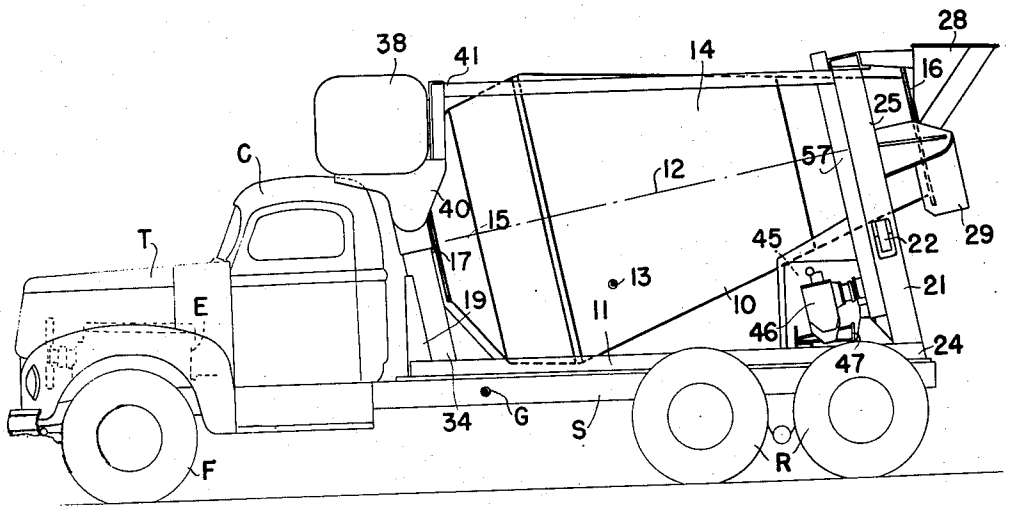
Dec. 7, 1954 J. W. LENDVED 2,696,371

TRUCK-MOUNTED CONCRETE MIXER

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FIG. 1.



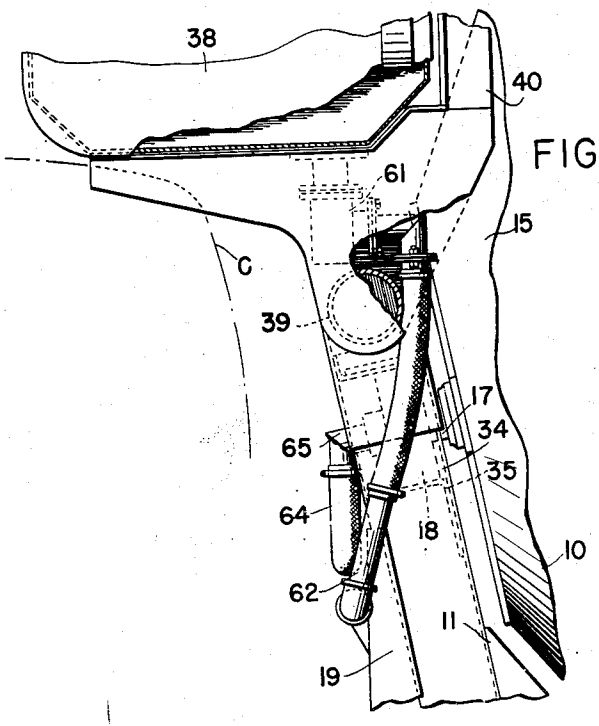


FIG. 2.

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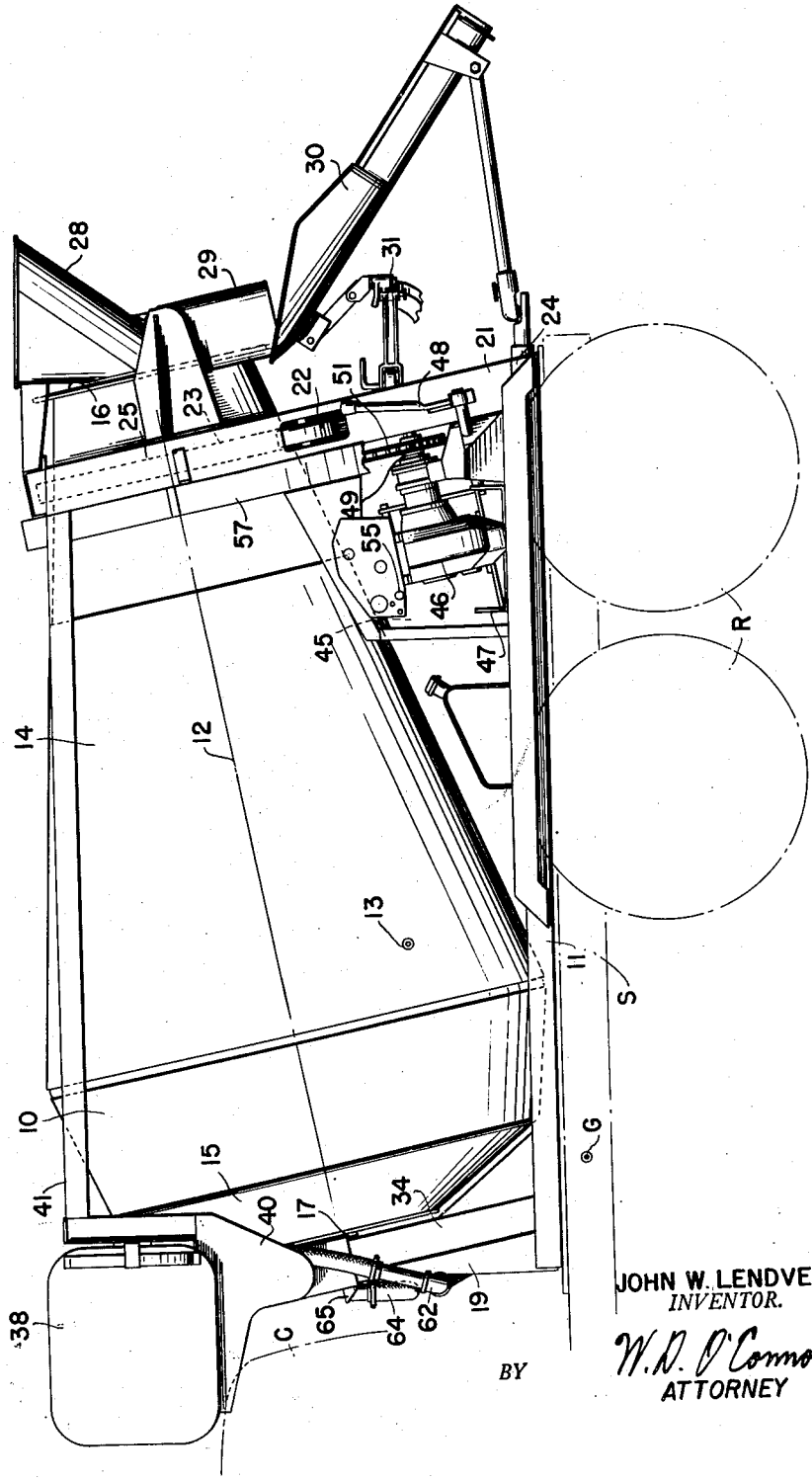
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TRUCK-MOUNTED CONCRETE MIXER

