2,334,375

MULTIPLE UNIT CONCRETE PUMP DRIVE

Filed Dec. 27, 1940 3 Sheets-Sheet 2

Fig. 2.



Inventor

Charles F. Ball,

By B. B. Collings

Attorney

Nov. 16, 1943. C. F. BALL 2,334,375

MULTIPLE UNIT CONCRETE PUMP DRIVE

Filed Dec. 27, 1940 3 Sheets-Sheet 3

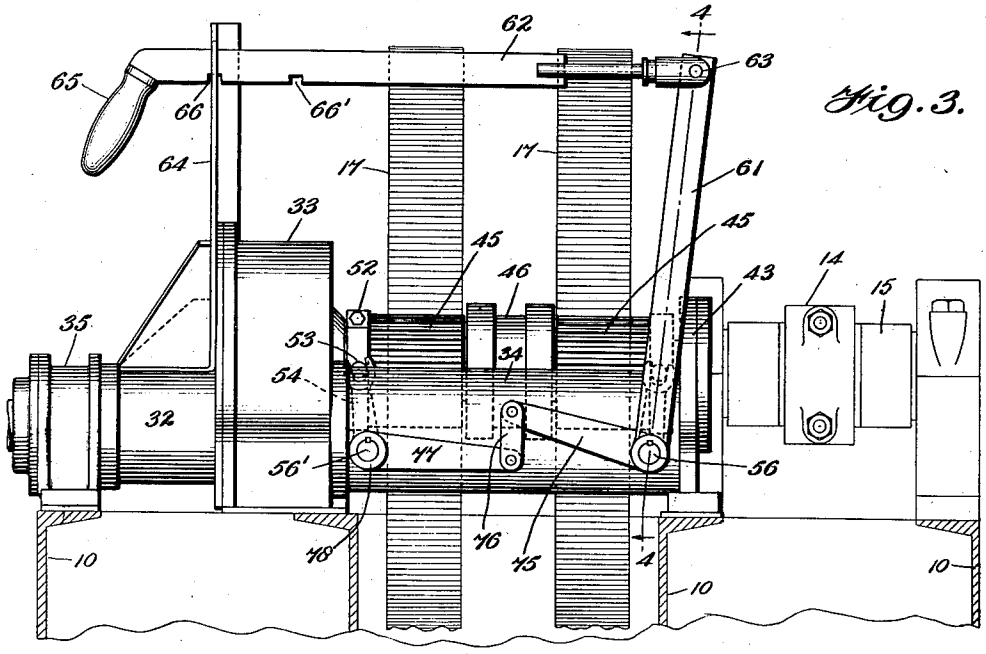


Fig. 3.

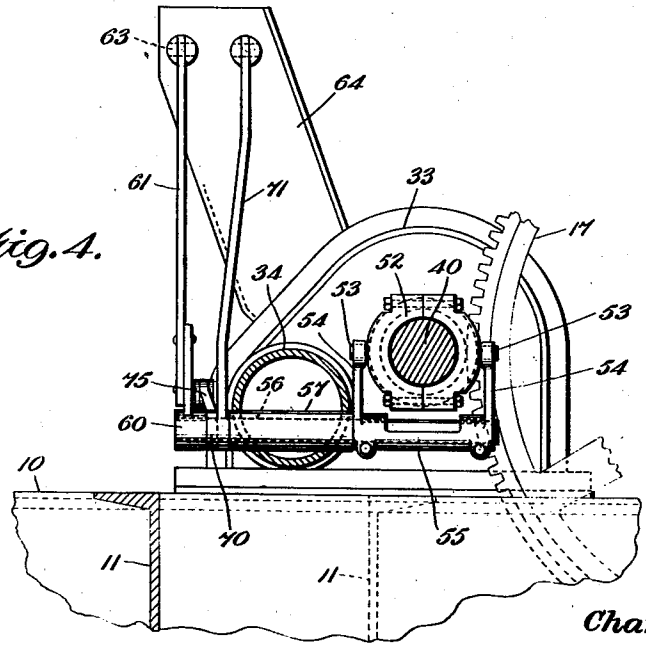


Fig. 4.

Inventor

Charles F. Ball,

By B. B. Collings.

Attorney

Patented Nov. 16, 1943 2,334,375

UNITED STATES PATENT OFFICE

2,334,375

MULTIPLE UNIT CONCRETE PUMP DRIVE

Charles F. Ball, Wauwatosa, Wis., assignor to Chain Belt Company, Milwaukee, Wis., a corporation of Wisconsin

Application December 27, 1940, Serial No. 371,963

2 Claims. (Cl. 192—48)

The invention relates to multiple unit concrete pump drives, and has for its principal object to provide a simple and effective drive mechanism whereby the working elements of the individual units of a multiple unit concrete pump may be selectively connected to and disconnected from a common source of power for said units.

