March 2, 1971 W. H. BUELOW 3,567,189

TRUCK MIXER WITH OFFSET DRUM AXIS

Filed Dec. 23, 1968

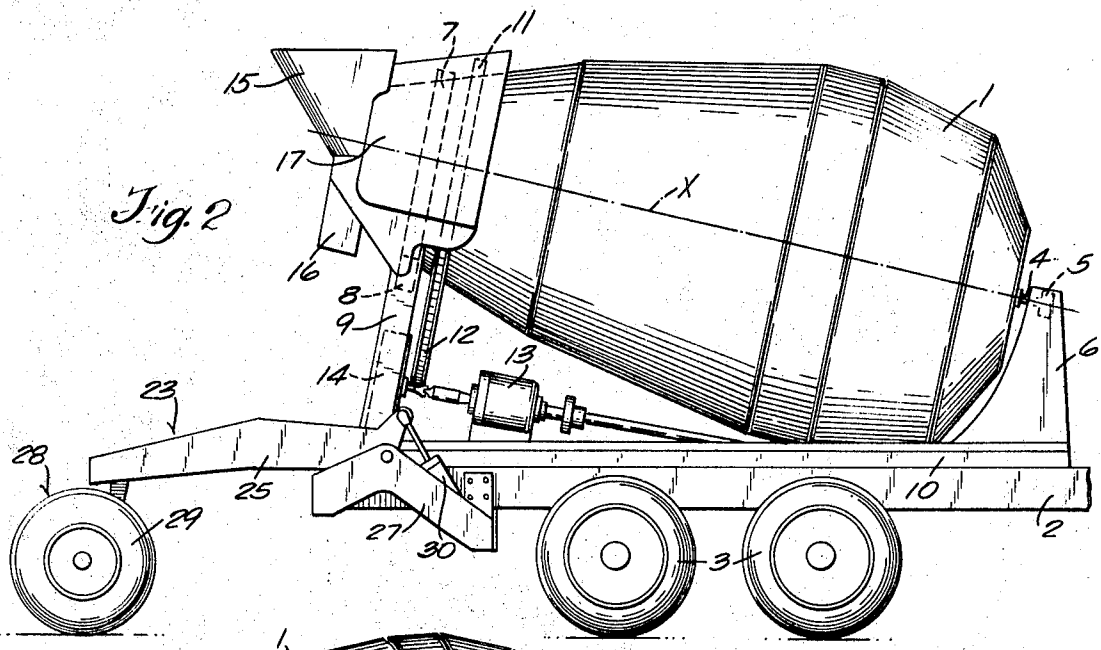



Fig. 2

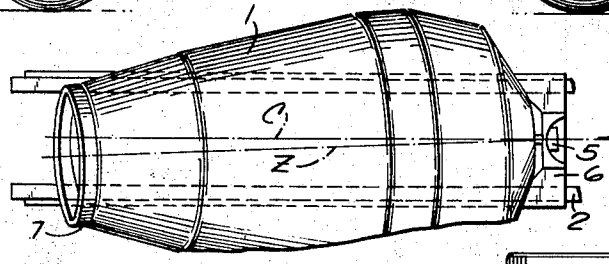



Fig. 4

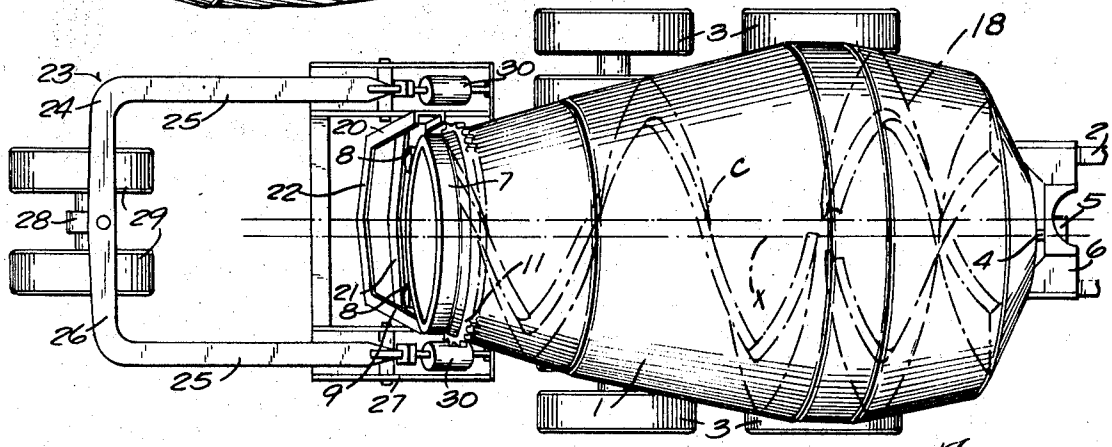



Fig. 1

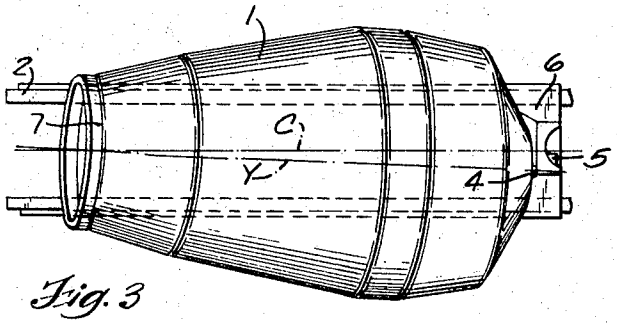



Fig. 3

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3,567,189

# TRUCK MIXER WITH OFFSET DRUM AXIS

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U.S. Cl. 259—176 7 Claims

## ABSTRACT OF THE DISCLOSURE

A truck mixer has a mixing drum mounted with its axis of rotation offset laterally of the centerline of the truck. The drum is offset in the direction opposite that in which the concrete ingredients are moved while being mixed and, since mixing is generally done in transit, the offset mounting has the effect of maintaining the center of gravity of the ingredients more nearly on the centerline of the truck during mixing and thereby minimizing lateral instability of the truck mixer in transit.

## BACKGROUND OF THE INVENTION

### (1) Field of invention

The present invention relates to truck mixers of the type having a mixing drum rotatably mounted on the chassis of a truck. More specifically, the invention herein resides in mounting the mixing drum on the truck in a manner to minimize the effect of the lateral shift of the center of gravity of the concrete, occurring during mixing in transit, on the stability of the truck mixer.

### (2) Description of the prior art

In transit type concrete mixers of the prior art, those employing rotatable mixing drums are of two basic types. In one type a generally cylindrical mixing drum is rotatably mounted on the frame of a truck and with its axis of rotation horizontally disposed. The more common type of truck mixer employs the well-known inclined axis type mixing drum, as shown, for example, in U.S. Pat. No. 3,073,580 issued Jan. 15, 1963 to J. W. Lendved. In