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FIG. 3.



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TRUCK-MOUNTED CONCRETE MIXER

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FIG. 4.

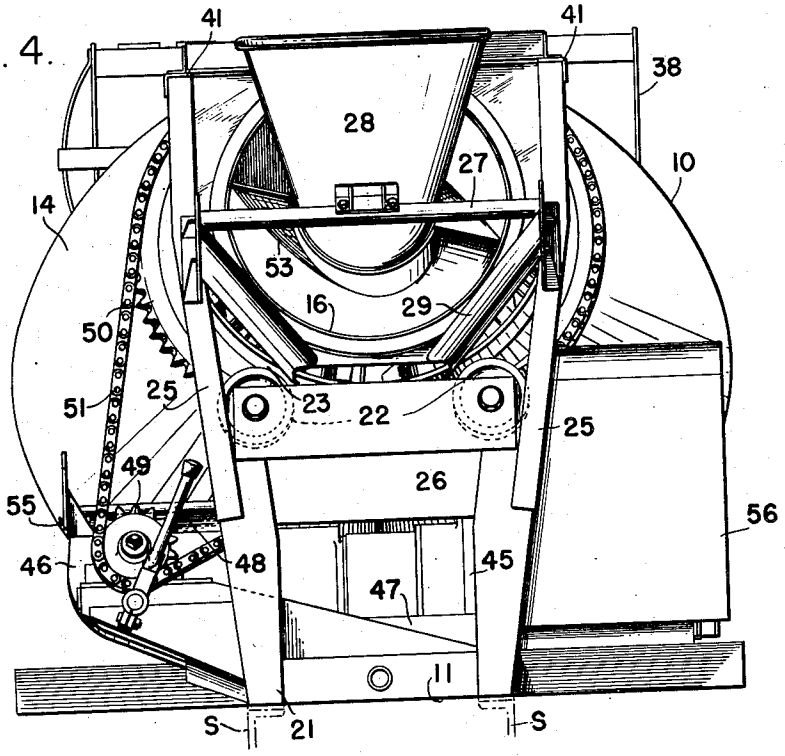
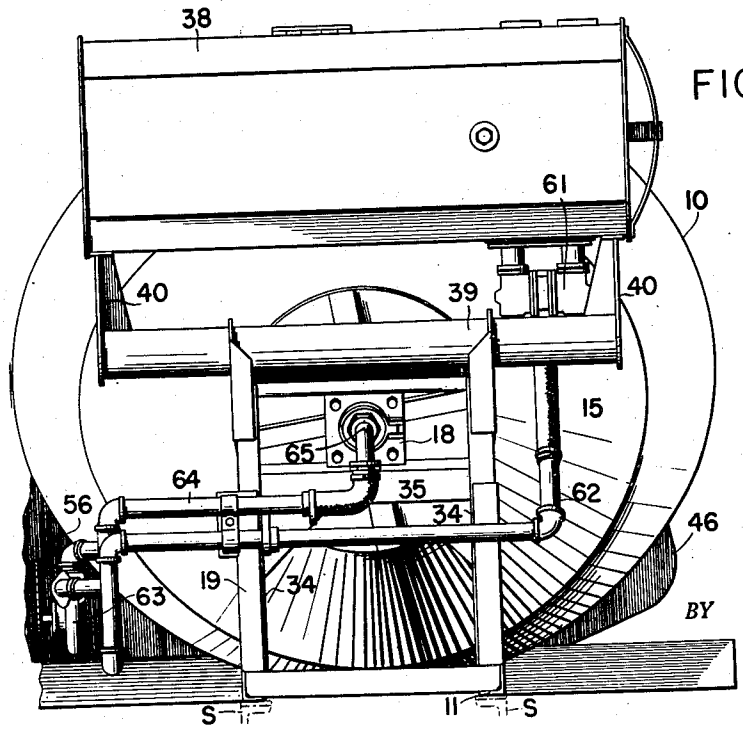


FIG. 5.



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2,696,371

Patented Dec. 7, 1954

2,696,371

TRUCK-MOUNTED CONCRETE MIXER

John W. Lendved, Milwaukee, Wis., assignor to Chain Belt Company, Milwaukee, Wis., a corporation of Wisconsin

Application August 3, 1951, Serial No. 240,141

10 Claims. (Cl. 259—161)

This invention relates, generally, to concrete mixers or agitators of the truck-mounted or transit-mixer type for mixing and/or transporting concrete, and more particularly to an improved mobile mixer especially arranged to carry the maximum permissible load of concrete on a motor truck of standard construction.

Heretofore, truck-mounted concrete mixers or transit-mixers for mixing or agitating concrete en route to or at the site of placement have been mounted on commercial motor trucks of standard construction in a position such that the discharge end of the mixer is located at approximately the rear of the truck frame for convenience in discharging the mixed concrete at the back of the truck. Another established characteristic of mixers of previously known construction has been the disposition of the drum-rotating mechanism between the mixer drum and the cab of the supporting truck. Under these circumstances the mixer drum has been so shaped and positioned that the weight of the mixer and its load of concrete is carried largely by the rear wheels of the truck, the front wheels ordinarily carrying only some ten to fifteen percent of the loaded mixer weight in addition to their proportionate share of the weight of the truck itself.

