May 3, 1938. C. F. BALL 2,116,473

APPARATUS FOR FEEDING PLASTIC CONCRETE MIXTURES TO PUMPS, ETC

Filed Aug. 17, 1934 2 Sheets-Sheet 1

Fig. 1.

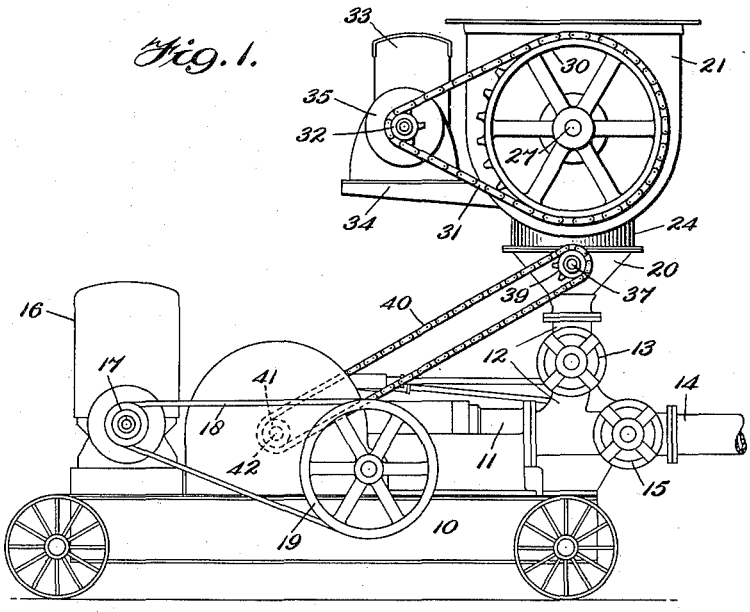

Fig. 2.

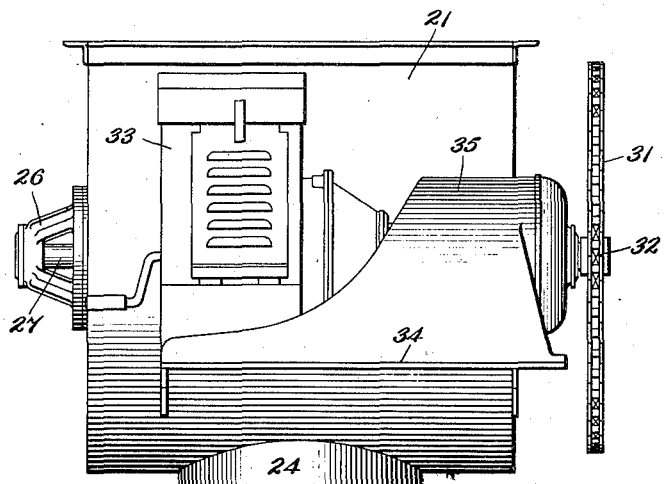

Fig. 3.

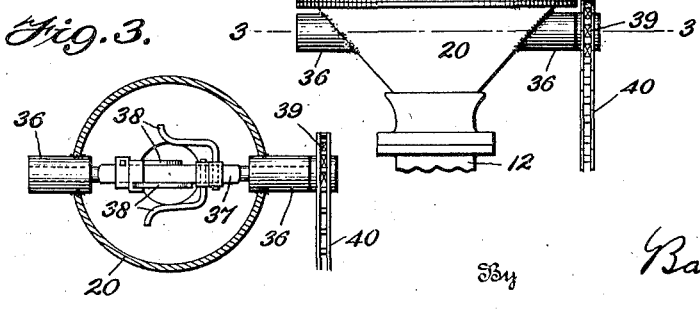

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Fig. 4.