this type of mixer the drum has an elongated frusto-conical rear portion which tapers to a relatively small, open end serving both as the charging opening for the concrete ingredients and the discharge opening for the mixed concrete. The axis of rotation is inclined upwardly to the rear so that the opening is raised for reasons well-known in the art.

Both the horizontal and the inclined axis mixing drums of the prior art are provided with spiral mixing and discharge blades attached to the inner peripheral surfaces of the drums, such as are shown in U.S. Pat. No. 3,328,006 issued June 27, 1967 to W. H. Buelow et al. In either type of drum the spiral blade is generally arranged such that rotation of the drum in the mixing direction causes the concrete ingredients to be simultaneously lifted in the direction of rotation and moved forwardly to the head end of the drum.

As the concrete ingredients are lifted in the direction of rotation, they are moved laterally with respect to the longitudinal axis of the drum and the truck chassis on which the drum is mounted. The center of gravity of the ingredients shifts laterally with such movement and, as a result, such shifting tends to decrease the lateral stability of the vehicle on the side to which the ingredients are moved.

The concrete carried by the mixer is generally completely mixed in transit to the place of delivery, and it is known in the art to take advantage of a normally crowned roadway surface to help overcome the instability produced by the lateral displacement of the ingredients during mixing. In other words, since a roadway is normally crowned at its centerline and slopes downward to the right with respect to the direction of travel, rotation of the mixing drum in a clockwise direction when viewed from the rear will move the ingredients to the left side or the side opposite that to which the truck is tilted due to the roadway crown.