For reasons of economy, transit-mixers are preferably mounted on motor trucks of well-known, standard commercial construction having the driver's cab behind the propulsion engine and provided with two front wheels for steering and either two or four rear wheels for driving. This provides the most economical form of transportation, inasmuch as trucks of this type are mass-produced and are extensively used and serviced throughout the country.

In an effort to promote further economy, users of transit-mixers have been adopting larger and larger mixer drums in order that greater loads of concrete can be carried in one haul. However, this desire to reduce costs by carrying heavier loads conflicts with the requirements that maximum limits be placed on the wheel loads of trucks operating over streets and highways.

In recent years studies of highway usage with respect to the relationship between highway deterioration and wheel loads, have indicated that excessive damage to highway surfaces results from subjecting highways to wheel loads that exceed determined safe maximum limits. As a result, governmental authorities have taken steps to protect highways from undue damage through establishing legal limits on overall truck loads and on the loadings of the several individual truck wheels under various circumstances. In view of the fact that the rear wheels of motor trucks carrying concrete are ordinarily already loaded to the limit, it is not feasible to increase the carrying capacity of a truck mixer by merely increasing the size of the mixer drum, as this would result in imposing upon the rear wheels of the truck a greater load than can be exerted without excessive injury to the highway.

A general object of the present invention is to provide an improved concrete mixer of the truck-mounted type that is especially adapted for mounting on a motor truck of standard construction and is so arranged as to be capable of carrying the maximum load of concrete that can be transported by the truck without imposing on any of the wheels of the truck a load in excess of that which the highway will sustain without undue deterioration.

Another object of the invention is to provide an improved truck mixer for mounting on a standard motor truck that is especially arranged to effect optimum loading of the several wheels of the truck.

Another object is to provide an improved truck-mounted concrete mixer so arranged that the front wheels of the truck will sustain from twenty to thirty percent of the mixer load.

A further object is to provide a truck-mounted concrete mixer in which the mixing drum is so proportioned and its auxiliary elements so arranged that the tapered discharge end of the drum may be disposed above the rear wheels of a standard motor truck in a position adapted for conveniently discharging the mixed concrete while its enlarged forward end is disposed adjacent to the cab of the truck in a position to impose the weight of the drum and its load of concrete sufficiently forward on the truck to effect optimum loading of the several wheels of the truck, all, without increasing the permissible overall dimensions of the mixer or impairing its operating functions.

According to the present invention, an improved concrete mixer of the truck-mounted type is arranged to transport a heavier load of concrete on a standard commercial motor truck by effecting optimum loading of the several wheels of the truck to the limits permitted for use on the highways over which the truck operates. This is accomplished by arranging the improved mixer whereby a larger proportion of the weight of the mixer and its load of concrete is imposed upon the front wheels of the truck, the arrangement being such that all of the wheels of the truck are loaded to full capacity, whereby the maximum possible load of concrete may be carried by the truck without subjecting the highway surface to injurious overloading. For best overall economy in transporting concrete, the improved mixer is especially arranged for use on the usual motor truck of conventional type, which is mass-produced by various manufacturers and economically serviced throughout the country, thereby providing transportation at the lowest cost. The optimum distribution of load on the truck is attained by so shaping and positioning the mixer drum that the concrete being transported is disposed forwardly on the truck frame close to the back of the driver's cab. To provide for discharging the mixer in the usual manner at the rear of the truck, the axis of the mixing drum is inclined upwardly to the rear, and the drum is made substantially longer than usual and tapers rearwardly to an elevated discharge end that is disposed above the rear wheels of the truck. The forward end of the tapered drum is made as large as possible in order that the load of concrete will tend to be concentrated forwardly therein. To make possible the positioning of the mixing drum as far forward as possible on the truck, the driving mechanism for rotating the drum, which may be either a separate engine or a transmission deriving its power from the truck transmission, is mounted on the mixer frame beneath and operatively connected as hereinafter described, to the elevated rear or discharge end of the drum. The water supply tank for the mixer is preferably mounted ahead of the closed or forward end of the drum in a position to overhang the truck cab. By this improved disposition of the mixer mechanism and improved shape of the mixing drum, a truck-mounted mixer embodying the present invention is adapted to carry a greater load of concrete than was heretofore considered possible on a motor truck of standard construction without exerting excessive wheel loadings on the roadway being traversed. By mounting the driving mechanism on the mixer frame closely adjacent to the discharge end of the drum, as hereinafter described, misalignment between the drum and its driving element is minimized, for such twisting of the frame as occurs when the truck is driven does not produce relative movement of these instrumentalities to the extent which previously occurred when the head end of the drum was driven from an adjacent power source.

The foregoing and other objects of this invention will become more fully apparent as the following detailed description of an exemplary embodiment thereof is read in conjunction with the accompanying illustrative drawings wherein:

Figure 1 is a somewhat diagrammatic view in left side elevation of a truck-mounted concrete mixer embodying

the present invention shown installed on a representative motor truck of standard commercial construction;

Fig. 2 is an enlarged fragmentary detail view of the water tank supporting frame element shown in Fig. 1, parts of the structure having been broken away to reveal internal details;

Fig. 3 is an enlarged view in left side elevation of the improved mixer shown on the truck in Fig. 1;

Fig. 4 is a view in rear elevation of the mixer shown in side elevation in Fig. 3; and,

Fig. 5 is a view in front elevation of the mixer illustrating particularly the water tank mounting arrangement.

Referring more particularly to the drawings and especially to Figs. 1 and 3 thereof, the mobile concrete mixer there shown as an exemplifying embodiment of the present invention constitutes an improvement upon the usual truck mounted or transit-mixer of well-known construction. As shown, the improved mixer comprises essentially a large, relatively long tapered mixing drum **10** of novel shape that is rotatably mounted in a rectangular box-like supporting frame **11**, the arrangement being such that the entire apparatus is especially adapted for mounting on the chassis of a standard commercial motor truck T with the axis **12** of the drum **10** disposed longitudinally of the truck and inclined upwardly toward the rear thereof.

