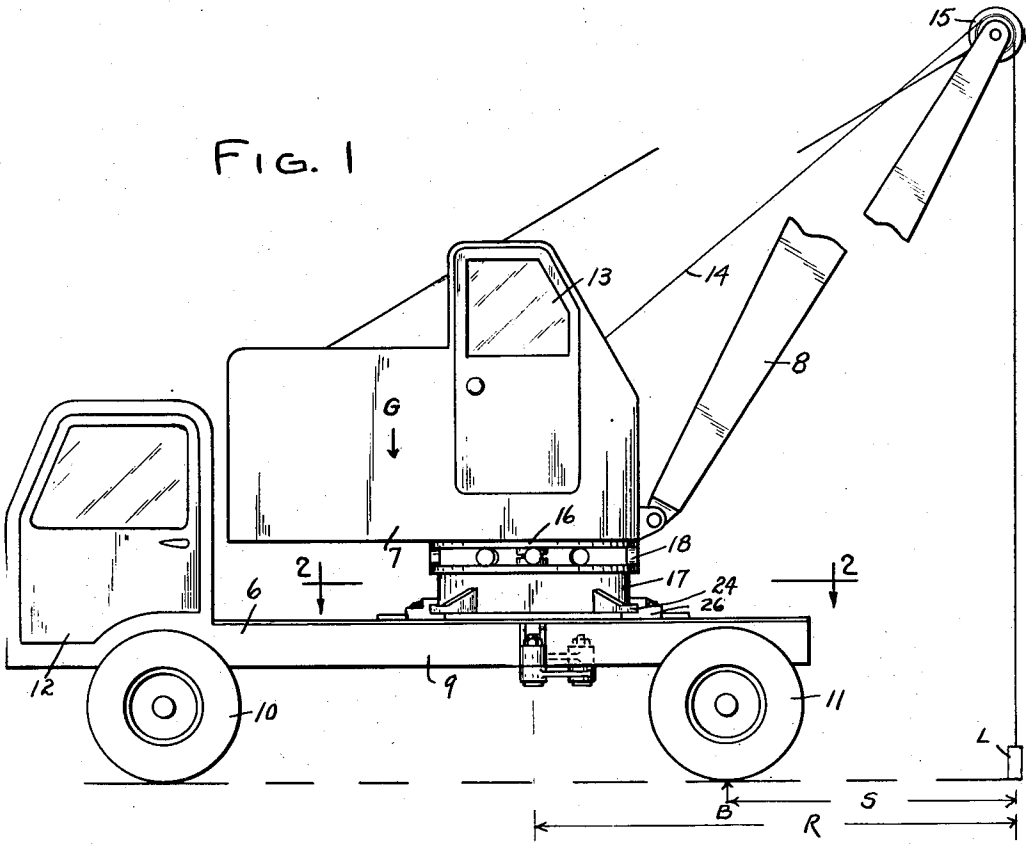
July 8, 1952 A. ORLOFF 2,602,552

CRANE

Filed Sept. 20, 1950 2 SHEETS—SHEET 1

FIG. 1



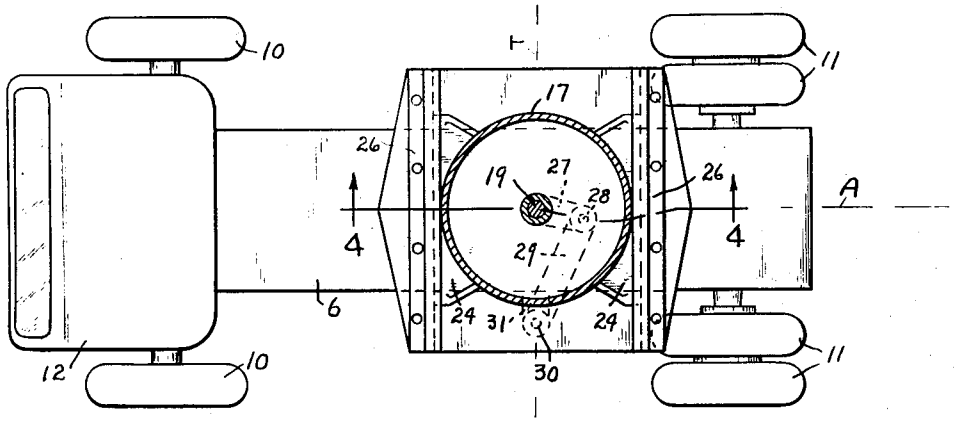


FIG. 2

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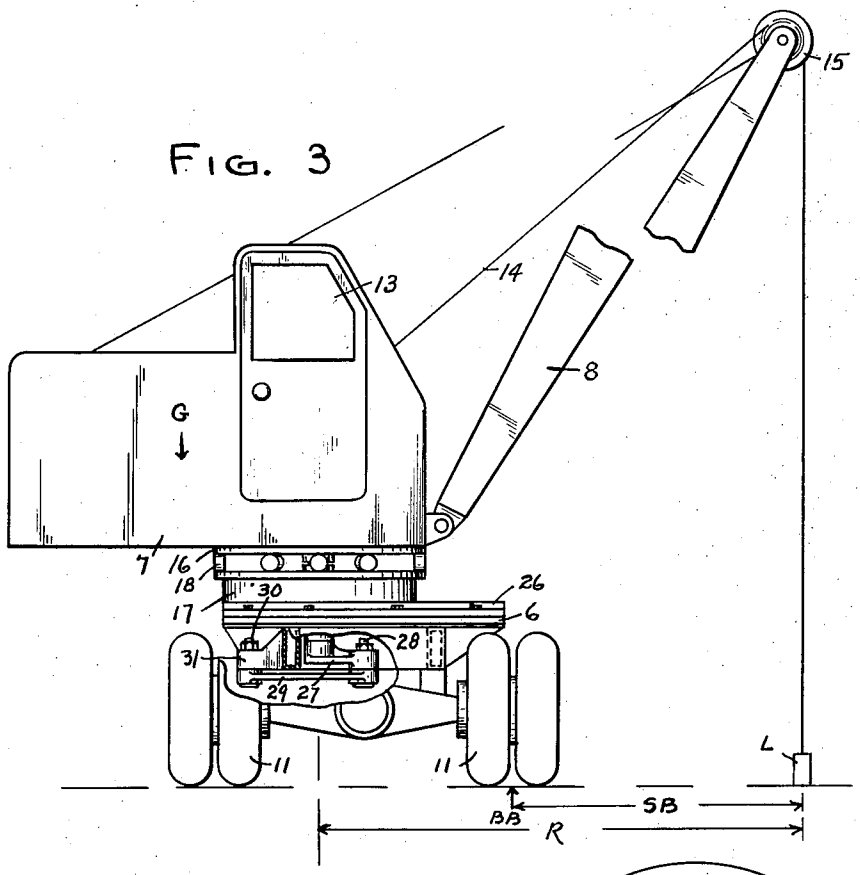
FIG. 3



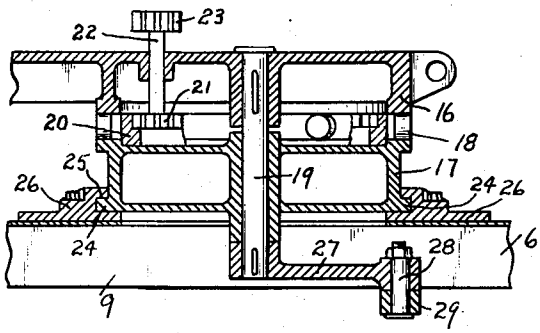


FIG. 4

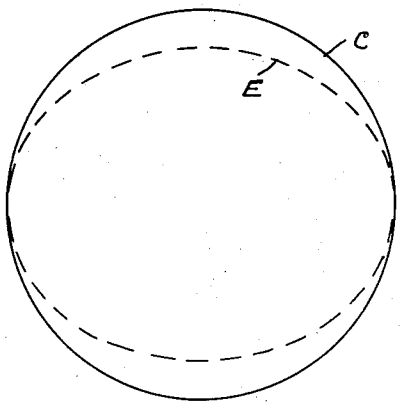


FIG. 5

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CRANE

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4 Claims. (Cl. 212—59)

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The invention relates to cranes and more particularly to cranes of the full rotating type in which the crane structure is mounted on a base rotatable on or about a mobile base or chassis.

Full rotating cranes are usually mounted on truck chassis, endless tread propelling structures, wheeled frames, or other forms of traveling or mobile bases that are narrower than their lengths because of the limitations in width of ordinary highway equipment. Steering mechanisms, and other factors also usually necessitate the wheel base be of substantially greater length than wheel tread.

In cranes of the character above described, the stability of the crane, or its capacity to hold a certain load varies considerably as the crane turns or swings in its complete revolution. Invariably the stability of the crane is much greater when the boom or load is over the ends, or in a plane of the long or longitudinal axis of the supporting base. When the boom swings over the transverse axis of the base or laterally thereof, the stability is reduced. This can be easily appreciated when we consider that the load swings around a circular path, but the base of the support of the load is non-circular and of rectangular form considerably narrower than its length. To improve the side-stability, a common practice of crane manufacturers is to provide retractable side-arms or outriggers, either manually adjustable or movable by power to provide increased bearing area for the support to permit the crane to swing its maximum load in a complete or full circle. The use of outriggers is objectionable because when they are in operation, the crane is temporarily immobilized for traveling.

It is common practice among crane manufacturers to rate their cranes on the basis of the minimum or cross-cross-stability of the apparatus. This permits the rated load to be safely swung in a complete circle without danger of tipping over and is known as "free-stability." To increase the "free-stability" it is the usual practice to add counterweight to the rear end of the crane carrying swinging base. This practice, however, adds considerably to the total weight of the crane and still does not reduce or remove the great differential existing between the side stability and end-stability of the crane.

