

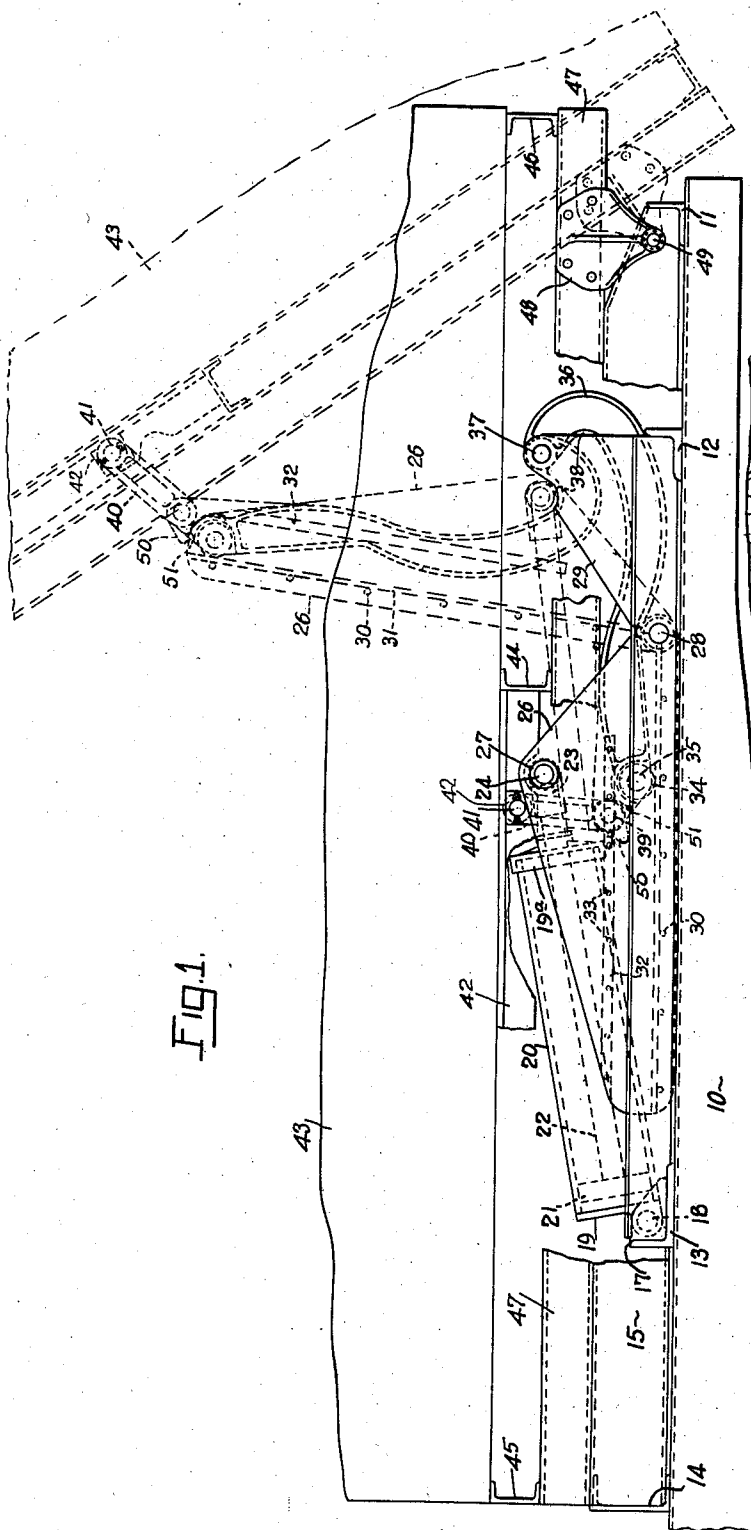
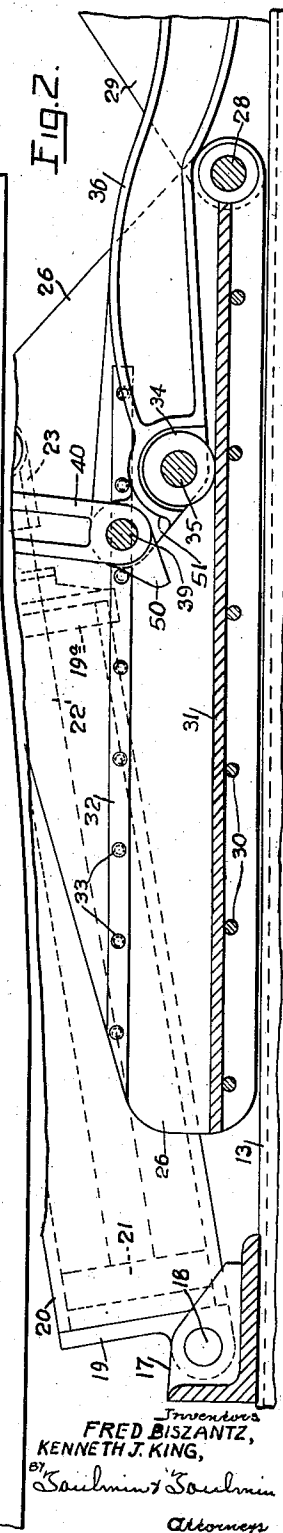
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F. BISZANTZ ET AL  
DUMP BODY LIFTING MECHANISM

