Nov. 7, 1933. K. E. CANFIELD 1,934,116

METHOD AND MECHANISM FOR AGITATING CONCRETE

Filed March 21, 1929 3 Sheets-Sheet 1

Fig 1

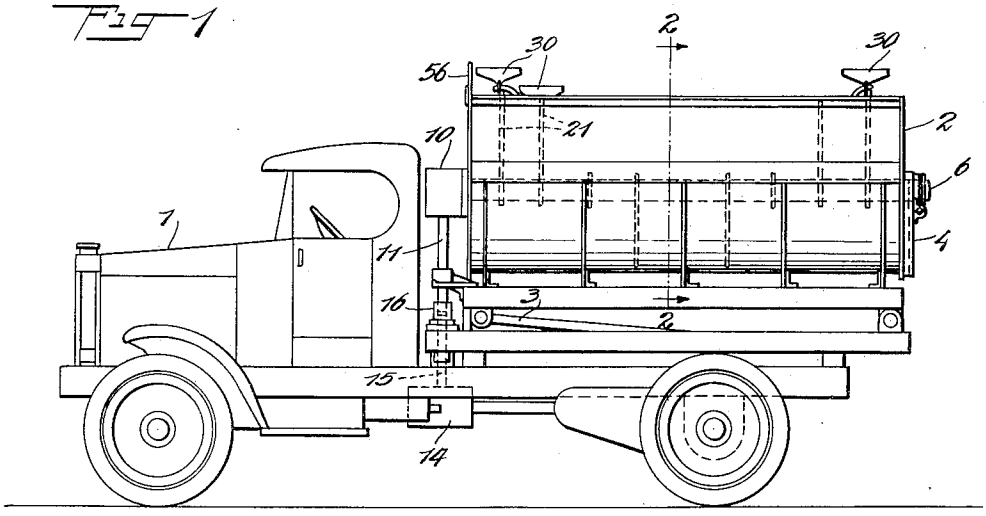
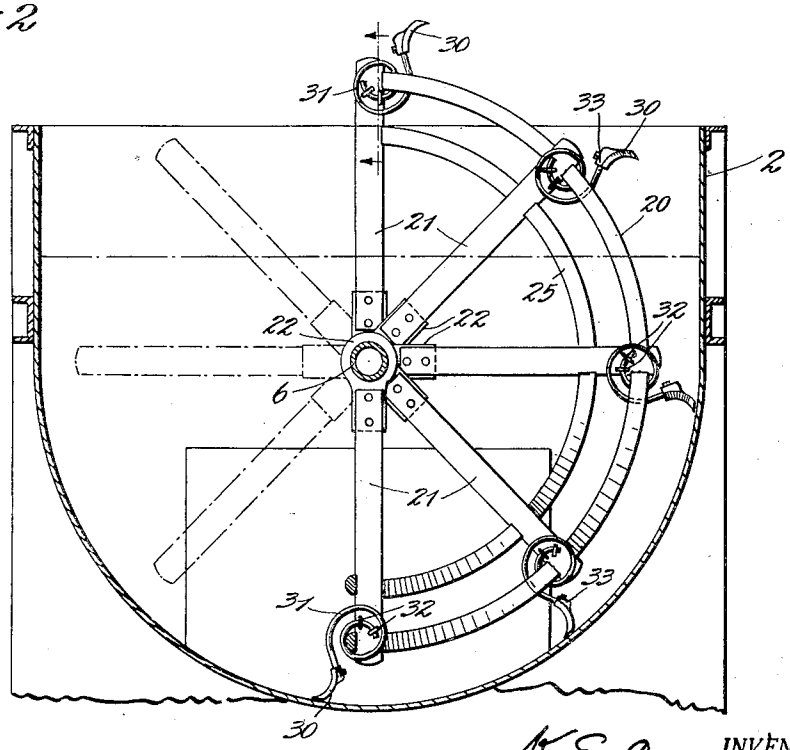