As best shown diagrammatically in Fig. 1, the particular motor truck T of standard or conventional construction that is represented in the drawing, is of the type having side frames S mounted on two front wheels F for steering and four rear wheels R arranged as a bogie in tandem axle relationship for driving, although it is to be understood that the mobile mixer of the present invention may be utilized with similar advantages on trucks of different construction having, for example, only two rear wheels. Furthermore, the standard truck T shown is of the type having the driver's cab C disposed behind the propulsion engine E. Because of the fact that trucks of this general type are mass-produced by various manufacturers in competitive sizes they constitute a most economical form of transportation for any suitable load such as a transit mixer.

As a specific example, but not to be taken as a limitation upon the scope of the invention, the particular standard truck T represented in the drawing may be assumed to have a wheel base of 193 inches and the total weight of its chassis is 12,250 lbs. With the chassis weight assumed as concentrated at a point G representing the center of gravity of the truck structure, the weight of the chassis is so divided between the wheels of the truck that the rear wheels R support 6,700 lbs. and the front wheels F support 5,550 lbs. According to previous practice, when a concrete mixer was loaded in the usual manner on a truck of this type, approximately ninety percent of the added load was ordinarily carried on the rear wheels R. This concentration of load on the rear wheels occurred because of the fact that previously used truck mixers were provided with mixing drums of such shape as to require mounting them rearwardly and largely over the rear wheels in order that the discharge end of the mixer might be above the rear end of the truck frame to facilitate discharging concrete at the back of the truck. Under these circumstances only about ten percent of the combined weight of the mixer and its load of concrete was carried by the front wheels of the truck.

A truck of the conventional type represented by the diagrammatically illustrated standard truck T is of such length and design as to enable it to carry on certain highways, for instance, a permissible total overall weight of 46,400 lbs., divided in such a manner that no more than 32,000 lbs. are imposed upon the highway by the rear wheel bogie nor more than 14,400 lbs. by the front wheels Allowing for the weight of the truck chassis itself, this truck is therefore capable of carrying a load that may impose as much as 25,300 lbs. additional weight on the rear wheel bogie and 8,850 lbs. additional on the front wheels, without exceeding the wheel load limits that have been established as the maximum permissible for use on these pubiic highways. With previously used transit mixers having drums of shape to concentrate the load over the rear wheels of trucks of this type, the total wheel loading of 32,000 lbs. on the rear wheels was attained with a load of approximately 4½ to a maximum of 5 cubic yards of concrete in the mixer drum.

In the improved transit mixer constructed in accordance with the present invention, the load of concrete is disposed forwardly on the truck to effect a better distribution of the total load between the rear wheels and the front wheels of the truck. As shown in Fig. 1, the combined weight of the improved mixer and its load of concrete may be assumed to be concentrated approximately at a point **13** representing the center of gravity of the loaded mixer under normal conditions with the drum stationary and the concrete in fluid condition of normal consistency. In this particular instance, and by reason of the improved construction, the center of gravity **13** is positioned about fifty inches forward of the load center of the rear wheel bogie. With the center of gravity **13** in this forward position and the mixer loaded to predetermined capacity to impose the permitted additional weight of 25,300 lbs. on the rear wheels R, there is also imposed a proportionate additional weight of 8,850 lbs. on the front wheels F, thereby bringing the total front wheel loading up to the allowable maximum of 14,400 lbs. Under these circumstances, the front wheels carry some twenty-six percent of the weight of the loaded mixer. By this improved arrangement of the mixer structure whereby proper distribution of the load is achieved, the truck is enabled to carry its total allowable maximum useful load of 34,150 lbs. without subjecting the roadway to excessive wheel loads. Through optimum loading of all of the wheels of the truck in this manner, this particular standard truck T is capable of carrying, in addition to the weight of the mixer, about 6¼ cubic yards of concrete. This constitutes an increase in the permissible load of concrete of substantially thirty to forty percent over that previously carried on trucks of similar characteristics in truck-mounted mixers of previously known design.

The new and improved results achieved by the invention have been set forth with respect to a particular type and size of standard commercial motor truck purely by way of illustration. It is to be understood that trucks of other sizes and styles may be utilized with mixers designed in accordance with the principles of the invention, perhaps to meet somewhat different particular load limitations, in an equally effective manner to achieve optimum wheel loading and maximum load carrying capacity. Furthermore, as improvements are made in highways and in the design of commercial trucks, particularly with respect to the load-carrying and steering capabilities of their front wheels, the invention will make possible still greater economies in the transportation of concrete to construction sites.

The term "standard commercial motor truck" as used in this specification is intended to refer to trucks of the type having the cab behind the engine as shown in the drawings. Other trucks provided with special cabs or of the type having the cab mounted over the engine involve additional expense both in first cost and in cost of operation and they are not considered standard or conventional in the sense of providing the most economical form of transportation. However, when the improved mixer is used with trucks of the cab-over-engine or similar special type, the advantages of the present invention persist and may be realized to an even greater degree.

As appears in Fig. 1 of the drawings, disposition of the weight of the mixer and its load forwardly on the truck T occurs because of the shape of the mixing drum **10** being such that the load of concrete is carried largely in the forward end of the drum and also from the fact that the drum itself is positioned forwardly on the truck. In this respect it should be observed that mixer drums necessarily must be made considerably larger than the volume of concrete to be mixed in order that mixing space may be available, and also that certain overall dimensions must be observed in order that the truck and its load will have adequate clearance on the roads.

As best shown in Figs. 1 and 3 the tapered drum **10** comprises mainly a body portion **14** that is preferably of generally coniform or frusto-conical shape, although the shape may vary somewhat from that of a true cone. The drum **10** is disposed longitudinally of the truck T with the large end of the conical body **14** positioned forwardly and closed by a domelike head **15** to constitute a mixing chamber or compartment. As shown, the large end or head **15** forming the closed end of the tapered drum **10** is disposed close to the back of the truck cab C and as low as practicable in relation to the side frames S of the truck, the maximum diameter of the drum being such

that its outer edges come within the clearance limits of the truck height and width. The longitudinal geometric axis **12** of the conical drum **10** is inclined upwardly and rearwardly at an angle of about 11 degrees to the plane of the frame S, the drum body **14** being of such length that its small end presents an elevated discharge opening **16** disposed above and in substantial vertical alignment with the rear edge of the rear pair of wheels R.