2,144,828

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3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 3.

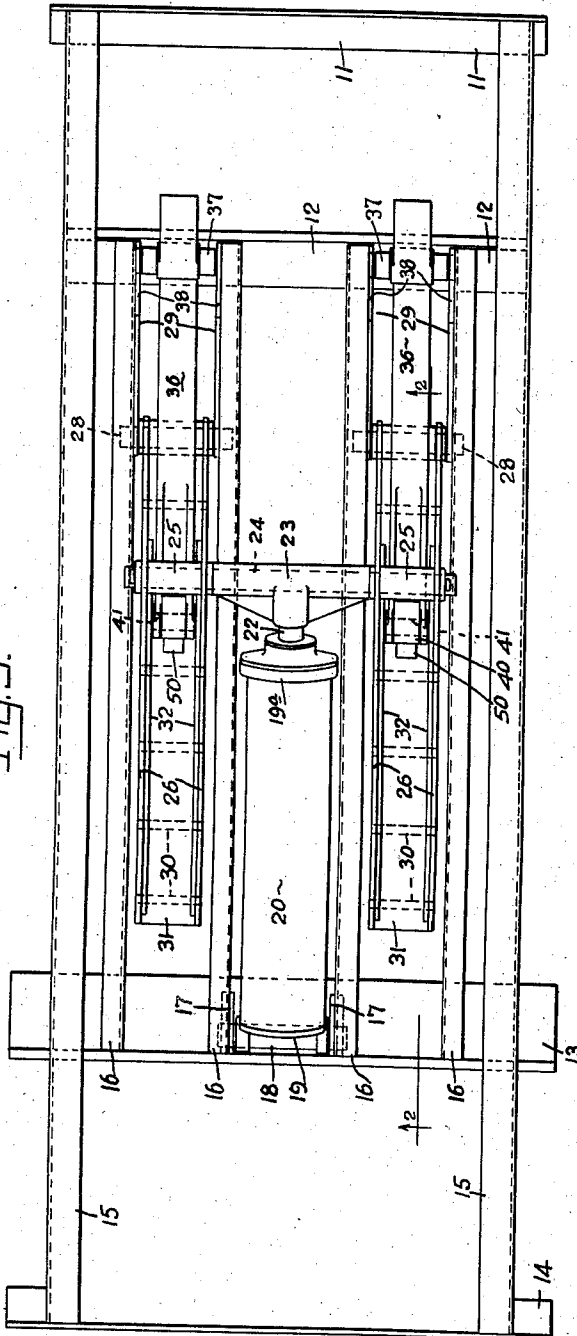
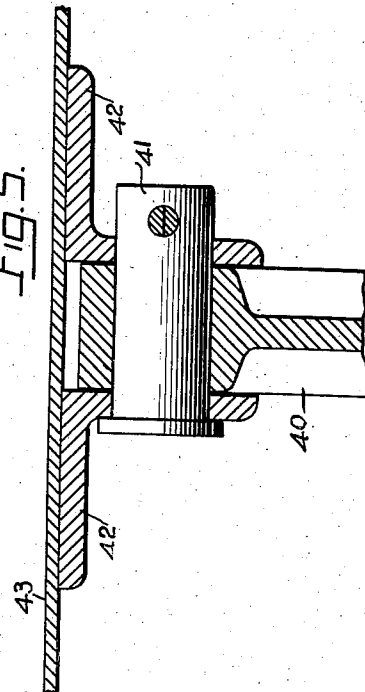