Fig 2



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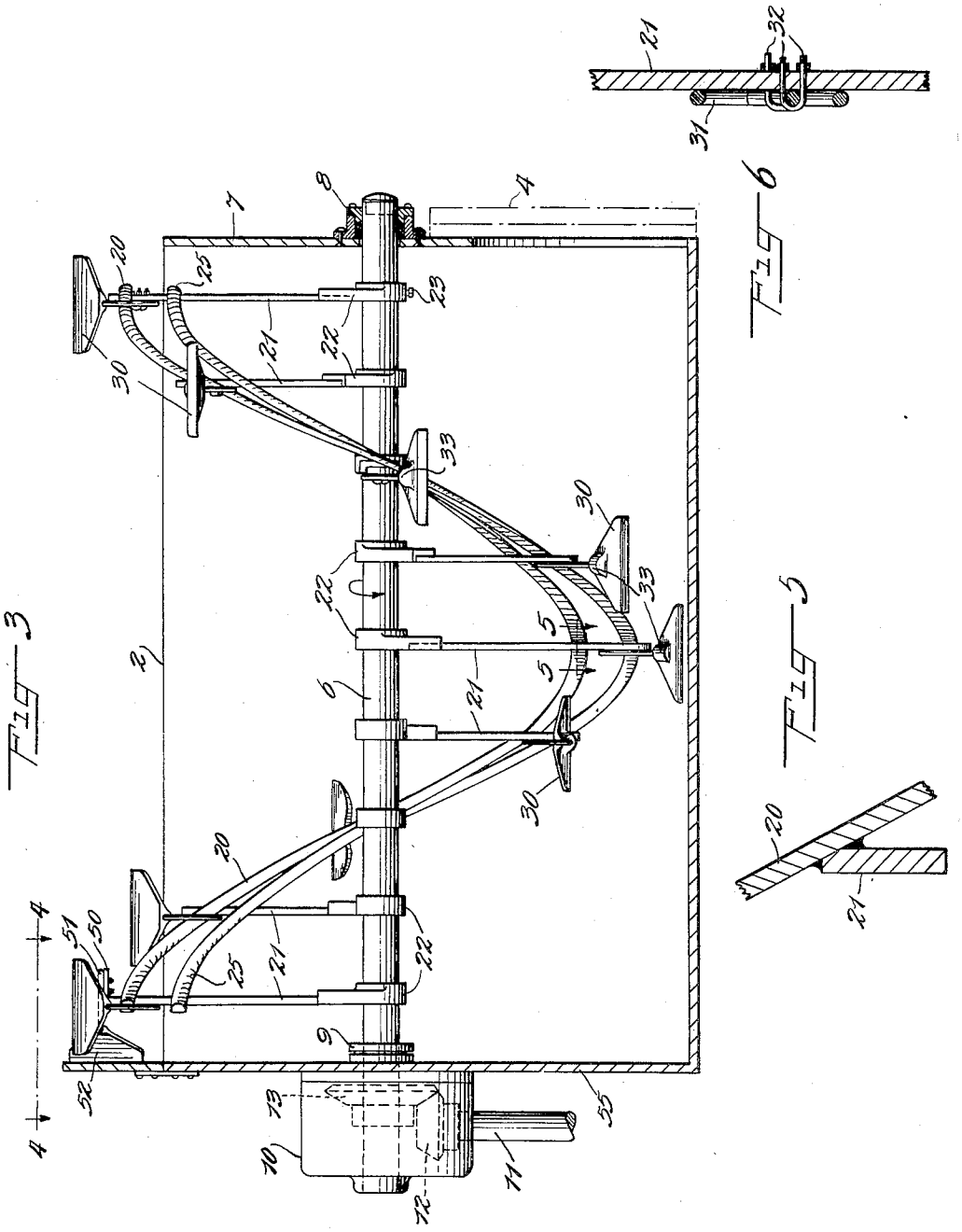


FIG 3

FIG 5

FIG 6

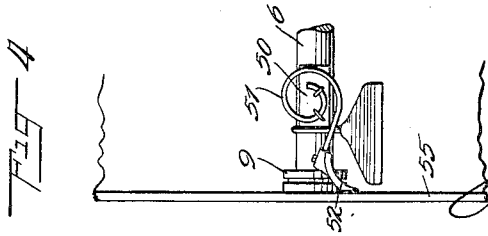


FIG 4

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METHOD AND MECHANISM FOR AGITATING CONCRETE

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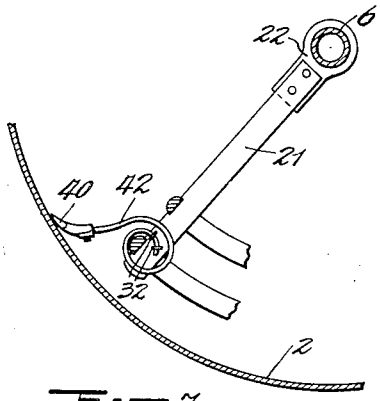