By this arrangement, the discharge opening **16** is disposed as high as desirable and conveniently positioned at the back of the truck T to facilitate spouting the discharged concrete at the site of placement while at the same time the closed large end of the drum is positioned as far forward as possible closely adjacent to the truck cab. The shape and degree of taper of the drum body **14** is such that its upper element is disposed substantially horizontally or nearly parallel with the plane of the truck bed or side frames S as appears in Fig. 1. The particular mixing drum **10** shown in the drawings as a specific example may be about 146" in length as measured along the axis **12** from the center of the head **15** to the plane of the discharge opening **16**. The frusto-conical body portion **14** is about 111" long and constitutes approximately seventy-five percent of the total length of the drum. The small end of the drum constituting the elevated discharge opening **16** is about 34" in diameter and the large end of the conical body **14** is about 84" in diameter, this being the largest diameter of the drum. The angle of the slope or the angle of inclination of the conical wall of the drum body **14** to the axis **12** is not over about 12½ degrees. The ratio of overall length of the drum **10** to its greatest diameter is in this instance of the order of 1.75.

That the dimensions and proportions of the exemplary drum as set out above are material departures from established truck mixer practice will be realized when one considers that according to established practices, the taper of the discharge cone of an inclined axis drum was generally of the order of twenty degrees, the angle of axis-inclination to the horizontal was substantially in the range of 15 degrees to twenty degrees, and the ratio of the length of the discharge cone section to the greatest drum diameter was substantially less than 1.5. These dimensions were dictated by the requirements imposed by the conventional disposition of the drum-driving mechanism and water supply tank between the mixing drum and the cab of the truck, so that in order to have adequate space for mixing at the forward, closed end of the drum, and adequate height for discharging the concrete a much shorter and relatively wider drum was employed, and it was set on an axis of much steeper inclination. In these drums, the length of the cone was generally of the order of not to exceed two-thirds of the total drum length and in some instances was even less.

By reason of the long tapered shape and inclined position of the present drum **10**, a large proportion of the load of concrete in the drum tends to move downward and forward, and accumulates in the lower part of the enlarged closed front end or head of the drum, thereby disposing the center of gravity of the load forwardly in the drum. This coupled with the fact that the drum itself is disposed forwardly on the truck frame positions the load in such a manner that some twenty to thirty percent of the weight of the loaded mixer is carried by the front wheels of the truck. As previously mentioned, in the particular structure illustrated, the center of gravity **13** of the loaded mixer is so positioned that about twenty-six percent of the load is carried by the front wheels, the center of gravity **13** being positioned about 50 inches ahead of the load center of the rear wheel bogie. Since the wheel base of the particular truck T shown in the drawing is 193 inches, the ratio of the distance by which the center of gravity is ahead of the bogie center, to the wheel base is .26, or that is, the center of gravity **13** is a little more than one-fourth the length of the wheel base ahead of the bogie center.

A simple method of determining the load which the mixer imposes on the rear wheels of the truck T when it is on level ground is expressed by the formula

$$RA \times WB = TL \times FG$$

where RA is the reaction force on the rear wheels, WB is the truck wheel base, TL is weight of the mixer and the concrete it contains, and FG is the distance from the front axle to the center of gravity of the mixer and its load, all dimensions being taken horizontally. In effect,

this equation expresses the static balance between the two moments of force around the truck's front axle. According to this formula, TL (the load that can be carried without exceeding the maximum permissible weight on the rear wheels) for a given wheel base truck is inversely proportional to the distance from the front wheels to the center of gravity **13** of the truck mixer. Part of this distance is occupied by the truck (its engine and cab) and will vary of course for different trucks. But regardless of this dimension, the balance, which may be referred to as the G dimension, from the back of the truck cab to the mixer center of gravity, is critical in determining the portion of the load imposed on the front wheels of the truck. The lower the G dimension, the greater is the proportion of the load on the front wheels.

Another critical dimension is the horizontal distance from the back of the truck cab, or rather from the front end of the mixer frame arranged closest to the cab (assuming only a very slight clearance is required) to the bottom of the discharge opening at the elevated end of the drum. It is from this latter point that the mixed concrete has to be spouted or discharged into receiving means. This dimension may be referred to as the L dimension. Increasing the L dimension increases the capacity of the mixing drum. Furthermore, if the L dimension is too short for a given truck, the discharge end of the drum may be ahead of the rear wheels of the truck, making it impractical to discharge laterally by the chute **30** or vertically (when the chute is removed) into a receiving hopper or buggy. The greater the L dimension, within practical limits, the less danger there is of having too short a mixer for adequate discharging purposes.

If these two dimensions are expressed by the ratio G/L, the lower the ratio is, within practical limits, the more advantageous the design will be, not only because weight will be distributed forward but adequate over-all length as well as mixing capacity will be obtained. The mixer of this invention represents a decided advance in the art, for the disposition of the drum **10** at the forward end of the mixer frame **11**, where it may be mounted closely adjacent the cab C of the truck and the shape of the drum as herein set forth, greatly reduces the G dimension, while the length of the drum on its inclined axis provides a substantial L dimension. In the embodiment of the invention illustrated hereby, the ratio G/L is less than .45 and of the order of .40, which is a substantial departure from prior art machines in which a ratio of not less than about .50 was obtainable.

In order that the G dimension may be uniformly determined, values here given are based on the determination of the center of gravity with the drum loaded to its rated capacity according to NRMCA (National Ready Mixed Concrete Association) standards; concrete fully mixed and of adequate slump (approximately five inches) so that the concrete does not build up unduly in certain areas of the drum; drum not turning; truck on level ground; and sufficient water in the water tank **38** to provide customary flushing of the drum when it is driven back to the loading plant after discharging its mixed concrete.