Fig. 5.



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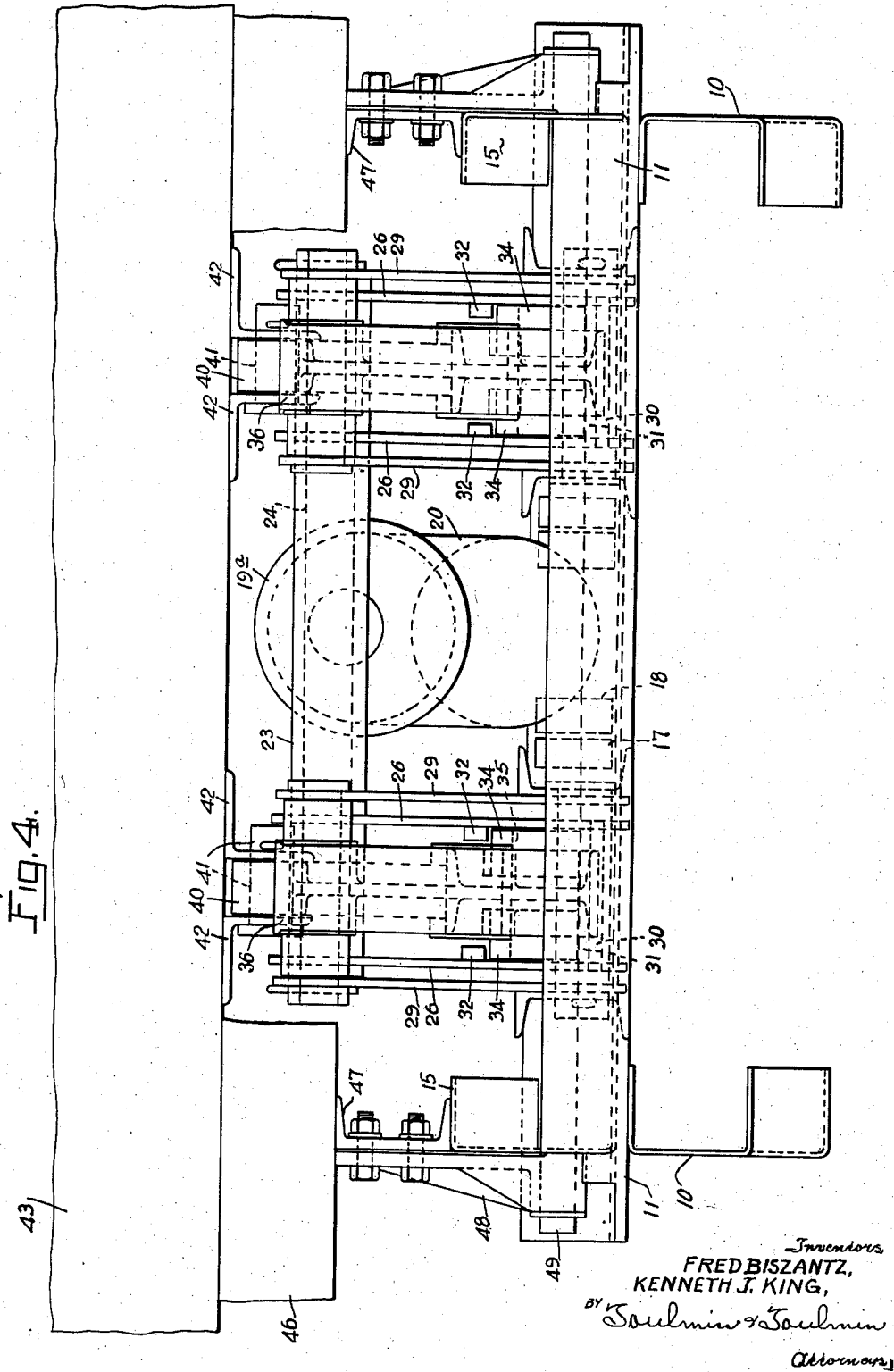
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3 Sheets-Sheet 3