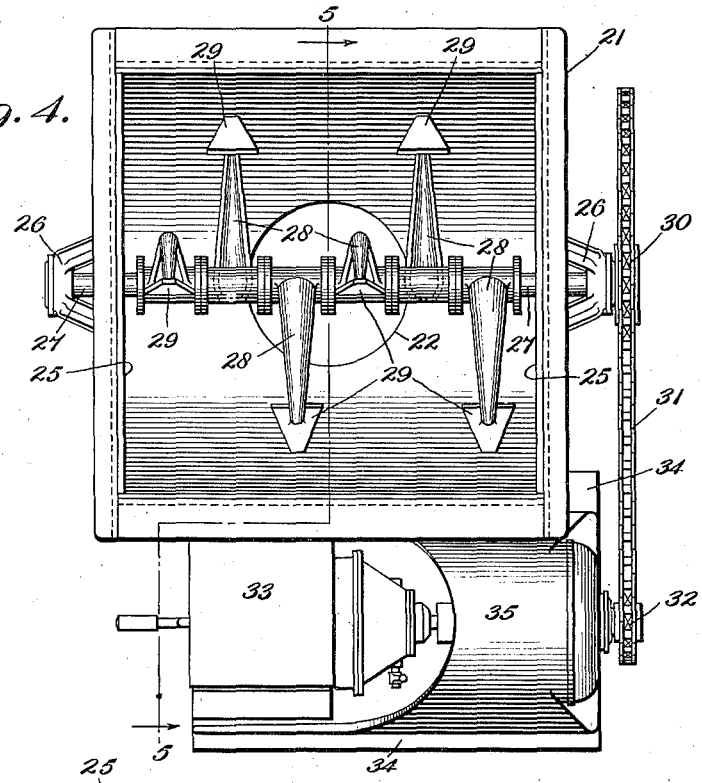
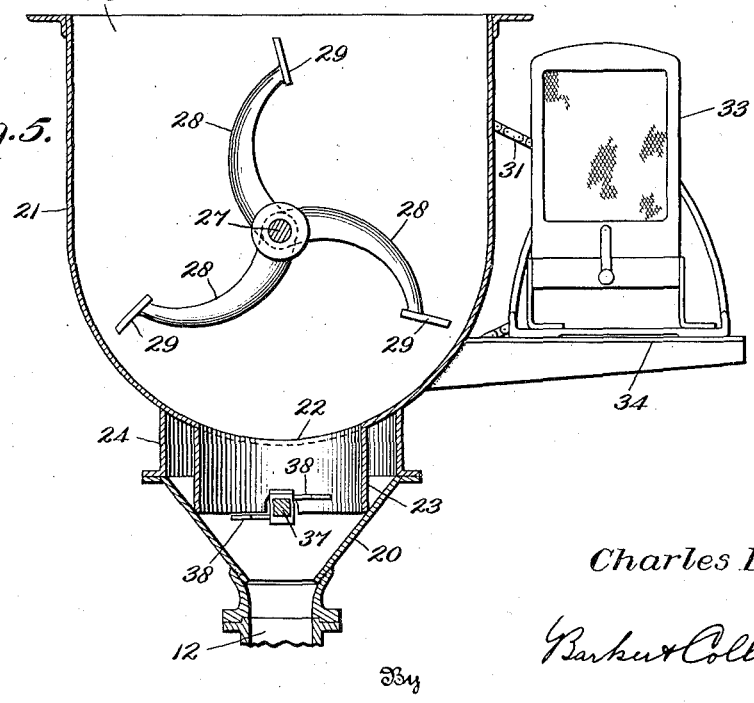


Fig. 5.



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2,116,473

APPARATUS FOR FEEDING PLASTIC CONCRETE MIXTURES TO PUMPS, ETC.

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Application August 17, 1934, Serial No. 740,328

10 Claims. (Cl. 83—73)

This invention relates to pressure pumps for plastic concrete mixtures, and more particularly to mixture-agitating and feeding mechanism for such pumps, and has for one of its objects to provide apparatus of this character which will greatly facilitate the handling by such pumps of extremely dry concrete mixtures embodying substantial proportions of coarse aggregates.

There has been recently developed a pump of the expansible chamber type which has quite successfully pumped plastic concrete mixtures up to 1000 feet or more horizontally, and up to approximately 125 feet vertically. One example of such a pump is disclosed and claimed in the copending application of Jacobus C. Kooyman, filed January 16, 1933, Serial No. 652,077 now Patent No. 2,017,975, granted October 22, 1935. Briefly, such pumps comprise a horizontal working cylinder, a piston working therein, inlet and outlet passages communicating therewith, and peculiarly constructed valves controlling said passages.

As is fully brought out in the said Kooyman patent, concrete is to be carefully distinguished from plaster, mortar, and grout, in that it contains a substantial proportion—50% or more—of coarse aggregates, which are not present in the latter mixtures. These coarse aggregates are usually in the form of gravel or crushed stone, the individual pieces of which may run up to 2½ or 3 inches in average maximum dimension, and their presence imparts to the mixture certain properties, e. g. "stowing" which are not to be found in any other mixture or material, so far as is now known and which render it exceedingly difficult to handle. The pumping of plastic concrete mixtures therefore presents certain problems which have no counterparts in the handling of plaster, mortar, grout, and of course liquids and gases.

