Jan. 2, 1940. C. L. CADY 2,185,540

APPARATUS FOR COMPACTING CONCRETE

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Fig. 1.

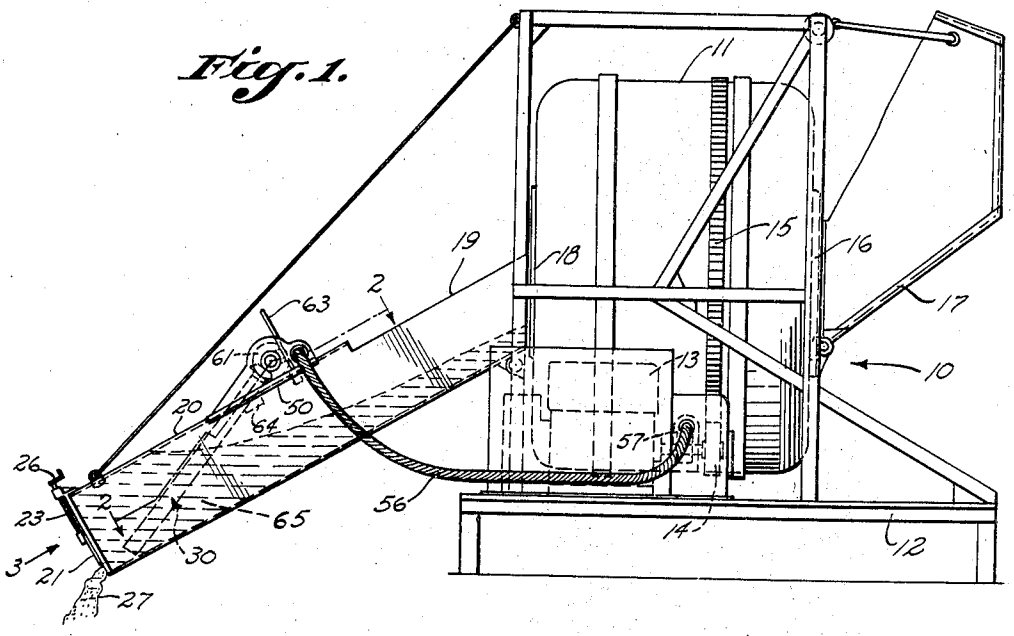


Fig. 2.

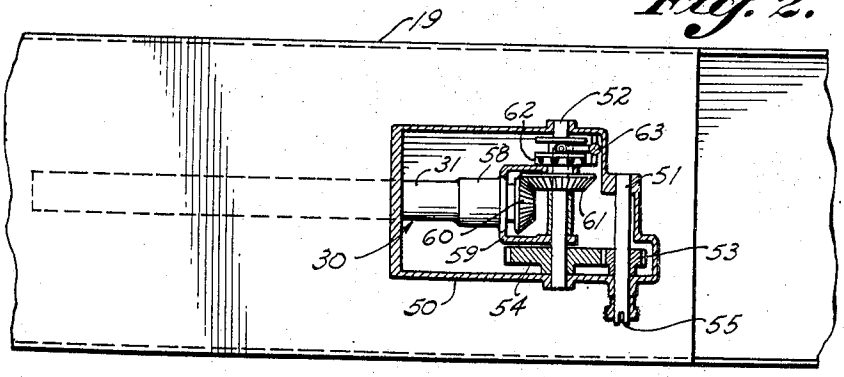
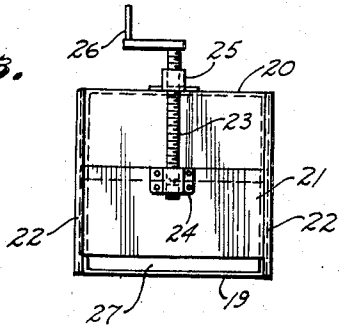


Fig. 3.



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Fig. 4.