However, it has been found that certain movements of a loaded truck mixer or characteristics of the surface over which it is traveling can act to increase the instability caused by the lateral shift of the concrete ingredients. Thus, the centrifugal force developed by too sharp or too rapid a turn to the right will further decrease the stability of the truck and greatly increase the tendency of the truck to overturn. This particular problem of truck mixer instability has become increasingly critical because of continuing improvements in the concrete mixers, the trucks on which they are mounted, and the roadways over which they travel.

Improvements in mixing techniques and apparatus have improved the quality of the concrete, primarily by providing for better mixing of concrete with a lower water content and consequent greater strength. Such concrete is, as a result of its lower water content, stiffer in its mixed form and, though readily mixable with improved mixers, it is moved farther to and is lifted higher on the side of the drum when being mixed. The center of gravity of the concrete is thus shifted farther in the direction of increased instability.

Larger and better trucks have allowed a substantial increase in the average size of concrete mixers and the loads they mix and transport. The centrifugal force exerted thereon as the truck mixer is turning has accordingly also increased. The centrifugal force acting to decrease stability is increased too in accordance with the greater speeds of which modern trucks are capable.

A particularly critical stability problem has been found to exist in truck mixers of the type employing a load-distributing trailer. Such trailers are used to distribute the weight of the concrete in large capacity mixers which would otherwise impose loads on the rear truck axles in excess of public highway weight restriction limits. A load-distributing trailer typical of the prior art is shown in U.S. Pat. No. 3,317,193 issued May 2, 1967 to W. H. Buelow et al. In a trailer of this type, hydraulic means are employed to impose a lifting force on the rear of the truck and thereby shift a portion of the load concentrated on the rear truck axles forwardly to the front truck axle and rearwardly to the wheels of the trailer.

For reasons known and disclosed in the prior art, the wheels of the typical load-distributing trailer are closely spaced and disposed generally on the centerline of the truck a substantial distance from the rear thereof. For this reason, any load transferred to the wheels of the trailer is placed on a support having far less inherent lateral stability than the truck. And, because of the rigid attachment of the trailer to the truck, the lateral instability of the trailer is transmitted to the unit as a whole. It will be readily appreciated that the previously mentioned factors acting to reduce the lateral stability of a truck mixer become even more critical where a load-distributing trailer is used.

## SUMMARY OF THE INVENTION

The present invention is directed to providing a truck-mounted concrete mixer having improved stability while operating in transit. By mounting the mixing drum so that its axis of rotation is offset laterally of the centerline of the truck chassis, the center of gravity of the mass of concrete ingredients which is shifted laterally due to mix-

ing drum rotation may be maintained more nearly on the centerline of the truck.

In its preferred embodiment, the mixer drum is offset by an equal lateral adjustment of the means by which both ends of the drum are rotatably supported. The forward end of the drum is supported on its axis of rotation by a single self-aligning roller bearing. The rearward end of the drum is supported by a pair of rollers rotatably engaging an annular peripheral track mounted on the outside of the drum and concentric with the axis of rotation thereof. The forward support bearing is mounted in a bearing pedestal and its position may be selected to effect the desired lateral offset position. The pair of rear drum rollers are mounted on an upright rear frame member and may also be adjusted laterally, within certain limits, to offset the rear portion of the drum with respect to the longitudinal axis of the truck on which it is mounted.

The modifications and adjustments necessary to effect the desired offset mounting of the drum may be made, with one exception, within the structure of a typical mobile concrete mixer of the prior art. The one exception is the upright rear frame member which mounts the rear drum rollers. A rear frame member wider in the lateral direction than that shown in the prior art is needed to provide the clearance necessary to offset the drum rollers by the desired amount.

In an alternate embodiment of the invention, the drum may be offset by a lateral movement in the appropriate direction of only the forward support bearing. In another embodiment, the forward support bearing is maintained in a non-offset position on the centerline of the truck, and the rear drum rollers and rear portion of the drum are offset as in the preferred embodiment. In either of these embodiments the axis of the drum lies skewed with respect to the longitudinal centerline of the truck chassis.

The foregoing embodiments of the invention are adaptable for use with various types of truck mounted mixers, however, they are particularly adaptable to provide increased stability in truck mixers equipped with load-distributing trailers.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of the rear portion of the chassis of a truck-mounted concrete mixer showing the offset mounted drum of the present invention with a portion of the rearward end of the drum removed, and additionally showing a load-distributing trailer operatively attached to the truck chassis.