Fig 7

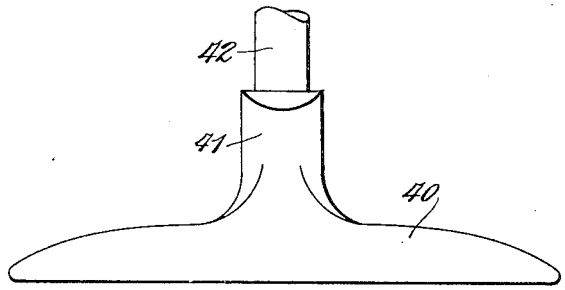


Fig 8

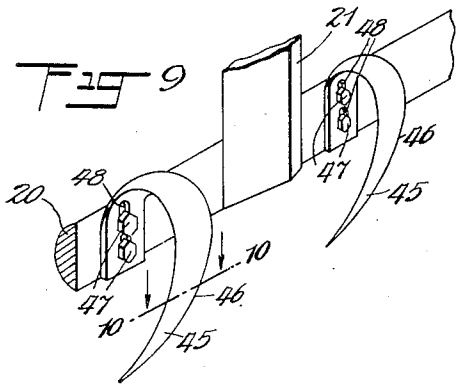


Fig 9

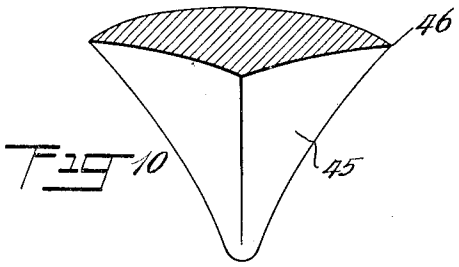


Fig 10

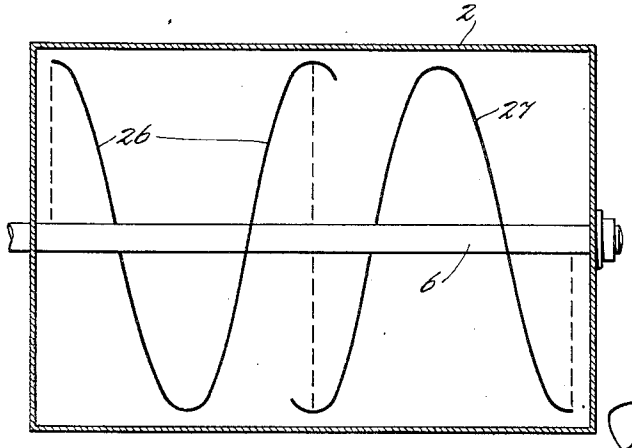


Fig 11

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1,934,116

UNITED STATES PATENT OFFICE

1,934,116

METHOD AND MECHANISM FOR AGITATING CONCRETE

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Application March 21, 1929. Serial No. 348,792

4 Claims. (Cl. 83—73)

The invention relates to a new and useful method and mechanism for agitating mixed concrete or other solid and liquid intermixtures, and more particularly to a method and mechanism for maintaining a load of mixed concrete or the like in a thoroughly intermixed and agitated condition while it is being transported from a central mixing plant to a distant point.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, construction, arrangements, combinations and improvements herein shown and described.

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:

Fig. 1 is a side elevation of an automotive truck having a concrete container equipped with mechanism embodying the invention;

Fig. 2 is an enlarged transverse vertical section taken on line 2—2 of Fig. 1 showing the interior of the concrete container equipped with the agitating mechanism;

Fig. 3 is a transverse vertical section of the mechanism shown in Fig. 2 taken longitudinally of the container;

Fig. 4 is a fragmentary detail of the end scraper, taken on line 4—4 of Fig. 3;

Fig. 5 is a fragmentary detail in transverse section on line 5—5 of Fig. 3, showing the manner of attachment of the helical webs to the agitator arms;

Fig. 6 is a detailed vertical section taken on line 6—6 of Fig. 2;

Fig. 7 is a fragmentary vertical section showing a modified form of scraper tooth attached to an agitator arm;

Fig. 8 is a detailed front elevation of the scraper foot shown in Fig. 7;

Fig. 9 is a fragmentary detail showing another modified form of resilient scraper tooth attached to the helical web;

Fig. 10 is a detail of the tooth shown in Fig. 9, taken on line 10—10 of Fig. 9; and

Fig. 11 is a diagrammatic view of a modified form of the helical agitating device.