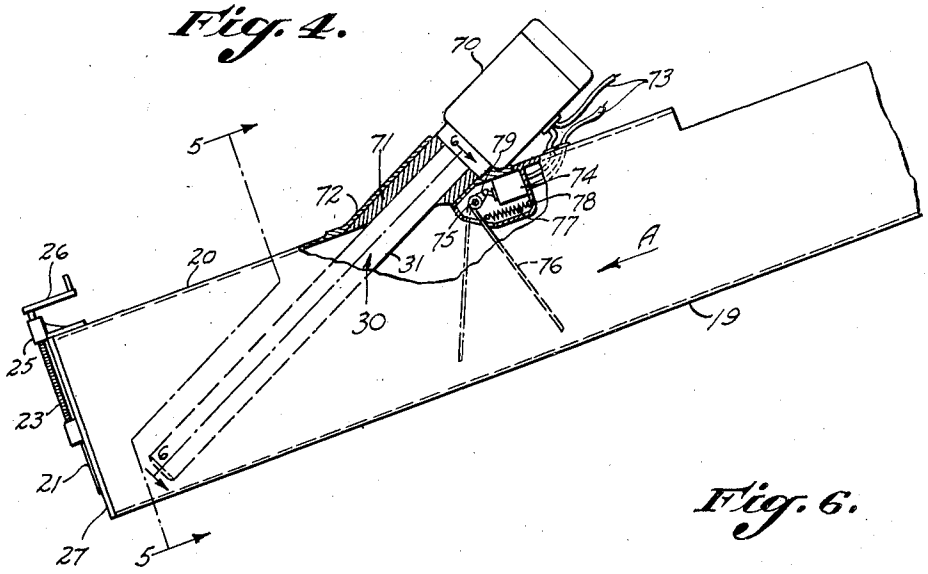


Fig. 6.

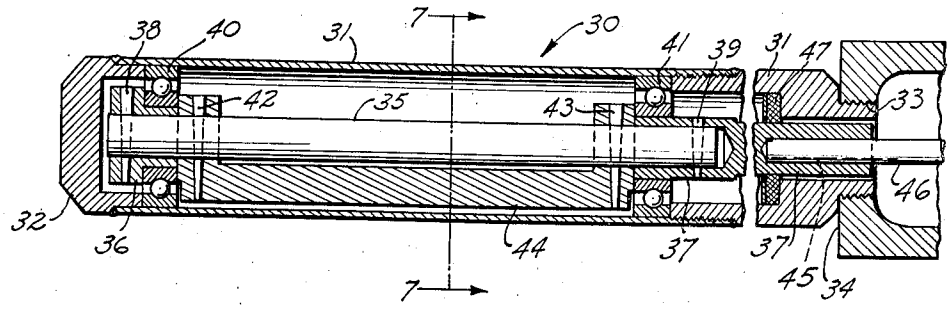


Fig. 5.

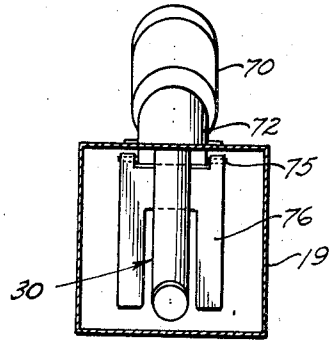
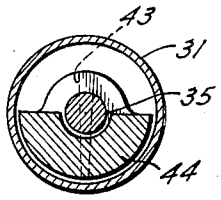


Fig. 7.



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APPARATUS FOR COMPACTING CONCRETE

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Application October 13, 1937, Serial No. 168,745

5 Claims. (Cl. 259—169)

My invention relates to apparatus for compacting concrete by vibration and particularly to apparatus that is capable of compacting the concrete prior to pouring and which may advantageously be employed in a concrete mixer.

The general problem to which my invention is addressed is one that is recognized as being of the utmost importance, namely, to improve the strength of concrete and the facility with which it is handled. It is known that concrete of small "slump", i. e., a mix that is relatively stiff, is vastly superior in strength to a thin concrete of great "slump". But the concrete of small slump is very difficult to work because of its low fluidity.

It is found that if a concrete mix is vibrated at a high frequency of vibration it becomes markedly more fluid in character and it is possible to successfully employ a drier mix of less "slump" and one which results in a finished concrete of much greater strength. Such vibration also forces out contained air and therefore eliminates to a large extent gas cavities which ordinarily reduce the strength of concrete. Vibration further compacts the concrete by rearranging the particles of the mix so that they occupy the smallest volume and presses them tightly together while in that condition to secure intimate contact of the binding constituent with the sand and rock. The total effect of high frequency vibration upon the concrete mix is to produce a remarkable increase in the strength of the finished concrete.