In order that the drum **10** may be rotated about its inclined longitudinal axis **12** in mixing or discharging concrete, the drum is provided at its forward end with a trunnion **17** that constitutes a journal projecting axially from the center of the head **15**. The trunnion or journal **17** is rotatably received within a bearing **18** (which is preferably self-aligning), that is carried by an upstanding forward frame member **19** constituting the front part of the mixer frame **11** and positioned closely adjacent to the back of the truck cab C. The elevated discharge end **16** of the drum **10** is likewise rotatably supported by a rear frame member **21** that also constitutes part of the mixer frame **11** and is upstanding at the rear of the truck. As best shown in Fig. 4, the rear frame member **21** carries a pair of spaced rotatably mounted drum supporting rollers **22** arranged to rotatably engage the respective lower quadrants of a ring or trackway **23** that encircles and is secured to the tapered body **14** of the drum **10** near its small end. The trackway **23** constitutes a rear journal that is disposed in axial alignment with the forward journal or trunnion **17** in rotatably supporting the drum at its respective ends to provide for turning it upon its inclined longitudinal axis **12**. Since by reason of the inclination of the axis **12** the entire drum **10** has a tendency to slide forward, the front or main bearing **18** in

the forward frame member 19 is preferably self-aligning and of well-known anti-friction type adapted to resist thrust loads as well as radial loads.

As appears in Figs. 4 and 5, the lower part of the mixer frame 11 is constituted by a pair of spaced parallel side frame elements 24 that are arranged respectively to rest upon and be secured to the side frames S of the truck chassis. As shown in Fig. 4, the rear frame member 21 comprises spaced vertically disposed side pieces or uprights 25 that are secured at their lower ends to the ends of the respective side frame members 24 and are connected near the midpoints by a transverse member 26 which carries the rollers 22 that rotatably support the rear end of the drum 10. A lighter transverse member 27 is connected between the rear side pieces 25 in the region of the axis of the drum 10 and serves to carry a charging hopper 28 through which material such as concrete aggregates may be fed into the drum through the rear opening 16 for mixing therein. Beneath the charging hopper 28, the rear side pieces or uprights 25 support a gathering chute or collection hopper 29 which operates during unloading of the drum to receive the discharged concrete and channel it into distributing apparatus such as a movable distributing chute or spout 30 that is pivotally supported on a spout pivot 31 at the rear of the frame 11 as shown in Fig. 3.

As best shown in Fig. 5 the front frame member 19 is constituted by a pair of upstanding side pieces or uprights 34 that are secured at their respective lower ends to the forward ends of the side frames 24 and are interconnected near their upper ends by a transverse member 35 that carries the main bearing 18. The front frame member 19 also carries a water supply tank 38 that is disposed transversely of the frame 11 ahead of the forward end of the drum 10 in a position to overhang the top of the driver's cab C as shown in Figs. 1 and 3. With the water tank 38 disposed in this overhanging position, it is arranged to offer no interference to positioning the drum 10 as far forwardly on the truck as may be desired. Furthermore, with the tank 38 overhanging the cab C as shown, its weight is likewise disposed forwardly on the truck in accordance with the principle of proper distribution of the weight among the wheels of the truck.

Referring to Figs. 2 and 5, it will be seen that the water tank 38 is of rectangular shape and is carried primarily by a transverse, tubular, torque-resisting element 39 that is rigidly secured to and extends outwardly from the upper ends of the front side pieces 34 at each side of the front frame member 19. Near its respective outer ends, the tubular transverse tank supporting member 39 is provided with a pair of angle brackets 40 each having two divergent arms extending upwardly and forwardly in a manner to engage and support the back and bottom of the respective ends of the rectangular water tank 38. As best shown in Fig. 1 the upper end of each bracket 40 is connected to the forward end of an upper tie piece or top frame element 41, the two tie pieces extending rearwardly along the top of the drum 10 at the respective sides thereof and being connected at the rear to the upper ends of the respective rear side pieces or uprights 25. The upper tie pieces 41, being disposed parallel to the lower frame side pieces 24, constitute with them and the front and rear vertical frame members a substantially rectangular box-like frame structure about the mixing drum 10.

Power for rotating the drum 10 in mixing or discharging concrete may be derived either from the propulsion engine E of the truck through the usual power takeoff connection or from a separate mixer driving engine. In either event the power transmitting apparatus is, in accordance with the present invention, mounted on the mixer frame 11 beneath the elevated discharge end of the drum 10. By this arrangement the power transmitting mechanism is so disposed as not to interfere in any way with positioning the drum 10 as far forwardly as may be desired on the chassis of the truck E.

In the particular exemplary construction shown in the drawings, the drum driving mechanism is represented by a separate mixer driving engine 45 and its associated power transmission mechanism or gear case 46. As shown, the engine and power transmission mechanism are joined to constitute a unitary structure that is mounted on a sub-frame 47 disposed transversely of the side frames 24 and secured thereto just ahead of the rear frame member 21. The power transmitting mechanism 46 is of the selective, reversing clutch type controlled by a vertically positioned hand lever 48 that extends from the gear case in an accessible position at the left rear corner of the frame 11. Power is transmitted from the transmission mechanism by means of a sprocket wheel 49 on the outer end of a shaft extending from the transmission gear case 46 with its axis disposed parallel with the rotational axis 12 of the drum 10. A complementary sprocket 50 of the ring type is disposed to encircle and is secured on the tapered body 14 of the drum 10 just forward of the bearing ring 23 and in cooperating alignment with the sprocket 49 on the transmission mechanism. A power transmitting chain 51 encircles the drum 10 in engagement with the sprocket 50 and passes around the transmission sprocket 49 as shown in Fig. 4 to interconnect the sprockets for transmitting power to rotate the drum.

It will be observed that with the three-point mounting for the drum as shown, i. e. with the front end supported by the axial bearing 18 and the elevated end by the rollers 22 in which the drum is cradled, twisting and weaving of the truck frame occasioned by travel of the truck over rough or sloping terrain produces angular movement of the drum axis about the self-aligning bearing 18. The disposition of the drum to swing angularly about the forward bearing resulted, in previously constructed mixers, in considerable misalignment in the power transmitting train between the relatively fixed power source on the frame and the angularly moving forward end of the drum to which the power was transmitted. By applying the driving power to the elevated discharge end of the drum, movement of the drum occasioned by the twisting and weaving of the truck frame results in a minimum of misalignment between the axis of the drum and the axis of the driving sprocket 49, since the transmission mechanism 46 follows the twisting movement of the frame.