The invention is directed to providing a new and improved method and mechanism for preventing segregation of a batch of mixed concrete while it is being transported from a central mixing plant to a distant job. In modern construction work, the practice of mixing concrete at a central mixing plant and transporting individual lots of the already mixed concrete in trucks or other container vehicles to outlying points, frequently several miles distant, has largely displaced the method of local mixing at the job. During this transportation the concrete has a decided tendency to segregate—that is, the water and mortar rise to the top and the coarse aggregate sinks to the bottom of the container and packs together, thus undoing the original mixing to a great extent. Furthermore, the segregated concrete sticks to the walls of the container where it packs and cakes, thereby preventing clean discharging of the load and requiring picking and prying at the sides of the container to loosen the mass, thus greatly prolonging the idle time of the mechanism.

The invention provides a highly efficient, useful and simple mechanism for agitating the concrete while it is being transported from the central mixing plant to the job, thereby maintaining the concrete in its mixed condition and actually improving the original mixture by prolonging the mixing action until the concrete is run into the forms at the job. While mechanisms for this general purpose have been proposed, they have not proved entirely satisfactory in practice. For example, one such machine comprises a semi-cylindrical truck body for carrying the concrete, having a plurality of radially extending arms or paddles spaced along a longitudinally disposed, rotatable shaft driven from the truck drive. The paddle arms are equipped at their outer ends with a plurality of rigid teeth or blades.

The above-described mechanism has a number of serious disadvantages which, moreover, are common to all machines having positive agitating devices. The pure rotary motion does not produce a thorough agitation and circulation of the mass. The rotating paddle members are forced broadside through the dense mass of liquid concrete, pushing and lifting a very great weight of material for the sole purpose of agitating the mixture. This unnecessary expenditure of force necessitates a relatively heavy drive mechanism and connections, with all parts of correspondingly heavy construction. Such heavy parts are costly and greatly reduce the effective load capacity of the container for carrying concrete,

while of course the weight-displacement throws a heavy load on the truck motor.

Furthermore, the rigid scraper teeth carried by the paddle arms of the construction described are both inefficient and harmful in their operation. These teeth are relatively narrow and have very little scraping or cleaning effect on the sides and particularly at the undisturbed end areas of the container, where the concrete packs and cakes in a practically solid mass, which must be pried loose when the container is unloaded. Furthermore, small stones in the concrete become caught between the sides or bottom of the container and the rigid agitator teeth, where they wedge and bind. Such wedging throws a serious strain on the mechanism, which usually results in a break in the drive mechanism, thus stopping operations until extensive repairs can be made, the concrete in the meantime becoming segregated and hardening on the mechanism parts.

The invention provides a novel method and mechanism which eliminates entirely the disadvantage of present mechanisms and possesses many additional advantages. An agitating device of relatively light construction is provided for use in a truck or other vehicle container which continuously and uniformly agitates the mass of concrete during its travel while expending relatively little power; provides a practically perfect scraping or wiping action over substantially the whole surface of the container; and absolutely eliminates the possibility of mechanical breakage due to the wedging action described.

More specifically, a truck container of the dumping type is provided with a rotatable screw-like or helical agitating device which continuously and positively agitates the concrete in a very uniform and thorough manner. The power required to effect the screw action of the device through the mass of concrete is far less than that necessary for the direct pushing action of the described mechanisms used at present, while the uniformity and thoroughness of agitation is much more complete.

While the combined translation and rotary motion at the periphery of the screw-like agitator will usually be found sufficient to provide the desired scraping and agitation along the surface of the container, flexible or resilient members may be optionally provided near the periphery of the screw agitator for engaging the surface of the container to effect a stirring and scraping action. These flexible members are adapted to closely wipe the inner surface of the container while their flexibility permits them to yield and spring back when they encounter particles of stone, thus entirely eliminating the undesirable wedging action of rigid members. The invention also preferably provides means for scraping the end or ends of the container, where the concrete has a tendency to pack up and keep out of circulation in the present types of agitators.