Concrete mixtures are commonly used in a wide range of consistencies, varying from the quite wet, sloppy mixes, to the extremely dry ones. The wet mixes, gauged by the commonly used slump test for determining consistency, may slump as much as 8 or 9 inches in 12 inches, while the dry mixes may slump as little as ½ inch in 12. The pumps above mentioned are themselves quite capable of handling mixtures throughout the entire range of consistencies, but some difficulty has been experienced in actual practice in getting dry mixes to feed to the inlet passage of the pump, and it is one of the principal objects of the present invention to provide an apparatus which will overcome this difficulty.

It is furthermore well known that concrete mixtures, particularly the wetter mixes, are subject to segregation, i. e., unless kept in constant motion, the larger and heavier constituents tend to settle to the bottom. A segregated mixture is unpumpable; and while the present invention is of material assistance in feeding dry, substantially non-segregating mixtures to the pump, at the same time it is so constructed and arranged as to also be susceptible of use for preventing segregation of the wetter mixes, and therefore it can be employed to advantage with mixtures throughout the entire range of consistencies commonly used.

With the above and other objects in view, which will appear as the description proceeds, the invention consists in the novel details of construction, and combinations and arrangements of parts constituting the apparatus, all as will be more fully hereinafter disclosed, and particularly pointed out in the appended claims.

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 side elevational view, partly diagrammatic, of a concrete pump equipped with one form of apparatus constructed in accordance with the present invention;

Figure 2 is an enlarged elevational view of the apparatus, as seen from the left of Figure 1;

Figure 3 is a horizontal sectional view through the usual hopper of the pump, taken approximately on the plane indicated by the line 3—3 of Figure 2, and showing the small agitator therein;

Figure 4 is a top plan view of the parts shown in Figure 2; and

Figure 5 is a vertical sectional view, taken approximately on the plane indicated by the line 5—5 of Figure 4, looking in the direction of the arrows.

Referring to the said drawings, 10 indicates generally the concrete pump of the type above described, having a working cylinder 11, the inlet 12 controlled by the induction valve 13 and the outlet 14 controlled by the eduction valve 15. The pump is driven by means of a suitable motor enclosed within the housing 16, through a pulley 17, a belt 18 and pulley 19. A conical hopper 20 surmounts the induction valve 13 and constitutes the normal feed chamber for the pump. All of the parts thus far described are old and of themselves constitute no part in the present invention.

Mounted upon the hopper 20 is a second and

preferably larger hopper 21, which as here shown is substantially cubical in shape, except that its lower portion is rounded to substantially semi-cylindrical form. The said lower portion is provided with a discharge opening 22 of greater cross sectional area than that of pump inlet passage 12 (see Figs. 4 and 5) from which a sleeve or tubular throat member 23 extends downwardly into the hopper 20. An outer tubular member 24 is welded or otherwise rigidly secured to the bottom portion of the hopper 21 in spaced relation to the tube or sleeve 23, and serves as a means for supporting and securing the apparatus to the hopper 20, as will be readily understood.

The end walls 25 of the hopper 21 carry suitable bearings 26 in which is journalled a shaft 27. Rigidly secured upon the shaft 27 is a plurality of staggered arms 28, each of which carries at its outer end a paddle member 29.

At one end shaft 27 is provided with a sprocket 30, about which passes a sprocket chain 31, which also engages a sprocket 32 by means of which the shaft 27, arms 28 and paddles 29 may be rotated from an internal combustion or other motor mounted within the housing 33, and supported upon a platform 34, rigidly secured to the hopper 21. The said motor preferably drives the sprocket 32 through a reduction gear mechanism 35 which is also mounted upon said platform.

The sub-hopper 20 is provided with suitable bearings 36, in which is journalled a shaft 37, which rigidly carries a plurality of agitating arms 38 (see particularly Figs. 3 and 5). The shaft 37 also carries a sprocket 39 which is engaged by a chain 40, which likewise passes around a sprocket 41 carried by the crank shaft 42 of the pump. It thus results that whenever the pump is operating, the agitating arms 38 will be rotated within the sub-hopper 20 by means of the chain and sprocket connection just described.

In use, the concrete mixture in its completely mixed state is introduced into the hopper 21, and with the independent motor associated therewith in operation, the agitating elements 28 and 29 will be continuously rotated. The agitation thus produced, together with that resulting from the operation of shaft 37 and arms 38, not only prevents segregation in the case of the wetter mixes, but also prevents stowing and arching of the material at the outlet opening 22 in the case of the dry mixes when the pump is running. The mixture passes from the hopper 21 downwardly through the tubular member 23 and into the sub-hopper 20 and if the pump 10 be in operation it is there agitated by means of the agitating elements 38. From the hopper 20 the mixture passes on through the inlet valve 13 and inlet passage 12 to the pump cylinder 11 from which it is ejected to the eduction valve 15 and discharge line 14 in the well known manner.