## UNITED STATES PATENT OFFICE

2,144,828

## DUMP BODY LIFTING MECHANISM

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12 Claims. (Cl. 298—22)

This invention relates to dump body lifting mechanisms, and in particular, to such mechanisms having a variable mechanical advantage for applying a variable force at a variable lifting speed during the dumping operation.

One object of this invention is to provide a lifting mechanism for dump trucks employing a system of levers arranged to alter the mechanical advantage of the mechanism so as to apply a relatively large lifting force with a relatively low lifting speed at the start of the lifting operation, and culminating in a relatively smaller lifting force with a more rapid lifting speed at the end of the dumping operation.

Another object is to provide a dump body lifting mechanism having a system of levers arranged to provide a short weight arm at the beginning of the dumping operation and increasing to a long weight arm at the end of the dumping operation, causing a very high lifting force to be applied initially at a low speed, and a relatively low lifting force to be applied finally at a high speed, so that the high lifting force is applied when the center of gravity of the load is farthest from the pivot of the body and the lighter lifting force is applied when the center of gravity has approached a position toward the rear of the truck and over the body pivots.

Another object is to provide such a mechanism employing a hydraulic motor of comparatively low power for exerting the lifting effect because of the arrangement providing a variable mechanical advantage throughout the lifting operation corresponding to variation in the load required to be lifted.

Another object is to provide a lifting mechanism for a dump truck, wherein a system of levers is arranged to provide a fixed length force arm with a variable length weight arm so as to apply a short weight arm initially and a long weight arm finally during the dumping operation.

In the drawings:

Figure 1 is a side elevation, partly broken away, of a dump body lifting mechanism according to the present invention.

Figure 2 is an enlarged detail section of a portion of Figure 1, taken along the line 2—2 in Figure 3.

Figure 3 is a top plan view of the dumping mechanism shown in Figures 1 and 2, with the dumping body removed to disclose the system of levers more clearly.

Figure 4 is a right-hand end elevation of the

dumping body lifting mechanism shown in Figure 3.

Figure 5 is an enlarged cross-sectional view showing the connection of the lifting mechanism to the dumping body.

In general, the dump body lifting mechanism of this invention consists of a suitable source of power, such as a hydraulic motor, connected to a plurality of approximately triangular swinging levers. Each lever is pivotally connected at one corner to the motor and at another corner to the truck frame. Each lever also has a longitudinal track forming a guideway for a roller on the end of another swinging lever pivotally mounted on the frame at a point spaced apart from the pivotal mounting of the triangular lever. The term "triangular" is used to describe approximately the relative positions of the pivots and track and not the mere outline of the lever itself, which may obviously be of another shape without affecting the operation of the invention. Links connect the ends of the swinging levers with the dump body in such a manner as to cause the body to be swung upwardly by the hydraulic motor and by the engagement of the triangular levers with the swinging levers. The various lever assemblies are thus analogous to a single set of levers having a fixed length of force arm and a variable length of weight arm, the latter length increasing from a minimum at the start of the lifting operation to a maximum at the close thereof.

Hitherto, dump body lifting mechanisms have been provided employing combined linkages, causing the length of the lever arms to vary abruptly because the point of application of the lifting force is changed abruptly from one point to another during the lifting operation. The present invention, however, utilizes swinging levers to apply a varying mechanical advantage which smoothly and continuously changes without any abrupt changes and without springs or chains required by the prior art for preventing the body from tilting into too extreme a position. In the present invention a relatively high lifting force is applied to the dump truck at the start of the lifting operation because the weight arm at this point is relatively short, hence, a relatively low speed of lifting occurs. The length of the weight arm, and consequently the speed of the lifting, vary continuously and without abrupt changes during the lifting operation until a relatively low lifting force is applied to the body at the end of the dumping operation, the

body being then in motion at a comparatively high speed.