It will be understood that the foregoing general description and the following detailed description as well, are exemplary and explanatory of the invention but are not restrictive thereof, as to the novel features and combinations included therein. While the invention is exemplarily described as applied to the agitation of concrete, it will be understood that the broad principles thereof are also applicable to other substances such as mortar and other liquid and solid intermixtures.

Referring now in detail to the illustrated and present preferred embodiment of the invention, an automotive truck 1 is shown equipped with a tank or container 2 having a semi-cylindrical body with straight side walls and ends and an open top for receiving and holding mixed concrete. The tank is adapted for movement relative to the truck chassis to discharge the concrete at the job, being mounted in any suitable manner so that the concrete may be dumped from the rear end of the container. As embodied, the truck is shown equipped with a standard form of hoist mechanism having toggle arms 3 for raising the tank and tilting it rearwardly. A regulatable discharge gate 4 is provided at the rear end of the container for permitting discharge of the concrete into suitable discharge chutes or hoppers at the job. Any suitable controlling means may be provided for regulating the operation of the hoisting and discharging mechanism, it being understood that the hereinbefore described mechanism constitutes no part of my invention and is merely illustrative of the type of mechanism in which the invention is employed.

Referring now to the preferred embodiment of concrete agitating mechanism provided by the invention, a rotatable shaft 6 is mounted to extend longitudinally and centrally through the container, preferably at the centre of the cylindrical portion thereof. The shaft is mounted in suitable bearings in either end of the container, the rear end being preferably journalled in the plate 7 which forms the rear end of the tank, and having a packed bearing 8 mounted on the outer face of the tank so that the inner face is rendered free from irregular surfaces which would become encrusted with concrete. At its front end, the shaft is similarly journalled in the end of the tank, being provided with a retaining collar 9 and extending into a gear housing 10. Means are provided for driving the shaft 6 from the driving mechanism of the truck, vertically extending shaft 11 being provided with a bevel gear 12 meshing with the bevel gear 13 on shaft 6. The shaft 11 may be connected by any suitable means with the motor shaft of the truck, a conventional gear housing 14 being shown for transmitting a slow speed drive to vertical shaft 15 which is connected by any suitable clutch mechanism 16 to the shaft 11. The clutch 16 is preferably controlled from the cab of the truck and is adapted to transmit driving power to the shaft 11 at all times while the motor is running regardless of whether the truck is moving forward or backwards or standing still. The clutch and driving mechanism are adapted to automatically disconnect the shaft 11 from its drive when the hoisting and dumping operations are being performed, and to automatically reconnect the drive when the container reassumes its normal position.

The invention provides a screw-shaped or helical agitating device actuated by the shaft 6 and adapted to uniformly and thoroughly agitate the concrete in the tank with the minimum amount of lifting and bodily displacement of the material. As embodied, one or more webs or bands 20 are twined in a helical or other screw-like configuration about the shaft 6 relatively near the inner surface of the tank. The helical bands are radially spaced from the shaft 6 and supported by radially extending arms 21 which are spaced along the shaft at regular intervals and angularly displaced with respect to each other about the shaft to form radii of the helix. The arms 21 are fixed to rotate with the driven shaft 6, being riveted to supporting collar members 22

which embrace the shaft and are fixed to rotate therewith by set screws 23. The helical bands 20, which are preferably formed of half round metal bars, may be welded or otherwise suitably attached to the arms 21 as shown in Fig. 5. One or more secondary bands 25 may be attached to the arms 21 to form additional concentric helices for agitating the material more centrally of the container.

It will be understood that the rotation of the shaft 6 in its fixed bearings causes the helical bands 20 and 25 to turn with a screw-like motion through the mass of concrete in the container. Due to the peculiar configuration of the helix, a continuous churning and agitating force is transmitted to the concrete both longitudinally and laterally of the mass. The disturbing forces due to the helical bands travel along lines parallel to the axis of the central shaft and to a certain extent propel the concrete longitudinally of the container so that there is a continuous longitudinal flow and reflow along the receptacle. The surface of the mass is kept in a continuous and positive agitation because a portion of the helix is passing through it at all times. Hence it is impossible for a scum to form on the surface or for the particles of the mass to become segregated. The half-round webs or bars which form the helix move sidewise through the concrete and present a very thin edge to the surface so that there is practically no pushing or bodily displacement of concrete. Furthermore, the container may be filled to practically any level without throwing an uneven torque upon the driven parts because practically the same amount of the helix is imbedded in the concrete at all times for a given level of concrete in the tank. In addition to the longitudinal or screw-like disturbance created by the helical bands, the radial supporting arms 21 have a rotary agitating action of their own which disturbs the concrete laterally throughout the whole mass. The arms 21 move edgewise and present a relatively narrow surface to the concrete and hence there is very little pushing or displacement from this source.