An object of my invention, therefore, is to provide apparatus for vibrating concrete.

Another object is to provide apparatus for vibrating concrete prior to pouring.

Another object is to provide apparatus in combination with a concrete mixer to vibrate the concrete.

Another object of the invention is to provide apparatus for vibrating concrete while it is in the trough of a concrete mixer.

Another object is to provide apparatus for vibrating concrete while it is in the trough of a concrete mixer and which includes means for regulating the flow of concrete past the vibrator.

A further object is to provide apparatus for vibrating concrete, which apparatus derives its power from the source of power for driving the concrete mixer associated therewith.

Still another object of the invention is to provide apparatus for vibrating concrete in the trough of a concrete mixer, and which includes means for energizing the vibrator only when concrete is in the trough.

These and other apparent objects I attain in a manner which will be clear from a consideration of the following description taken in connection with the accompanying drawings, of which:

Fig. 1 is an elevational view of a concrete mixer and one form of my concrete vibrating apparatus in combination therewith, the trough being shown in cross-section.

Fig. 2 is a sectional view of the trough and vibrating unit taken along the line 2—2 of Fig. 1 in the direction of the arrows as shown.

Fig. 3 is a view of the end of the trough showing the gate for controlling flow of concrete from the trough.

Fig. 4 is a view, partly in section and partly cut away, showing the trough of the concrete mixer and an alternative form of concrete vibrator attached thereto.

Fig. 5 is a sectional view of the apparatus of Fig. 4 taken along the line 5—5 in the direction of the arrows as shown.

Fig. 6 is a cross-sectional view of the concrete vibrator employed in my apparatus.

Fig. 7 is a sectional view of the vibrator of Fig. 6 taken along the line 7—7 in the direction of the arrows as shown.

My vibrating apparatus is adapted to be operated in combination with a concrete mixer, one form of which is illustrated in the drawings and designated generally by the numeral 10. The concrete mixer illustrated comprises a rotatable mixing drum 11 supported on the frame 12 and driven by the motor 13 through connection of a spur gear 14 with the peripheral gear 15 on the drum 11. The drum 11 has an opening 16 at one end through which is fed the constituents, generally rock, sand, cement, and water, going to make up the concrete mix. These constituents are fed into the opening by means of the pivotally mounted chute 17 which may be lowered to receive the material and raised to empty it into the mixing drum. The mixing drum is provided internally with vanes which thoroughly mix the constituents of the concrete when the drum is rotated. The drum 11 has on its other end an opening 18 through which it discharges the concrete, after mixing has taken place, into the inclined trough 19 from which the issuing concrete dumps into the location where it is to be applied or into a conveyance for transporting it to that location.

I prefer to employ a conduit or trough 19 which

is of different construction from that ordinarily employed in that it is partially or entirely covered as at 20, and a gate 21 is provided for regulating the flow of concrete from the trough. The gate 21 may have edges which slide in grooves 22 provided at the end of the trough. The gate 21 may be adjusted in height by means of the screw 23 the end of which is mounted to rotate in the member 24 attached to the gate and to cause the gate 21 to be raised and lowered with the screw 23. The screw 23 is screwed through the nut 25 fixed on the top of the trough and terminates in the crank 26 by which the screw is turned to adjust the gate to provide an opening 27 of any desired height.