FIG. 2 is a side elevational view of the mixer drum and the portion of the truck chassis shown in FIG. 1, and additionally showing the charging hopper and a portion of the drum drive mechanism.

FIG. 3 is a top plan view of the rear portion of a truck chassis with a mixer drum mounted thereon showing the general arrangement of an alternate embodiment of the present invention.

FIG. 4 is a top plan view similar to FIG. 3 showing the general arrangement of a second alternate embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawing, FIG. 1 shows the mixing drum **1** mounted on the rear portion of a truck chassis **2** in the manner of the preferred embodiment of the present invention. The truck chassis **2** is supported by the rear wheels **3** and it extends forwardly beyond the mixing drum **1** to support the cab and engine (not shown) in a known manner.

Referring also to FIG. 2, the mixing drum **1** is of the frusto-conical, inclined axis type known in the art. The forward or head end of the drum **1** has a trunnion **4** extending forwardly therefrom on the axis of rotation X. The trunnion **4** is rotatably supported by a self-aligning bearing **5** which is mounted within the upper portion of a bearing pedestal **6**.



Near the open rear end of the drum **1** an annular roller track **7** is mounted on the outer periphery of the drum concentric with the axis of rotation X thereof. The rear end of the drum is rotatably supported by a pair of drum rollers **8** which are mounted for rotatable engagement of the roller track **7** to a rear upright frame member **9**.

The bearing pedestal **6** and the upright frame member **9** are fixed, respectively, to the forward and rearward ends of a pair of longitudinal frame members **10**. The longitudinal frame members, in turn, are bolted or otherwise secured to the truck chassis **2**.

The mixing drum is driven by means of an annular drum sprocket **11** attached to the outer periphery of the drum slightly forward of and in a manner similar to the roller track **7**. The drum sprocket **11** is operatively connected by means of a drive chain **12** to a drive sprocket which receives power from the truck engine or a separate power source through a transmission **13**, a speed reducer **14**, and interconnecting torque transmitting members.

FIG. 2 also shows the charging hopper **15** by which the concrete ingredients are fed into the open end of the drum and the discharge hopper **16** into which the mixed concrete is directed and from which it is chuted for placement. A semicircular curved shield **17** is attached by its ends to the upright frame member **9** and serves both as a cover for the roller track **7** and drum sprocket **11** and as a supporting means for the charging and discharge hoppers **15** and **16**, respectively. Either or both of the hoppers **15** and **16** may, alternatively, be mounted on and carried by the load distributing trailer **23**.

Referring to FIG. 1, after the mixing drum **1** has been charged with the ingredients for a batch of concrete and the drum is rotating in the mixing direction or clockwise as viewed from the rear, the concrete is moved forwardly and to the left by the action of the spiral mixing blades **18** mounted on the inside of the drum. Because the mixing of the concrete ingredients or the agitation of pre-mixed concrete is ordinarily done in transit, it can be seen from FIG. 1 that the lateral movement of the concrete will cause a substantial shift in the center of gravity as explained above. In order to compensate for this shift and thereby maintain the stability of the truck mixer, the mixing drum is mounted with its axis of rotation X to the right of the centerline C of the truck chassis **2**.

It has been found that an equal offset of both the forward and rear ends of the drum of approximately 2 inches provides a drum mounting wherein the center of gravity of the contents during mixing is maintained more nearly on the centerline of the truck chassis. With an offset of approximately 2 inches it is also possible to mount the drum with a minimum of change to the structure of truck mixers known in the art and in common use.

To provide the desired offset mounting, the self-aligning bearing **5** which supports the forward end of the drum is shifted to the right within the upper portion of the bearing pedestal **6** within which it is mounted. There is sufficient lateral clearance within the upper portion of the type of pedestal used in mixers of the prior art so that the offset mounting of the bearing **5** can be made without structural modification. The rear portion of the drum is offset by the same amount and in the same direction by shifting laterally the supporting drum rollers **8**.

However, it has been found that the upright frame member **9** to which the rollers are mounted must be modified slightly to provide additional clearance for the required lateral adjustment of the drum rollers **8**. The upright frame member **9** comprises a pair of upwardly divergent channel members **20** connected by upper and lower cross members **21** and **22** respectively. By increasing slightly the divergence between the channel members **20** or, alternately, by increasing the lengths of the cross members **21** and **22**, the width of the upright frame member **9** may be increased by an amount sufficient to allow the

required offset adjustment of the drum rollers **8**, particularly the right side drum roller which is offset outwardly to the right.