Single unit pumps of the type to which the invention is particularly applicable are generically disclosed and claimed in the prior U. S. Patent No. 2,017,975, granted October 22, 1935, to Jacobus C. Kooyman, and in my prior U. S. Patent No. 2,062,200, granted November 24, 1936, and to the limits of their capacities of from 15 to 33 cubic yards per hour, have proven very efficient in the pressural pipe line transportation of plastic concrete mixtures. For structural and other reasons it is not very practical to increase the capacities of single unit apparatus of this type materially beyond those above mentioned, and therefore when such increased capacities are essential it is customary to provide it by means of double or multiple unit machines, in which two or more units are mounted side by side on a single frame and driven from a single source of power, such as a gasolene engine or electric motor.

When concrete up to the capacity of these multiple unit machines is desired at a single point, it is the usual practice to combine the separate streams of mixture issuing from the individual pumping units into a single stream which is piped to the desired point. In some instances however, it may be of advantage to have simultaneous discharge of the mixture at two or more points, in which case a separate pipe line may be run from each unit to one of the discharge points. With such a set up it may become necessary to interrupt the discharge at one point while continuing it at others, and the present invention enables this to be quickly and easily done by disconnecting one pumping unit from the source of power, thereby throwing it out of operation, while the remaining unit or units continue to function.

As was pointed out at some length in the above mentioned patents, plastic concrete mixtures, which contain relatively high percentages of coarse aggregates, when moving under pressure in confined streams are subject to packing or "stowing" at restrictions or sharp changes of direction in the conduits, a property not present in liquids, gases or plastics lacking the said coarse aggregates. Although in practice every effort is made to avoid undesired "stowage" of the mixture, it may nevertheless occur at times, rendering one or more of the units inoperative until the cause of the "stowing" has been located and removed, and the present invention may be utilized in such cases to cut out the affected unit until proper operating conditions therefor are restored. The same is also true should breakage or other necessity for repair of any particular unit occur, the affected unit being disconnected from the source of power during such repair while remaining unit or units continue to operate as usual.

With the above and other objects in view which will appear as the description proceeds, the invention more specifically comprises a drive especially adapted for multiple unit concrete pump use, which includes a jack shaft driven from the source of power; a drive shaft connected thereto preferably by reduction gearing; an annular toothed clutch element rigidly mounted by said drive shaft in co-operative relation to each main driving gear with which the crank shaft of each pumping unit is provided; a pinion constantly meshing with each of said main driving gears, said pinions being rotatably and slidably mounted on the drive shaft and being of a length which is sufficiently greater than the width of said main drive gears that the end portions of their teeth may be slid into and out of engagement with the teeth of their associated annular clutch element while the body portion of said pinion teeth remain in mesh with those of the drive gears; a shifting ring or collar carried by each pinion; a shifting fork connected to each collar; and manually operable lever connections for selectively actuating the forks to control the respective pinions.

Referring to the accompanying drawings forming a part of this specification, in which like reference characters designate like parts in all the views:

Figure 1 is a plan view, more or less diagrammatic, of the essential portions of a double unit concrete pump of the type set forth in my said prior Patent No. 2,062,200, and equipped with one form of selective drive mechanism constructed and arranged in accordance with my present invention;

Fig. 2 is an enlarged sectional plan view of the drive mechanism and immediately adjacent pump elements;

Fig. 3 is a transverse sectional elevational view, taken approximately on the plane indicated by the line 3—3 of Fig. 2, looking in the direction of the arrows; and

Fig. 4 is a sectional elevational view, taken

approximately on the plane indicated by the line 4—4 of Fig. 3, looking toward the left.

Referring more particularly to the said drawings, the concrete pump illustrated therein for purposes of the present disclosure is a two-unit machine of the type now in commercial production in which the units R and L are mounted in spaced parallel relationship upon a suitable framework comprising longitudinal channel members 10 and transverse channel members 11. Each of the said pumping units comprises a working cylinder 12 in which a piston 13 is reciprocatable by means of a connecting rod 14 actuated by a crank 15 on a crank shaft 16 which is driven by a spur gear 17. Each cylinder 12 is also provided with an inlet valve 18 having an inlet opening 19 leading from a suitable hopper or other source of supply for the plastic mixture, not shown, and with an outlet valve 20 provided with a suitable fitting 21 by means of which the discharge pipe line may be readily detachably secured to respective units. Suitable mechanism for actuating the said valves from the crank shafts 16 similar to that disclosed in the said Kooyman and Ball patents above referred to is also provided but is not here shown since it is immaterial to an understanding of the present invention. A prime mover 22 here illustrated as an electric motor is mounted upon a platform 23 and its drive pulley 24 drives a pulley 25 through a plural V-belt drive 26.