Supported preferably from the top of the trough is a vibrator 30 which may be constructed as shown in Fig. 6. The vibrator here shown includes an elongated tubular shell 31 having a heavy walled end 32 welded thereto. The other end of the shell 31 is reduced and is threaded at 33 to provide together with shoulder 34 means for connecting the vibrator to its mounting. Axially located within the shell 31 is the shaft 35 mounted in bushings 36 and 37 and pinned thereto by taper pins 38 and 39, the bushings 36 and 37 being mounted for rotation in the anti-friction bearings 40 and 41. Between these bearings and pinned to the shaft by taper pins 42 and 43 is the eccentric weight 44, preferably in the form of a half cylinder of slightly less radius than the inner surface of shell 31 in order to secure the maximum unbalanced centrifugal force for a given weight. The length of the weight 44 is preferably made about one-third that of the shell 31, and the weight 44 is preferably located in the lower part of the shell. The bushing 37 is elongated, extending to the end of the tubular shell 31 and is bored and keyed at 45 to receive the shaft 46 of the driving mechanism. An oil seal 47 is provided around the elongated bushing 37 at its upper end. An additional bearing for the bushing 37 may be provided at its upper end in the case of a long vibrator.

When the shaft 35 and its attached eccentric weight 44 are rotated, an unbalanced force of considerable magnitude results which exhibits itself as a vibration of the entire lower part of the vibrator 30 which is positioned in the path of the flowing concrete. It is found that a speed of rotation of the shaft and attached weight of between 5000 and 10,000 revolutions per minute is satisfactory to compact concrete after the manner of the invention.

The vibrator 30 may be mounted as illustrated in Figs. 1 and 2, in which I have shown the vibrator adapted to be driven by the source of motive power 13 which drives the mixer 10. A supporting structure 50 is attached to the cover 20 of trough 19 preferably in such a position that when the vibrator 30 is suspended therefrom the end of the vibrator comes near to the opening 27 between the gate 21 and the trough 19 and the vibrator will be immersed in the flowing concrete, as shown in Fig. 1. The supporting structure 50 has journaled in it two shafts 51 and 52 in geared relation through gears 53 and 54. Shaft 51 extends out beyond the structure 50 and is adapted to be connected at 55 for rotation with a flexible shaft housed in conduit 56 and connected, through gear connection 57, for rotation with the motor 13 which drives the concrete mixer 10. The shell 31 is screwed into the member 58 which is pivotally suspended from the shaft 52 by the clevis 59. The vibrator is prevented from contacting the bottom of the trough by engagement of the shell 31 with a stop 64, which may be of rubber, attached to structure 50. The bevelled gear 60 is connected to shaft 46 which turns the rotating parts of the vibrator, and the gear 60 is meshed with gear 61 which is connectible for rotation with shaft 52 by the clutch 62 operated by handle 63. The gears 53—54, and 60—61 are of suitable sizes to provide a high ratio of speed between shafts 46 and 51, the shaft 46 running at the higher speed.

In operation, the concrete, after having been mixed in the drum 11, is dumped into the trough 19 whereupon it flows down the trough and out under the gate 21. I preferably adjust the height of the opening 27 of the gate 21 to only a little more than the size of aggregate employed in the concrete mix in order to maintain a relatively slow passage of the concrete past the vibrator 30. As a result of this regulation of the flow, the concrete 65 may be caused to build up in the trough to a relatively high level, as shown in Fig. 1. As soon as concrete arrives at the vibrator in its passage down the trough I operate the clutch 62, either manually or automatically to cause rapid rotation of the eccentric weight 44 within the vibrator 30. The shell of the vibrator immediately starts to vibrate vigorously; and as the concrete passes by the vibrator 30 on its way down the trough, air which has been stirred into it in the mixer is expelled, and the concrete is compacted prior to pouring from the trough. The vibration to which the concrete is subjected also results in increasing its fluidity and makes it possible to employ a mix of considerably less "slump" prior to vibration. It is essential that the concrete remain in the zone of vibration in the trough an adequate length of time, and this condition is obtained by regulating the rate of flow of concrete past the vibrator through adjustment of the gate 21. The uniformity of flow of concrete under the gate is assisted by the nearness of the end of the vibrator to the opening 27.