The above described offset drum mounting is particularly adaptable for use on truck mixers equipped with load-distributing trailers. Referring again to FIGS. 1 and 2, a load-distributing trailer **23** of a type known in the art is shown operatively attached to and extending rearwardly from the rear of the truck chassis **2**.

The trailer **23** comprises a generally U-shaped frame **24** having a pair of side arms **25** interconnected at their rearwardly disposed ends by a cross member **26**. The free forward ends of the side arms **25** are hingedly connected to an auxiliary frame **27** which is secured to the rear of the truck chassis **2**. The U-shaped frame **24** is adapted to pivot about the hinged connections between an elevated position (not shown) adjacent the rear of the mixer and a lowered operative position shown in FIGS. 1 and 2. A trailing wheel assembly **28** is attached to the cross member **26** and comprises a pair of closely-spaced tag wheels **29** for support of the trailer **23** when it is in the lowered position.

Movement of the trailer frame **24** between the elevated and lowered positions is effected by a pair of hydraulic cylinders **30**. Each cylinder **30** is pivotally connected at its respective ends to the forward end of a side arm **25** and the auxiliary frame **27**. The cylinders **30** also serve to distribute a portion of the weight on the rear wheels **3** of the truck to the front axle of the truck and to the wheels **29** of the trailer. Thus, when the trailer **23** is in the lowered position, as shown, force exerted by the cylinders is transmitted through the frame **24** and imparts a downward force to the trailing wheel assembly **28** and a resultant lifting force to the rear of the truck. Because the trailing wheel assembly **28** is spaced a substantial distance from the rear wheels **3** of the truck, the moment arm through which the lifting force acts also distributes a substantial portion of the load on the rear truck wheels **3** to the front axle of the truck.

The trailing wheel assembly is caster-mounted and the tag wheels **29** are closely spaced so that the trailer will follow turning movements of the truck without appreciably affecting the maneuverability or increasing the turning radius thereof, and without causing a scuffing of the wheels of the trailer. Because the tag wheels **29** have a substantially narrower track than the rear truck wheels **3**, they provide significantly less lateral support. Consequently, as the portion of the load initially carried by the rear wheels of the truck is distributed rearwardly to the wheels of the trailer by increasing the force exerted by the cylinders **30**, the lateral stability of the unit as a whole is decreased. Thus, it will be appreciated that the offset drum mounting of the present invention is particularly useful in maintaining the stability of truck mixers utilizing a load-distributing trailer of the type described.

As described and shown in U.S. Pat. 3,317,193, the chassis **2** of a truck to which a load-distributing trailer is attached is substantially longer than the chassis of a standard truck mixer not incorporating such a trailer. Because of its increased length, the chassis **2** provides less resistance to torsional stresses such as those imposed by the shifting of concrete in the mixing drum or surface irregularities of a road over which the truck is travelling. There is thus imposed on the chassis a twisting which further decreases the lateral stability of the unit.

The two alternate embodiments of the invention shown in FIGS. 3 and 4 comprise the same basic structure as shown and described above in the preferred embodiment. The position of the mixing drum **1** in each alternate embodiment is, however, offset in a manner slightly different than in the preferred mounting shown in FIG. 1. In both the alternate embodiments the mixing drums are mounted such that their axes of rotation are skewed with respect to the longitudinal centerline C of the truck chassis **2**.

In the alternate embodiment shown in FIG. 3, the forward end of the drum **1** and the supporting bearing **5** are offset laterally in a similar manner and in the same direction as in the preferred embodiment of FIGS. 1 and 2. The rearward end of the drum and the supporting drum rollers (not shown) are not offset, but are instead maintained centered on the centerline C of the truck chassis **2**. Because only the forward end of the drum is offset, that end must be offset by a greater amount than the corresponding end of the drum in the preferred embodiment in order to afford substantially the same compensation for the described lateral shift in the center of gravity of the concrete. Thus, the lateral distance between the centerline C and the axis of rotation Y at the position of the trunnion **4** is preferably twice the corresponding offset distance of the preferred embodiment or about 4 inches.