Referring to the drawings in detail, Figure 1 shows the longitudinal members 10 of a truck frame having a subframe thereon, as shown in Figure 3, the main truck frame in Figure 3 being omitted in order to bring out more clearly the nature of the subframe. The subframe consists of a plurality of cross members 11, 12, 13 and 14 of angular cross section, interconnected by longitudinal members 15 in such a manner as to form a compact sub-unit. Extending between the cross members 10 and 13 are short longitudinal members 16. Pivotally mounted upon the brackets 17, supported by the cross member 13 and adjacent the central longitudinal member 16, is the pivot shaft 18 supporting one end 19 of a hydraulic cylinder 20 having a piston head 21 therein. From the opposite end 19a of the hydraulic cylinder 20 a piston rod 22 emerges and terminates in a transversely extending cross-head 23.

Passing through the crosshead 23 is a shaft 24, the outer ends of which terminate in sleeves 25 mounted in and extending between the opposite sides of pairs of triangular shaped levers 26. The pivot points of the shaft 24 in the triangular levers 26 are designated 27, these triangular levers being pivotally supported upon pivot shafts 28, which extend between and are supported by triangular brackets 29. The brackets 29 are supported in part by the cross member 12 and in part by the longitudinal members 16. The triangular levers 26 are provided with cross rods 30, arranged to support a trackway 31. Also mounted upon the triangular levers 26 are inwardly extending ledges 32 secured thereto by the bolts 33. Each pair of triangular levers 26 thus forms a lever unit having a trackway portion 31 and a pair of inwardly extending ledges 32. These provide for the reciprocation of a pair of rollers 34 mounted upon shafts 35 supported near the ends of a pair of swinging levers 36, the opposite ends of which are mounted upon the pivot shafts 37 at the upper corners of the triangular brackets 29 (Figures 1 and 2). The swinging levers 36 are curved roughly in the form of a sickle, the indentation 38 of which serves as a stop to receive the sleeve 25 mounted on the crosshead shaft 24 at the end of the lifting operation.

The outer ends of the curved swinging levers 36 are provided with pivot shafts 39, to which are connected links 40, the opposite ends of which are pivotally attached to the pivot shafts 41 supported by the longitudinal members 42 beneath the truck body 43. The longitudinal members 42 are interconnected by truck body cross members 44 and 45, and a cross member 46 supports the rearward end of the body. The cross members 44, 45 and 46, in turn, rest upon longitudinal truck body frame members 47, interconnected by suitable cross members (not shown) and having secured thereto the downwardly extending brackets 48. The brackets 48 are provided with a pivot shaft 49, which is supported by the longitudinal subframe members 15 and the cross member 11. In order to prevent the centers of the shafts 41, 39 and 37 from ever getting into a straight-line position, the links 40 are provided with projections 50. These projections also serve as safety stopping points, which engage the levers 36 at 51 and insure the proper return of the body after dumping.

In the operation of the dump body lifting mechanism of this invention, fluid under pressure

is admitted to the left-hand end of the hydraulic cylinder 20 (Figure 1), thereby causing the piston rod 22 thereof to move to the right, carrying with it the crosshead 23, the shaft 24 and the sleeves 25 associated therewith. This action swings the triangular levers 26 upwardly to the right in an arcuate path around the pivot shafts 28 as a center. As this occurs the rollers 34 travel upwardly in the guideway formed between the track portion 31 and the ledges 32, thereby causing the left-hand ends of the curved levers 36 to be swung upwardly to the right around the pivot shafts 37 mounted in the triangular brackets 29 (Figures 1 and 2). As a result of this motion the shafts 39 on the outer ends of the curved levers 36 describe an arcuate path and exert an upward push upon the links 40, which in turn, transmit a lifting motion to the shafts 41 mounted on the substructure of the dump body 43. By reason of this application of forces, the dump body 43 and the various levers are lifted into the positions shown in the dotted lines in Figures 1, around the pivot shaft 49. At the extreme upper limit of the lifting operation, as shown in the dotted lines in Figure 1, the sleeves 25 come to rest in the indentations 38 of the curved levers 36, these acting as stops to limit the upward motion of the mechanism.