The inner surface of the drum 10 is provided with helical mixing blades 53, partly shown in Fig. 4, that function to tumble and propel the concrete during mixing or discharging thereof. In the particular mechanism here shown, the hand lever 48 is arranged to have a central neutral position in which the transmission mechanism is disengaged so that no power is transmitted to the drum. When the lever 48 is moved in the one or the other direction from the central neutral position, the drive mechanism is engaged to effect rotation of the drum 10 in the corresponding forward or reverse direction as selected. In the particular arrangement shown, the mixing blades 53 are so arranged that when the drum is rotated in one direction the concrete aggregates are fed inwardly and mixed by the blades in the forward end of the drum 10. When the control lever 48 is moved to the other position to reverse the direction of rotation of the drum, the helical blades 53 propel the mixed concrete upwardly and outwardly along the tapered drum body 14 to discharge it through the discharging opening 16 into the collection hopper 29. Under other circumstances, the mixing apparatus may be so arranged that the mixing action occurs while the drum is rotating in the direction to discharge the concrete, the discharge opening 16 then being closed during the mixing operation by a suitable removable cover or the like of well-known construction, the details of which need not be set forth herein. The speed of rotation of the drum for mixing or discharging is established by adjusting the speed of operation of the engine 45, a throttle control lever 55 being provided for that purpose on the left side of the machine near the directional control hand lever 48. The engine 45 and associated mechanism is protected by an enclosing metal housing 56 and the chain and sprocket drive is enclosed by a suitable chain guard housing 57.

The water tank 38 is preferably of the two-compartment type, one compartment containing water for introduction into the concrete during mixing and the other containing water for flushing out the mixer drum after discharging the concrete. A dual control valve 61 is connected as shown in Fig. 5 to the respective compartments of the tank 38 and is arranged to connect either compartment selectively with a water pipe or conduit 62. The pipe 62 extends across the front of the drum 10 and then back along the right side thereof to a water pump 63 that is disposed adjacent to and is operatively

connected to be driven by the engine 45. From the pump 63 a return pipe 64 leads back along the drum to a water inlet connection 65 that projects axially through the trunnion 17 into the interior of the drum 10, being provided within the drum with a nozzle of the usual type for injecting water into the concrete mix as the drum is rotated during the mixing operation.

By disposing the water tank over the cab of the truck and arranging the drive mechanism, as set forth, beneath the elevated end of the drum, the space that these essential elements formerly occupied between the drum and the cab has been made available for utilization by the mixing drum so that the latter, being lengthened, can be set at an appreciably less angle of inclination without sacrificing discharge height or maximum diameter for effective mixing. As a result, greater drum capacity is provided, as well as improved discharging ability.

From the foregoing description and explanation of the operation of the exemplary transit-mixer set forth herein it will be apparent that the truck-mounted mixer embodying the present invention is capable of carrying the maximum load of concrete that can be transported by a standard motor truck without causing any wheel of the truck to impose an excessive load on the roadway being traversed.

Although a single mixer structure illustrative of the present invention has been set forth in detail herein by way of a full disclosure of a practical and useful embodiment of the invention, it is to be understood that various other arrangements and different proportional relationships of the elements of the apparatus may be utilized without departing from the spirit and scope of the invention as defined in the subjoined claims.

An exemplary embodiment of the invention having now been fully described, I claim as my invention:

1. In a truck mounted mixer adapted for economical use in conjunction with a motor truck of conventional construction having the driver's cab disposed behind the truck engine, a long tapered mixing drum arranged for mounting longitudinally on the truck for rotation upon its axis with its large end closed forming a mixing chamber of large diameter disposed closely adjacent to the back of the truck cab and with its axis inclined upwardly and rearwardly in fixed position relative to the truck to present its open discharge end in the usual elevated position approximately above the rear edge of the rear truck wheels, said drum being of substantially frusto-conical shape with the ratio of its length to its greatest diameter substantially in excess of one and one-half to one, the shape and position of said drum being such that the weight of the drum and its load is distributed among the wheels of the truck in such a manner that twenty to thirty percent thereof is carried by the front wheels of the truck, whereby optimum distribution of the load on the truck wheels is effected to provide for carrying upwards of six cubic yards of concrete in said mixing drum without imposing in excess of 32,000 pounds on the rear wheels of the truck.

2. In a transit mixer adapted for mounting on a conventional motor truck of the type having the driver's cab mounted behind the propulsion engine, a long rotatable mixing drum having a frusto-conical body portion tapering at not more than fifteen degrees throughout in excess of two-thirds of the total drum length and having a dome-like head closing the large end thereof to constitute a mixing chamber of large diameter, said mixing drum presenting a discharge opening at its small end adapted to be disposed in elevated position above the rear of the truck as is usual for convenient discharging of mixed concrete and being of such length that its large closed mixing end may be disposed closely adjacent to the back of the driver's cab, whereby concrete carried in said drum tends to be concentrated in the large forward end thereof during mixing and transportation to dispose the center of gravity of the loaded mixer substantially forward of the mid-point between the rear of the truck cab and the discharge opening at the end of the drum.

3. In a truck mounted transit-mixer for use on a motor truck of standard construction, a supporting frame adapted to be mounted on the truck chassis, a relatively long mixing drum arranged on said frame in a manner to extend from a position directly behind the cab of the truck rearwardly and upwardly to a position above the rear of the truck, power transmitting mechanism for driving said mixing drum disposed on said frame beneath and operatively connected to the upwardly extending end of said drum, and a water supply tank mounted on said frame forwardly of the forward end of said mixing drum in position to be disposed above and overhang the cab of the truck and operatively connected to furnish water to said drum, the arrangement being such that said water supply tank constitutes an integral part of the transit-mixer structure that is separable from the truck as a unit yet said tank is disposed in a position which does not interfere with said mixing drum being mounted directly behind the cab of the truck.