The pulley 25 is mounted upon a jack shaft 30 constituting the power input shaft of the drive mechanism constituting the present invention, said pulley being preferably connected to the said shaft by a suitable shear pin coupling 31 in order to avoid damage to the parts in the event of dangerous overloads upon the apparatus. The said jack shaft 30 is enclosed in an extension 32 of a housing 33 which is mounted upon certain of the longitudinal frame members 10 as will be clear from Figs. 1 and 2, which housing is also provided with a second tubular extension 34 in axial alinement with the first named extension 32. This extension 32 is received in part by a pillow block or bearing housing 35 in which a roller or other suitable bearing 35 is mounted for journalling in one end of the jack shaft 30, the other end of which may be journalled in a companion roller bearing 37 mounted in the tubular extension 34.

The jack shaft 30 rigidly carries a gear or pinion 38 which meshes with a companion gear 39 keyed or otherwise rigidly secured to drive shaft 40 of the present invention, which shaft is journalled in suitable ball or other anti-friction bearings 41, 42 mounted within the housing 33 and an end plate 43 thereof. As will be clear from Figs. 1 and 2 the drive shaft 40 is mounted in co-operative relationship to the main driving gears 17 of the crank shafts 16, extending across the working faces thereof, and the said shaft has slidably and rotatably journalled upon it the gears or pinions 45 the teeth of which are in constant mesh with those of the crank shaft gears 17.

The drive shaft 40 has keyed or otherwise rigidly secured to it a clutch member 46, said member being located on the said shaft at a point intermediate the gear pairs 17 and 45, as will be readily understood from Figs. 1, 2 and 3. The clutch member 46 is provided with two sets of annular internal teeth 48 disposed in axial alinement with the teeth of the respective pinions 45 for selective meshing engagement therewith. It will be noted that the said pinions 45 are of an axial length which is sufficiently greater than the width of their companion gears 17 as to enable the said pinions to be slid axially upon the shaft 40 to bring the inner end portions of their teeth into engagement with the clutch teeth 48, while at the same time the main body portions of the said pinion teeth constantly remain in mesh with the teeth of the said gears 17.

The outer ends of the pinions 45 are circumferentially grooved as at 50 for the reception of annular flanges 51 of shifting collars 52 which encircle the said pinion ends. These said collars are provided with pins 53 engaged by the bifurcated upper ends of the arms 54 of the shifting forks 55. These forks are rigidly carried by rock shafts 56 and 56' which are journalled in bearing sleeves 57 and 57' passing transversely through and being rigidly secured to the tubular extension 34 of the housing. The rock shaft 56 which is associated with and controls the drive for the pump unit R has keyed or otherwise rigidly secured to it the hub 60 of an operating lever 61 which extends upwardly, as best shown in Figs. 3 and 4, and to the upper end of which a link 62 is pivotally connected as at 63. The said link 62 passes through an aperture in a bracket member 64 carried by the housing 33 and is provided at its end with a hand grip 65 by means of which said link may be reciprocated to oscillate the lever 61 and rock the shaft 56 to engage and disengage the pinion 45 associated with the pump unit R with and from its clutch teeth 48, as will be readily understood. The said link 62 may be notched as at 66 and 66' for engagement with the bracket 64 to retain the parts in either engaged or disengaged position.

Journalled upon the rock shaft 56 intermediate the hub 60 and the bearing sleeve 57 is the hub 70 of an operating lever 71 for the pump unit L, which lever extends upwardly and is provided with a link 72 the construction and operation of which, including hand grip and notches, is or may be substantially identical with that of the link 62. The said hub 70 however differs from the hub 60 in that the hub 70 also rigidly carries an arm 75 which is connected by links 76 to an arm 77 carried by a hub 78 keyed or otherwise rigidly secured to the rock shaft 56' which controls the pinion 45 driving the gear 17 of the unit L of the pump. The provision of this linkage 75, 76 and 77 enables both links 62 and 72 to be moved in the same direction for the purpose of engaging their respective pinions with the clutch teeth 48 and in the same opposite direction for effecting disengagement thereof thereby avoiding any confusion on the part of the operator as to the direction in which either link 62 or 72 is to be moved to attain a desired position of the pinions.