When it is desired to lower the truck, fluid is discharged from the rearward end of the hydraulic cylinder 20, the piston 21 and piston rod 22 of which move downwardly to the left, reversing the operation of the lever system from that previously described. As the triangular levers 26 move downwardly toward the left, around their pivot shafts 28, the rollers 34 likewise move downwardly in their guideways, causing the curved levers 36 to swing downwardly and carry with them the dump body 43 by reason of the intermediate connection therewith through the links 40.

From a consideration of the forces and lever arms involved in the operation of this mechanism, it will be seen that the length of the force arm, consisting of the distance between the centers of the shafts 24 and 28, remains fixed and invariable as the triangular levers 26 swing upwardly around the pivot shafts 28. The length of the weight arm, however, consists of the distance between the centers of the shafts 35 and 28 and varies enormously during the lifting operation. At the start of the lifting operation the weight arm, as shown in Figure 1, is comparatively short and is smaller than the power or force arm, comprising the distance between the shafts 24 and 28. At the top of the lifting operation, however, the weight arm length greatly exceeds the power arm length. Thus the truck body will be lifted slowly with a comparatively large lifting force at the start of the lifting operation, but will increase in lifting speed as the body rises toward its position of maximum height. While this is occurring the lifting force applied is, of course, correspondingly reduced. During the lifting operation, however, the triangular levers 26 do not move at a uniform speed, but their movement is faster at the start and at the finish than during the middle of the stroke, at which time the line between the centers of the shafts 24 and 28 may be approximately at right angles with the piston rod 22. The action of this mechanism thereby adapts itself to the mechanical conditions under which a load is lifted in a dump body.

As the dump body rises and swings toward the

rear, under the influence of the lifting force, the center of gravity of its load moves more and more toward a vertical plane passing through the pivot shaft 49 of the dump body. Under these conditions the force required to continue to move the dump body upwardly is correspondingly lessened so that a higher speed of lifting may be accomplished with a given force. The mechanism of the present invention takes advantage of these conditions to produce an efficient arrangement, and requires a lifting motor of a minimum power for this purpose. As the tilting movement starts, however, the length of the weight arm or lifting lever starts increasing until the triangular levers 26 have reached the full extent of their movement, at which time the rollers 34 upon the ends of the curved levers 36 will have reached the upper ends of the guideways formed between the track portions 31 and ledges 32. During the operation of the mechanism, these ledges 32 hold the rollers 34, arm 36 and link 40 in proper relationship with the track 31 and arms 26, and also prevent the body, when tilted, from pulling away from the lifting mechanism.

The present mechanism, therefore, is especially well adapted for use with dump trucks having unusually large bodies, and adapted to carry loads which are heavier than the loads ordinarily accommodated by such trucks. At the same time, this lifting mechanism will lift such a body to the required angle of 45, 50 or 55 degrees, according to the particular requirements.

It will be understood that it is desired to comprehend within this invention such modifications as come within the scope of the claims and the invention.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a dump truck, a frame, a dump body pivotally mounted thereon, a pair of levers pivotally mounted on said frame at spaced pivot points, the first of said levers having an elongated guideway and the second lever having means movably engaging said guideway at varying points of engagement along said first lever, means for pivotally connecting said second lever to said dump body, and a source of lifting force connected to said frame and applied to the first of said levers to vary the effective lifting force during the lifting operation.

2. In a dump truck, a frame, a dump body pivotally mounted thereon, a pair of levers pivotally mounted on said frame at spaced pivot points, the first of said levers having an elongated guideway and the second lever having a roller traveling in said guideway at a varying distance from the pivot point of said guideway-equipped lever, means for pivotally connecting said second lever to said dump body, and a source of lifting force connected to said frame and applied to the first of said levers.