4. In a concrete mixer for mounting on a standard motor truck of the type having the operator's cab on the bed behind the engine, an open-ended mixing drum of generally frusto-conical shape having a closed dome-like head at its larger end and of length such that when mounted as hereinafter specified, the center of gravity of the loaded mixer is substantially forward of the mid-point between the back of the truck cab and the small end of the drum, said drum being mounted for rotation upon its longitudinal geometrical axis with its closed large end arranged for mixing concrete and disposed adjacent to the cab of the truck and with its upper longitudinal element disposed approximately parallel with the plane of the truck bed to present its open small end in elevated position above the rear wheels of the truck for discharging mixed concrete, and power driving mechanism disposed between the elevated small end of said drum and the frame and operatively connected to said drum for rotating it.

5. In a truck mounted, transit concrete mixer adapted for mounting on a conventional motor truck, a supporting frame arranged to be mounted on the truck chassis, a relatively long, generally tapered mixing drum rotatably mounted on said frame with its axis of rotation fixedly inclined to the plane of the truck chassis at a relatively low angle of inclination such that the larger forward end which is closed provides a mixing chamber of maximum diameter ample for adequate mixing and closely contiguous to the forward end of the supporting frame and the back of the cab of the truck when the mixer is mounted thereon while the elevated end of the drum which is open provides a discharge opening at the usual height for wide spouting range, and the length of said drum being substantially greater than its maximum diameter, the arrangement being such that when the mixer is mounted directly behind the cab of the truck the ratio G/L is less than .45, where G is the horizontal distance from the back of the cab to the center of gravity of the loaded mixer and L is the horizontal distance from the back of the cab to the discharge opening.

6. Apparatus as set forth in claim 5, wherein the angle of drum inclination is substantially less than 15 degrees, the ratio of drum length to maximum drum diameter is of order of at least 1.5 to 1, and the tapered portion is substantially in excess of two thirds of the length of drum.

7. A concrete mixer adapted for mounting on a conventional motor truck of relatively short wheel base for easy maneuverability, said mixer comprising a frame including members substantially co-extensive with the portion of the truck chassis in back of the driver's cab and securable thereto, a separate drum-rotating engine arranged transversely at the rear of said frame, a rotatable, internally-bladed mixing drum longitudinally mounted on said frame having its axis of rotation inclined to the bed of the truck and its forward end closed and disposed above the forward end of said frame members, said drum having a generally frusto-conical discharge portion tapering inwardly toward an elevated discharge opening disposed rearwardly of said motor, the inclination and taper of said drum affording clearance beneath the drum and above said motor, and insuring when the drum is mounted closely adjacent to the rear of the truck cab that the center of gravity of the drum when carrying its rated load of concrete is substantially forward of the point of wheel mounting support at the rear of the truck, and power transmitting means interconnecting the motor and the drum to produce rotation of the drum.

8. In a transit-mixer especially adapted for mounting

on the chassis of a motor truck of the usual commercial type having the driver's cab behind the propulsion engine; an internally-bladed mixing drum of tapering shape arranged for mounting longitudinally of the motor truck on an inclined axis with its small end open and in elevated position at the rear of the truck to constitute a discharge opening, and with its large end closed to constitute a mixing chamber; a frame disposed to support said drum for rotation about its inclined longitudinal axis and adapted to be secured to the truck chassis in a manner to maintain said drum in position on the truck with its forward end closely adjacent the cab of the truck; power transmitting mechanism mounted on said frame adjacent the elevated discharge end of said drum and operatively connected to said drum in a manner to effect rotation of said drum in either direction selectively for mixing and discharging concrete, the taper and inclination of the drum being such that the weight of the concrete mixed and transported by said drum is disposed forwardly on said frame so that the ratio of G/L, where G is the horizontal distance from the back of the truck cab to the center of gravity of the loaded mixer and L is the horizontal distance from the back of the cab to the lower end of the discharge opening is not in excess of .45, whereby a maximum load of concrete may be transported without imposing excessive wheel loads on the highway being traversed.

9. A truck-mountable concrete mixer capable of mixing and hauling a larger batch of concrete than heretofore possible without imposing in excess of a predetermined load on the rear wheels of the truck, said mixer comprising a frame arranged for mounting on the bed of the truck behind its cab, an internally-bladed, rotatable mixing drum journalled on said frame with its axis of rotation inclined upwardly toward the rear of the frame at a fixed angle to the plane of the truck bed, said drum having its forward end closed by a dome-like head of large diameter providing ample free-mixing space above the materials constituting such a batch, the elevated end of said drum being open to permit charging and discharging, and the sides of said drum tapering inwardly from said dome-like head to said charging and discharging opening, said drum being of a length at least as great as said frame and having its forward end at the forward end of the frame whereby the mixer may be mounted with the head of the drum closely behind the cab of the truck, the length of said drum providing that the discharge opening is at the usual high and rearwardly disposed elevation for wide spouting range, and means for rotating the drum including a power transmission mounted on the frame adjacent the tapered portion of the drum, the entire arrangement being such that the center of gravity of the mixer when transporting such a batch is sufficiently forward of the mid-point between the rear of the truck cab and the open end of the drum to impose not in excess of the predetermined permissible load on the rear wheels of the truck.

10. A truck-mountable concrete mixer capable of mixing and hauling a larger batch of concrete than heretofore possible without imposing in excess of a predetermined load on the rear wheels of the truck, said mixer comprising a frame arranged for mounting on the bed of the truck behind its cab, an internally-bladed, rotatable mixing drum journalled on said frame with its axis of rotation inclined upwardly toward the rear of the frame at a fixed angle substantially less than 15° to the plane of the truck bed, said drum having its forward end closed by a dome-like head of large diameter providing ample free-mixing space above the materials constituting such a batch, the elevated end of said drum being open to permit charging and discharging and the sides of said drum tapering inwardly to said opening over at least two-thirds of the length of the drum, said drum being of a length at least as great as said frame and having its forward end at the forward end of the frame whereby the mixer may be mounted with the head of the drum closely behind the cab of the truck, the length of said drum providing, despite the low angle of the drum inclination, that the discharge opening is at the usual high elevation for wide spouting range, and means for rotating the drum including a power transmission mounted on the frame between the tapered portion of the drum and the frame, the entire arrangement being such that the center of gravity of the mixer when transporting such a batch is sufficiently forward of the midpoint between the rear of the truck cab and the open end of the drum to impose not in excess of the predetermined permissible load on the rear wheels of the truck.

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