While the invention has been described as illustratively embodying a single continuous helical form of agitator, it will be understood that the invention is not limited to any particular helical or screw shaped form of agitating device. For example, the helix shown in Fig. 3 may consist of more or less than one complete turn for the length of the tank, in certain embodiments a double turn or one or one half turn being preferable. Furthermore, the helix need not necessarily be continuous but may be broken and consist of several helical portions 26 as shown in the diagrammatic modification of Fig. 11. Again, for certain purposes it may be desirable that the screw action of the agitator be different in different parts of the tank as, for instance, one half the tank may be provided with a helix 27 opposed in direction to that in the other half of the tank. Many other forms of helical or screw shaped agitating devices will suggest themselves, but it will be understood that they all fall within the broad purview of the invention.

The invention may be employed with a completely cylindrical tank, as shown in Fig. 11, instead of the open top form shown in the other figures, or an open top cylinder may be used in lieu of the straight sided tanks shown in Figs. 1, 2 and 3.

Referring now to the resilient means for scraping the surface of the container, a plurality of scraper blades or teeth 30 is provided for extending from the periphery of the helical members 20 to yieldingly engage the inner walls of the container. As embodied, the blades 30 are resiliently mounted at or near the ends of the radial arms 21 by means of flat coiled springs 31 which rest against the flat sides of the arms 21 near the outer ends thereof. Each coil 31 is adjustably attached to its respective arm 21 by a number of U-shaped clamping bolts 32 which pass through suitable apertures in the arm 21 and are held in position by nuts as shown in Fig. 6. As the construction of the scraper blades and their spring mountings for all the arms 21 is identical, only one will be mentioned in the ensuing description.

The coiled spring 31 has preferably about one and one half turns, the outer portion curving around the fixed inner end under or behind the outer band 20, then along side the face of the arm 21, the end portion projecting freely in a substantially straight line or reverse curve from the advancing edge of the rotating arm 21. The scraper blade 30 is mounted on the free end of its coil spring 31, by a suitable socket 33 into which the end of the spring fits and where it is held by a clamp screw or other fastening means. The blade 30 is urged outwardly and forwardly in the direction of movement of the rotating arms 21, by the free end of the spring.

The scraper blade itself comprises a relatively wide and thin member having a wide entering edge and tapering to a narrow thickened portion toward its end of attachment. The blade is preferably slightly concave on its entering face to facilitate its movement through the concrete. It will be clear that the width of the blades 30 is such that the path of one blade is paralleled or slightly overlapped by the blades on the adjacent arms 21, so that the entire lateral surface of the container is subjected to the scraping action.

By virtue of the resilient urge of the spring 31 the blade 30 is held in intimate and yielding scraping or wiping contact with the curved surface of the container so that a very thorough scraping action is obtained. The position of the blade and its spring mounting is such that the spring is normally under a certain amount of compression when the blade contacts with the surface of the container. In a concrete container of the type described, the curved portion is rarely a true cylinder because the weight of the loads of concrete soon cause the container to sag and acquire a slightly distorted shape which takes a permanent set. However, this irregularity of the container shape is taken care of by my invention, because the spring-urged blades closely follow the contours of the container surface. It will be noted that the compression of the springs can be regulated by advancing or turning back the length of spring held by the bolts 32.

As embodied, the invention eliminates all danger of breakage of parts and consequent stoppage due to wedging and binding of stones or the like between the sides of the tank and the scraper blades. Due to the yielding action of the resilient blades, a stone or other particle cannot remain wedged beneath a scraper blade, because the blade gives momentarily when it encounters the resistance of the obstructing stone and the obstruction is immediately released. In the present embodiment, the scraper blades forces the loose portion of the spring back against the arm 21 until the obstructing particle is cleared. The scraper blade is also adapted for a certain amount of lateral play, because the outer portion of the

coiled spring lies free against the face of arm 21.

The scraping blades are preferably shaped to advance through the concrete with as little pushing action as possible. A preferred form of scraper blade is shown in Figs. 7 and 8, wherein the relatively wide and thin, knife-like blade 40 has a suddenly narrowing supporting shank 41 to which the spring 42 is attached as described. The free end of spring 42 is straightened out to advance the blade 40 at a relatively slight angle to the side of the container, so that the blade will knife under the concrete and displace as little weight as possible.