3. In a dump truck, a frame, a dump body pivotally mounted thereon, a pair of levers pivotally mounted on said frame at spaced pivot points, the first of said levers having an elongated guideway and the second lever having a roller traveling in said guideway at a varying distance from the pivot point of said guideway-equipped lever, means for pivotally connecting said second lever to said dump body, and a source of lifting force connected to said frame and applied to the lever having the guideway.

4. In a dump truck, a frame, a dump body pivotally mounted thereon, a pair of levers piv-

totally mounted on said frame at spaced pivot points, the first of said levers having an elongated guideway and the second lever having a roller traveling in said guideway at a varying distance from the pivot point of said lever, means for pivotally connecting said second lever to said dump body, and a source of lifting force connected to said frame and applied to the lever having the guideway at a point remote from the fulcrum point of said guideway lever.

5. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever with an elongated guideway having its fulcrum mounted on said frame, motor means connected to said frame and operatively connected to another point on said lever, a second lever pivotally mounted on said frame at a point remote from the fulcrum of said first lever and toward said dump body pivot on said frame, a follower engaging said guideway and connected to said second lever for effecting a sliding engagement between said levers, and means for connecting one of said levers to said dump body.

6. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever having its fulcrum mounted on said frame, motor means connected to said frame and operatively connected to another point on said lever, a second lever pivotally mounted on said frame at a point remote from the fulcrum of said first lever and toward said dump body pivot on said frame, said first lever having a guideway and said second lever having a follower for movably engaging said guideway, and means for connecting said second lever to said dump body.

7. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever having its fulcrum mounted on said frame, motor means connected to said frame and operatively connected to another point on said lever, a second lever pivotally mounted on said frame at a point remote from the fulcrum of said first lever and toward said dump body pivot on said frame, said first lever having a guideway and said second lever having a follower for movably engaging said guideway, and means for connecting said second lever to said dump body at a fixed location thereon.

8. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever having its fulcrum mounted on said frame, motor means connected to said frame and operatively connected to another point on said lever, a second lever pivotally mounted on said frame at a point remote from the fulcrum of said first lever and toward said dump body pivot on said frame, said first lever having a longitudinal guideway and said second lever having a roller engaging and traveling in said guideway toward and away from the fulcrum of said first lever, and link means for pivotally connecting said second lever to said dump body at a fixed location thereon.

9. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever pivotally mounted on said frame and having its free end operatively connected to said dump body, an approximately triangular lever pivotally mounted on said frame and having a guideway, motor means mounted on said frame and operatively connected to said triangular lever at a point spaced apart from the fulcrum thereof, and means associated with said first-mentioned lever for movably engaging said guideway whereby to receive and transmit a variable lifting force to said dump truck.

10. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever pivotally mounted on said frame and having its free end operatively connected to said dump body, an approximately triangular lever pivotally mounted on said frame at a point remote from the other lever and having a guideway, motor means mounted on said frame and operatively connected to said triangular lever at a point spaced apart from the fulcrum thereof, and means associated with said first-mentioned lever for movably engaging said guideway whereby to receive and transmit a variable lifting force to said dump truck.
11. In a dump truck, a frame, a dump body pivotally mounted thereon, a lever pivotally mounted on said frame and having its free end operatively connected to said dump body, an approximately triangular lever pivotally mounted on said frame and having a guideway, motor means mounted on said frame and having a cross-head operatively connected to said triangular lever at a point spaced apart from the fulcrum thereof, and means associated with said

first-mentioned lever for movably engaging said guideway whereby to receive and transmit a variable lifting force to said dump truck.

12. In a dump truck, a frame, a dump body pivotally mounted on the rear end of the frame, a lifting motor pivotally mounted on the frame forwardly of the pivotal mounting of said dump body thereon, a plurality of pivotally mounted levers pivotally mounted on spaced pivots on said frame, one of said levers having an elongated guideway and the other lever having a guideway follower thereon engaging said guideway for operatively interconnecting said levers by mutual sliding engagement, one of said levers being connected to said motor at an additional pivot remote from the other pivots and means for pivotally connecting the other lever to said dump body at a fixed location thereon, said body-connected lever having a curved portion adapted to provide limiting means for limiting the stroke of said motor-connected lever.

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