In actual field operations, it is often necessary to stop the operation of the pump for shorter or longer times, for various reasons, and if such stoppage occurs when the hopper 21 is partially or completely filled with extremely dry mixture, unless the same be continuously agitated during such stoppage, it has been found that upon again starting the pump the mixture will not flow thereto. Likewise, in the case of wet mixes, unless agitation be continued in the hopper 21 the larger and heavier aggregates will segregate and settle to the bottom of the hopper during the time the pump is not operating, and as above explained segregated concrete is substantially wholly unpumpable. It is therefore essential for the best results that the agitators 28 and 29 be operated continuously whether the pump be running or not.

The constant operation of the large agitators 28 and 29 within the hopper 21 at such time as the pump is not running, has a tendency to pack the material in the tubular member 23 and sub-hopper 20, particularly in the case of the drier mixtures. If the shaft 37 and its agitator arms 38 were not present, this stowing or packing of the mixture would extend down into the inlet passage 12, and there would be a relatively deep mass of compacted concrete, extending from the inlet valve 13 itself up to the port 22, which no amount of agitation in the hopper 21, would break up and start moving, even when augmented by the suction of the pump piston on its suction stroke. Even if the shaft 37 and arms 38 be present, and operated when the pump is stopped, they tend to aggravate the stowage conditions below them, in sub-hopper 20 and inlet passage 12. But with the shaft 37 and arms 38 located comparatively close to the opening 22, and not operating when the pump is stopped, they constitute partial restrictions in the confined stream of concrete which produce stowing thereof, and localize it above them in the tubular member 23, while that portion of the mixture in the sub-hopper 20 and the inlet passage 12, will not be seriously compacted but will in fact be protected from undue pressure by the stowed material in the tube 23, above the plane of shaft 37. It will thus be seen that only a layer of concrete of comparatively little depth—between the planes of the opening 22 and the shaft 37—will be packed or stowed by the action of the agitators 28 and 29 when the pump is not running; and, with the smaller agitators 37 and 38 operating as soon as the pump is started, the packed mixture thereabove will be broken up thereby and will freely flow from the hopper 20 to the inlet passage 12.

I am aware that it is not broadly new to provide material agitators in connection with pressure pumps for plaster and mortar, but so far as I am aware it has never before been proposed to provide the two separate agitators for the purpose of facilitating, and in fact making possible at all, the pumping of extremely low slump concrete mixtures which embody heavy aggregates. As above explained, these mixtures possess radically different properties from mortar, plaster and grout, and therefore in the prior devices for handling these latter mixtures it has not been necessary to provide more than a single agitator, since the problems involved in handling large aggregate concrete were not there present.

While one form of the invention has been illustrated and described, it is obvious that those skilled in the art may vary the precise details of the construction constituting the apparatus, 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.

I claim:—

1. In a pump for plastic concrete mixtures which embody substantial proportions of coarse aggregate which impart thereto a strong tendency to stow, said pump having a working chamber, a valved inlet passage communicating therewith, and a power shaft, the combination of an agitating means in said passage; driving connections between said agitating means and power shaft, arranged to actuate said means only when the pump is operating; a receptacle arranged to

receive the plastic concrete mixture and feed it to said passage; a separate agitating means in said receptacle; and means associated with said receptacle arranged to actuate the agitating means therein continuously and independently of the agitating means in said passage.

2. In a pump for plastic concrete mixtures which embody substantial proportions of coarse aggregate which impart thereto a strong tendency to stow, said pump having a working chamber, a valved inlet passage communicating therewith, and a power shaft, the combination of a rotatable agitator shaft in said passage; agitating arms carried by said agitator shaft having portions disposed parallel to the shaft axis, arranged to cut through the mixture in said passage and prevent stowing thereof; driving connections between said power and agitator shafts for actuating the latter when the pump is operating; a receptacle arranged to receive the plastic mixture and feed it to said passage; a separate agitating means in said receptacle; and means associated with said receptacle arranged to actuate the agitating means therein independently of the agitating means in said passage.

3. Apparatus for feeding premixed plastic mixtures possessing stowing properties to a pump having an inlet passage and an inlet valve therein, comprising means arranged to receive and feed the mixture to said passage and valve under conditions which may compact or induce stowage thereof in the passage apart from that induced by the valve; means in the line of mixture flow and intermediate said valve and feeding means, arranged to cause said feed-induced stowage to occur before the mixture enters the passage and reaches the valve; and means for moving said last named means to cause it to relieve said feed-induced stowage.