The loads imposed upon the working parts of these pumps are quite heavy in view of which it is dangerous and impractical to shift the pinions 45 into meshing engagement with the clutch teeth 48 while the latter are rotating, and therefore such shifting is ordinarily done while the clutch and its shaft 40 are stationary, either through stoppage of the electric motor 22, or through disengagement of the main clutch of the apparatus where a gasoline motor drive is employed. In case the teeth of the pinions 45 are not in exact meshing alinement with the teeth 48 of the clutch member 46 the drive pulley 25 may be rocked by hand a distance sufficient to enable meshing of the complementary teeth. It is of course desirable that under all oper-

ating conditions the several pumping units be operated in synchronism and in cases where the units are delivering concrete through a single pipe line it is essential that in a two-unit pump for example the cranks 15 be timed to operate 180° apart. In bringing a unit into engagement after it has been out of operation this timing may be effected with sufficient accuracy by merely observing the relative positions of the cranks 15, since a difference of one or two teeth either way will not materially effect the output of the pump. If desired, suitable marks may be placed upon the crank shaft gears 17 to aid the operator in bringing the units into proper phase relationship.

It will be seen from the above that the present invention provides a relatively simple and effective drive for selectively controlling the operations of a plurality of pumping units whereby any unit may be cut into and out of operation by the single source of power without affecting the operation of the remaining unit or units. As above explained, this is of vital importance in connection with the pumping of plastic concrete mixtures. In instances in which the several units are delivering to a single pipe line should one of them become damaged thus necessitating repairs, or become clogged due to stowing of the mixture within it, the entire machine must be shut down until the difficulty is overcome unless a selective drive such as or equivalent to that just disclosed be present. With pumps so equipped, however, the procedure is to pump out all of the concrete in the hopper and then shut down the pump while the piping connection between the single pipe line and the several units is disengaged and a new piping connection made with the unit or units which will be operable thereafter. After blocking off the feed from the hopper to the unit which is being cut out, concrete placement through the pipe line may be resumed with the remaining pumping unit or units. The disengaged unit is flushed with water to prevent concrete from setting in it, and whatever work it may be necessary to perform is done without requiring a cleanout of the entire pipe line.

This is desirable, not only in case of repairs, but also, on jobs requiring a continuous pour, where it may not be possible to maintain the capacity of all the pumping units for the duration of the job, the extra pumping units afford additional stand-by capacity.

The entire time consumed for breaking the pipe line connection and cutting off a pump should in any case be less than that usually required by the concrete to segregate or set in the pipe line. Without means for selectively establishing and breaking driving connection for the different pumping units, should a prolonged interruption occur, the plastic mixture in the entire concrete transporting system would have to be thoroughly cleaned out, since to permit the mixture to harden in the pumping units or pipe line is something which must be carefully avoided, as it entails a tedious and costly procedure to clean it out if it once sets. With the present drive however, the affected unit may be cut out while the remaining unit or units keep the mixture flowing through the pipe line, thus preventing setting therein.

While one form of the invention has been illustrated and described it is obvoius that those skilled in the art may vary the details of construction as well as the precise arrangement of parts without departing from the spirit of the invention and therefore it is not wished to be limited to the above disclosure except as may be required by the claims.

What is claimed is:

1. A selective drive mechanism for concrete pump or like machine having at least two units each having operating elements to be driven from a single source, said drive mechanism comprising a housing; a shaft journaled in said housing to be driven by said power source; means for connecting and disconnecting the operating elements of each unit to said shaft at will, including a movable clutch member for each unit, at least one of which members is movable to its connecting position in a direction opposite to that in which another of such members is movable for a like purpose; a rock shaft journaled in a portion of said housing adjacent each movable clutch member, and provided with means engaging the latter to shift the same; a pair of operating levers carried by one of said rock shafts, one of which levers is rigid with said shaft while the other lever is journaled thereon and provided with a rigid angularly extending arm; an arm rigidly carried by an adjacent rock shaft; and connections between the free ends of said arms, whereby motion of said journaled operating lever in a given direction will produce motion of the clutch member controlled thereby in a direction opposite to that imparted by the other operating lever to its clutch member when such lever is moved in said given direction.

2. In a selective drive mechanism for transmitting power from a single source either simultaneously or alternatively at will to a plurality of individual pumping units of a concrete pump, said mechanism having a power-driven shaft, and a clutch for each unit, each of which clutches includes a clutch member movable in a direction opposite to that in which the like member of the other clutch moves to make and break a power-transmitting connection between its unit and said shaft: means for independently controlling said clutch members, comprising a separate actuating member for each clutch for positively shifting its movable clutch member to and from power-transmitting position; connections between said actuating members and their respective clutch members whereby like-directional movements of the former in either direction will cause positive opposed-directional movements of the latter; and means for positively independently retaining each clutch in or out of power-transmitting condition at will.

CHARLES F. BALL.