By maintaining the rearward end of the drum in FIG. 3 centered such that the axis of rotation Y of the drum intersects the centerline C of the truck chassis at approximately the position of the roller track **7**, the upright frame member need not be modified as is necessary in the preferred embodiment. The drum rollers (not shown) need only be canted slightly with respect to the centerline C to provide proper tracking of the roller track **7**.

In the second alternate embodiment, shown in FIG. 4, only the rearward end of the drum is offset. The forward support bearing **5** is mounted centrally within the bearing pedestal **6** and on the centerline C of the truck chassis **2**. The rearward end of the drum is offset in the same manner as described previously in the preferred embodiment and as shown in FIG. 1. The lateral offset distance, however, must be greater than in the preferred embodiment and, similarly as in the case of the embodiment of FIG. 3, should be approximately twice the offset distance of the preferred embodiment. Thus, the distance by which the axis of rotation Z of the drum **1** is offset from the centerline C at the position of the roller track **7** is approximately 4 inches. In this embodiment, the modified or widened upright frame member **9** of the preferred embodiment must be used.

When it is desired to discharge the mixed concrete from a drum mounted in any of the manners shown in FIGS. 1, 3 or 4, the rotation of the drum is reversed from the mixing direction. The spiral mixing blades cause the concrete to be moved rearwardly and generally to the right as viewed from the rear. Thus, during discharge the concrete is moved laterally in the same direction in which the mixing drum is offset. However, instability of the truck mixer in this situation is precluded or at least minimized for two reasons. First, the truck is generally not moving or turning or is moving or turning very slowly during discharge and is therefore not subjected to the adverse effect of centrifugal force. Secondly, because the mixing drum is substantially narrower toward its rearward end, the concrete is not displaced laterally to the extent it is when being mixed or agitated.

While the invention has been shown and described with reference to particular embodiments thereof, it will be understood by those skilled in the art that various changes may be made in form and detail without departing from the spirit and scope of the invention.

What is claimed is:

**1**. In a mobile concrete mixer of the type having a mixing drum rotatably mounted on the frame of a truck for mixing concrete in transit, the improvement comprising means mounting said mixing drum on said frame such that the axis of rotation of said drum is offset laterally from the longitudinal centerline of the truck and in the direction opposite that in which the concrete is moved by the rotation of the drum as the concrete is being mixed, whereby the center of gravity of the concrete ingredients being mixed is maintained more nearly on the longitudinal centerline of the truck.

**2**. In a truck mixer including a rotatable mixing drum having at least one open end for receiving concrete ingre-

dients and discharging the mixed concrete and an internally projecting spiral mixing and discharge blade arranged so that drum rotation in the mixing direction moves the concrete ingredients away from the open end and to one side of the axis of rotation of the drum thereby effecting a lateral shifting of the center of gravity of the drum contents, the improvement comprising bearing means carried by the truck and journally supporting the respective ends of the drum such that the axis of rotation of the drum is offset in the direction opposite said one side respecting the centerline of the truck whereby the effect of the described shifting of the center of gravity of the drum contents on the stability of the truck as the drum rotates in the mixing direction is reduced or minimized.

3. The invention of claim 2 wherein the mixing drum is offset such that the axis of rotation thereof is parallel to the centerline of the truck.

4. The invention of claim 2 wherein the mixing drum is of the frusto-conical type having a large closed forward end and a relatively smaller open rearward end, and said bearing means are disposed to journally support the respective ends of said drum such that the axis of rotation thereof is inclined upwardly toward said rearward end.

5. The invention of claim 4 wherein the mixing drum is offset such that the axis of rotation thereof lies in a vertical plane parallel to the center-line of the truck.



6. The invention of claims 2, 4, or 5 including a load-distributing trailer operatively connected to the rear of the truck for applying a lifting force thereto, whereby the tendency toward increased lateral instability of the mixer when a lifting force is applied by the trailer is reduced or minimized.

7. The invention of claims 2, 4, or 5 including a load-distributing trailer comprising a frame hingedly connected to the rear of the truck, castered wheel means including a pair of closely spaced ground-engaging wheels disposed to support said frame at the rearward end thereof, and power operated means for forcefully urging said frame downwardly relative the rear of said truck whereby a resultant lifting force is applied thereto.

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