4. Apparatus for feeding premixed plastic mixtures possessing stowing properties to a pump having an inlet passage and an inlet valve therein, comprising means arranged to receive continuously and feed the mixture to said passage and valve under conditions which tend to compact or induce stowage thereof in the passage when the pump is stopped, apart from that induced by the valve; means disposed in the mixture stream intermediate the valve and feeding means arranged to localize said feed-induced stowage to a zone precedent said inlet passage and valve; and means operable by the pump when re-started for actuating said stowage-localizing means to cause it to relieve said feed-induced stowage.

5. In apparatus for feeding a plastic mixture possessing stowing properties to the inlet passage of a pump, a receptacle for said mixture having a discharge conduit communicating with said pump inlet passage; means in said receptacle for agitating said mixture, said agitating means tending to compact or produce stowage of the mixture in said passage; and means within said conduit intermediate said passage and receptacle arranged to restrict said stowage to a relatively thin stratum between said means and receptacle, whereby the mixture beyond said means is protected against compacting or stowage.

6. In apparatus for feeding a plastic mixture possessing stowing properties to the inlet passage of a pump, a receptacle for said mixture arranged to feed it to said pump inlet passage; means in said receptacle for agitating said mixture, said agitating means tending to compact or produce stowage of the mixture in said passage when the pump is stopped; means intermediate said passage and receptacle arranged to restrict said stowage to a relatively thin stratum between said means and receptacle, and thereby protect the mixture in said passage against compacting or stowage; and means operable by the pump when started arranged to actuate said stowage-restricting means to cause it to break up the stowed stratum, whereby the mixture may move freely from the receptacle through the passage.

7. In apparatus for feeding a plastic mixture possessing stowing properties to the inlet passage of an intermittently operable pump, a receptacle for said mixture arranged to feed it to said pump inlet passage; constantly operating mixture-agitating means in said receptacle, said means tending to compact or produce stowage of the mixture in said passage when the pump is stopped; and additional agitating means operable when the pump is running, disposed between said passage and receptacle, and arranged when not operating to localize stowage induced by said first named agitating means in a relatively thin stratum between said second named agitating means and said receptacle, thereby protecting the mixture in said inlet passage against campacting or stowage, said second named agitating means serving when the pump is started to break up the stowed stratum, whereby the mixture may move freely from the receptacle through the passage.

8. In apparatus for feeding a plastic mixture possessing stowing properties to the inlet passage of a pump, a receptacle for said mixture having an eduction port of greater cross sectional area than that of the pump inlet passage; a convergent hopper interposed between said port and passage for conducting the mixture to the latter; mixture agitating means in said receptacle, said means tending to compact or produce stowage of the mixture in said hopper and passage; and additional agitating means disposed in said hopper adjacent said eduction port, arranged to localize said stowage in a relatively thin stratum between said second named agitating means and said eduction port, said second agitating means operating when the pump is started to relieve said stowage, whereby the mixture may move freely from said receptacle through said port, hopper, and passage.

9. In apparatus for feeding a plastic mixture possessing stowing properties to the inlet passage of a pump, a receptacle for said mixture having an eduction port of greater cross sectional area than that of the pump inlet passage; a convergent hopper interposed between said port and passage; a tubular throat extending from said port into said hopper; a mixture agitator in said receptacle, said agitator tending to compact or produce stowage of the mixture in said throat, hopper, and passage; additional agitating means disposed in said throat and hopper adjacent said eduction port, arranged to localize said stowage in a relatively thin stratum between said means and port, thereby protecting the mixture in said hopper and passage beyond said means against compacting or stowage; and means for actuating said last named agitating means when the pump is operating to cause it to break up the stowed stratum, whereby the mixture may move freely from the receptacle through the port, throat, hopper, and passage.

10. In apparatus for feeding a plastic mixture possessing stowing properties to the inlet passage of an intermittently operable pump, a receptacle for said mixture having an eduction port of

greater cross sectional area than that of the pump inlet passage; a convergent hopper interposed between said port and passage for conducting the mixture to the latter; a tubular throat extending from said port into said hopper; a constantly operable mixture agitator in said receptacle, said agitator tending to compact or produce stowage of the mixture in said throat, hopper, and passage when the pump is stopped; additional intermittently operable agitating means disposed in said throat and hopper adjacent said eduction port, arranged when at rest to localize said stowage in a relatively thin stratum between said means and port, thereby protecting the mixture in the hopper and passage beyond said means against compacting or stowage; and means operable by the pump for actuating said last named agitating means to cause it to break up said stowed stratum when the pump is started, whereby the mixture may move freely from the receptacle through the port, throat, hopper, and passage.

CHARLES F. BALL.