An alternative mounting and driving means for the vibrator 30 is shown in Figs. 4 and 5. Here the shaft 35 and its eccentric weight 44 are rotated by an electric motor 70 whose shaft 46 is keyed in the bushing 37 and whose frame joins the shell 31 of vibrator 30. In this embodiment the vibrator is supported in a rubber bushing 71 which surrounds the vibrator at its upper end and is mounted on the cover 20 of trough 19 through the metallic exterior shell 72. The bushing 71 is preferably so positioned and directed that the vibrator 30 extends downwardly into the trough 19, its end being near the bottom of the trough and close to the opening 27 under gate 21. It will be observed that in both embodiments illustrated the vibrator 30 is supported at its upper end, for it is found that a vibrator constructed as illustrated in Fig. 6, when mounted in this manner, produces relatively little vibration at the point of support. What little vibration exists at the support is, in the embodiment of Fig. 4, largely prevented from passing to the trough by reason of the resilience and damping effect of the supporting rubber bushing 71.

The conductors 73 leading from the electric motor 70 are connected to a source of electric current. In circuit with one or both of the conductors 73 I preferably provide a switch 74 adapted to open or close the circuit to the motor depending upon the position of the switch. Pivotally suspended on the spindle 75 is the bifurcated vane 76 having an open portion di-

rectly in back of the vibrator 30 so as not to interfere with the flow of concrete to the vibrator nor with the transmission of vibration rearwardly therefrom. The vane 76 is urged to the right in Fig. 4 by the spring 77 attached at one end thereto and at the other end to a housing 78 covering the switch and attached to the shell 72. In its right-most position the vane 76 maintains the switch 74 in open position by reason of engagement of arm 79, connected to the vane 76, with the operating lever of the switch 74. When concrete flows down the trough 19 in the direction of the arrow A it forces vane 76 forward into the position shown in Fig. 4 in dotted lines, and the arm 79 is rotated downwardly operating the switch 74 to close the motor circuit. When no more concrete is in the trough 19, the vane 76 is returned to its right-most position and the circuit of motor 70 is again opened. By this means the vibrator 30 is operated only when there is concrete in the trough to be acted upon by the vibrator. A similar vane may, if desired, be employed in the embodiment of Fig. 1 and may be mechanically connected to automatically operate the clutch 62 to cause operation of the vibrator 30 only when concrete is in the trough.

By use of the apparatus of my invention, concrete is compacted prior to being laid in place, and a drier concrete mix of less "slump" may be successfully poured, resulting in the production of a stronger finished concrete without the necessity of performing any compacting operation after pouring.

It is understood that various changes and modifications in design and construction of the apparatus disclosed herein may be made by those skilled in the art without departing from the spirit of the invention defined in the appended claims.

I claim as my invention:

1. In combination, a trough for the flow of concrete therethrough, a vibrator supported on said trough and positioned in the path of said flowing concrete, and means including an element adapted to be acted upon by the concrete in said trough for controlling the operation of said vibrator in such manner that said vibrator is operated only when concrete is in said trough.

2. In combination, a trough for the flow of concrete therethrough, a vibrator supported on said trough and immersed in said concrete, said vibrator including an eccentric weight rotatable about an axis in the vibrator, means for rotating said weight, a vane in the path of said concrete which is resiliently urged in a direction opposite to the direction of flow of the concrete, and means operated by said vane for making inoperative said rotating means when said vane is not acted upon by concrete in the trough and for restoring said rotating means to operation when said vane is acted upon by concrete in the trough.

3. In combination, a concrete mixer including a source of motive power therefor and an inclined pouring trough through which the mixed concrete flows, a vibrator suspended at one end from said trough and positioned in the path of said flowing concrete, said vibrator including an eccentric weight rotatable about an axis in the vibrator, means connected to and powered by said source of motive power for rotating said weight, and an adjustable gate at the lower end of said trough for regulating the rate of flow of concrete past the vibrator.

4. In combination, a concrete mixer including an inclined pouring trough through which the mixed concrete flows, a vibrator suspended at one end from said trough and positioned in the path of said flowing concrete, said vibrator including an eccentric weight rotatable about an axis in the vibrator, means for rotating said weight, and an adjustable gate at the lower end of said trough for regulating the rate of flow of concrete past the vibrator.

5. In combination, a concrete mixer, an elongated inclined pouring trough associated with said mixer along which mixed concrete flows from said mixer, a vibrator supported on said trough and immersed in said concrete, said vibrator including an eccentric weight rotatable about an axis in the vibrator, means for rotating said weight, and an adjustable gate on said trough for regulating the rate of flow of concrete past the vibrator.

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