While I have described the resilient scraper devices as comprising scraper blades mounted on coiled springs at the ends of the agitator arms, it will be understood that this description is merely illustrative and not restrictive of the invention, which embraces any resilient or yielding means for scraping and agitating the concrete for the purposes described. For example, in Figs. 9 and 10 is shown a modified form of this mechanism, wherein curved, resilient blades or teeth are mounted at spaced intervals along the helical band 20. The teeth 45 may be tapered to a point and have thin entering edges 46 so as to pass easily through the concrete. The teeth 45 are preferably adjustably fastened to the band 20 by bolts 47 cooperating with slots 48. As many such teeth may be provided as may be needed for effecting a thorough scraping and stirring action.

Means may be provided for scraping one or both ends of the container, as well as the sides thereof. In a container which is discharged at the rear end, there is a particular tendency for the concrete to pack and collect against the front end of the container. As embodied, the forward radial arm 21 is provided with an angularly extending portion 50, on which is mounted a coiled spring 51 with a scraper blade 52 connected thereto, in the same manner as has been hereinbefore described in connection with members 30 and 31. The scraper blade 52 is adapted to scrape the front end 55 of the container in a circular path near the periphery of the container, so that the corner or pocket at the junction of the bottom and end of the container is cleanly scraped. If desired, more than one scraper may be mounted on the front arm 21 to scrape the more central portion of the rear end, and scraper blades may be similarly provided for the front end of the container, although these provisions will usually be unnecessary.

Means may be provided for preventing the front end scraper 52 from springing over the top of the front end wall 55 of the container when the front arm 21 is in the upper part of its swing. As embodied, the front end 55 of the container may be provided with a segmental extension 56 which is attached to or forms an integral part of the end piece 55. The extension 56 is preferably curved on top to describe the arc of movement of the scraper 52. The extension plate 56 acts as a guide or keeper for holding scraper 52 in its compressed position at all times as it travels on the upper arc.

The invention in its broader aspects is not limited to the specific mechanism shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:—

1. A mechanism for agitating mixed concrete including in combination a container for holding previously mixed liquid concrete, a shaft rotatively mounted in the container, a relatively thin helical band connected to the shaft by a plurality of relatively thin, radially extending arms, said band and arms being disposed to advance their thinnest edges in the direction of rotation so as to effect a minimum displacement of concrete.

2. A mechanism for agitating mixed concrete including in combination a cylindrical container for holding mixed concrete, a vehicle supporting said container for transporting the concrete from a mixing plant to a distant point, and means for agitating the concrete during transportation thereof comprising a longitudinally-disposed shaft mounted in the container, a plurality of relatively thin agitator arms extending radially from the shaft and disposed to present their minimum dimension to the concrete in their paths of advance therethrough when rotated with the shaft, said arms being disposed about and along the shaft in a substantially helical relation, scraper members at the ends of said arms, and means for driving said agitating means from the driving mechanism of the vehicle.

3. A mechanism for agitating mixed concrete including in combination a cylindrical container for holding mixed concrete, a vehicle supporting said container for transporting the concrete from a mixing plant to a distant point, and means for agitating the concrete during transportation thereof comprising a longitudinally-disposed shaft mounted in the container, a plurality of relatively thin agitator arms extending radially from the shaft and disposed to present their minimum dimension to the concrete in their paths of advance therethrough when rotated with the shaft, said arms being disposed about and along the shaft in a substantially helical relation, scraper members at the outer ends of said arms having resilient engagement with the container surface, and means for driving said agitating means from the driving mechanism of the vehicle.

4. A mechanism for agitating mixed concrete including in combination a cylindrical container for holding mixed concrete, a vehicle supporting said container for transporting the concrete from a mixing plant to a distant point, and means for agitating the concrete during transportation thereof comprising a longitudinally-disposed shaft mounted in the container, a plurality of relatively thin agitator arms extending radially from the shaft and disposed to present their minimum dimension to the concrete in their paths of advance therethrough when rotated with the shaft, said arms being disposed about and along the shaft in a substantially helical relation, spade-like scraper members at the outer ends of said arms, and means for driving said agitating means from the driving mechanism of the vehicle.

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