The object of the present invention is to provide a crane of the full rotating type whose cross or transverse stability is substantially the same as its lengthwise stability so that the crane will swing in a full circle any load that it can pick up over its ends with the result that its end stability can be used as a basis for rating the capacity of the crane, so that weight for weight, the crane embodying my invention has much greater rate capacity and will safely swing any rated load in any of its angular positions relative to its mobile supporting base. More particularly, according to the present invention, the ability of the crane to handle a load across its transverse axis of the same magnitude as can be handled along its longitudinal axis is accomplished by providing means for shifting the rotating or crane carrying base of the machine relative to the transverse axis of the traveling base of the machine in such a direction that the center of gravity of the rotating base is so disposed relative to the traveling base that the loaded crane will have substantially the same transverse stability as longitudinal stability.

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The invention further consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a side elevation view of a crane embodying the invention showing the load applied in the longitudinal axis of the traveling base, parts being broken away;

Fig. 2 is a detailed horizontal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a side elevation view similar to Fig. 1 showing the load applied along the transverse axis of the traveling base, parts being broken away;

Fig. 4 is a detailed vertical sectional view taken on the line 4—4 of Fig. 2;

Fig. 5 is a comparative diagrammatic view of the load paths of the improved crane and the usual crane.

Referring to the drawings, the numeral 6 designates generally any suitable form of traveling or mobile base, 7 the rotating base carrying the load supporting boom 8.

The traveling base 6 is here shown as a truck chassis having a frame 9 supported by the running gear including front wheels 10 and rear propelling wheels 11 driven through any suitable transmission by the engine located in the cab 12, the length of the wheel base being greater than its width. The rotating base 7 is provided with the usual power operated hoist drum (not shown) controlled by the operator in the cab 13 of said base and over which a hoist cable 14 is wound, said cable extending upwardly over a guide sheave 15 at the point of the boom 8 and downwardly therefrom to the load L.

According to the present invention, the axis of

rotation of the rotating base is adapted to be shifted laterally of the travelling base, so that the center of gravity or weight of said rotating base is also shifted relative to said traveling base during the swinging or rotation of the rotating base. For accomplishing this purpose, the base member 16 of the rotating base 7 is mounted to turn on a subbase 17 which is shiftably mounted on the traveling base 6. As shown in Fig. 4, the base member 16 rotates on rollers 18 interposed between the base members 16 and 17 and has a center pin or shaft 19 keyed thereto, which shaft is journalled in the base member 17 and projects below the same. The rotating base 7 may be swung or rotated relative to the traveling base 6 by any suitable swing mechanism as, for example, a ring gear 20 fixed to the sub-base 17 and meshing with a pinion 21 on a shaft 22 journalled in the base member 16 and carrying a drive gear 23 driven in any suitable manner from the prime mover in the cab 13. The sub-base 17 has laterally disposed side base flanges 24 slidably mounted in transversely disposed spaced guide grooves 25 in guides 26 suitably mounted on and secured to the traveling base 6.

The lower end of the shaft 19 has a crank arm 27 keyed thereto and carrying a pin 28 pivotally connecting its outer end with one end of a link 29 whose other end is pivotally connected by a pin 30 to an anchor bracket 31 secured to the frame 9 of the traveling base 6. The disposition of the crank 27 relative to the traveling base 6 when the rotating base is in a position in which the boom 8 is disposed substantially in line with the longitudinal axis A of the traveling base is shown in Fig. 1 in which R designates the load radius and S the stability arm between the balancing point B and the load L. The center of gravity or weight of the rotating base is indicated by the arrow G. Now, if the swing gear mechanism is operated to turn the rotatiing base 7 in a counterclockwise direction, as viewed in Fig. 2, the shaft 19 turning with the base 7 acts to turn the crank 27 in the same direction, but since said crank is attached to the free end of the link 29, the shaft 19, under the restraint of said link, together with the base member 16 will move laterally on the sub-base 17 toward the anchored end of the link 29, so that when the base 6 has made a quarter turn and the boom 8 is alined with the transverse axis T of the traveling base, the position of the rotating base and its load relative to the traveling base is shown in Fig. 3. In this position it will be noted that the stability arm SB between the balancing point BB of the base 6 and the load L is the same as the stability arm S and that the center of gravity G has been displaced further away from the longitudinal center line of the base 6 than it would be were the base 7 mounted to rotate on an axis alined with the longitudinal center line of the truck, thus securing increased stability. It will also be noted that in the position shown in Fig. 3 the load L has been moved closer to the base 6 because of the transverse movement of the base 7. In the ordinary crane the load moves in a full line circle C, as shown in Fig. 5, while in the improved crane the load moves in the dotted line elliptical path E. The same stability effect and the lateral movement of the base 7 and its load relative to the base 6 is secured when the base 7 is turned in a clockwise direction. Thus rotation of base 6 in either sense of direction will cause the pin or center shaft 19 to move along the transverse axis T with an

increasing tendency or moment of stability of the entire weight of the rotating base 7 with respect to the balancing point BB. Concurrently with this, the load L, although rotating radially about shaft 19, by virtue of sub-base 17 sliding along the travelling base 6, will have reduced the stability arm SB. The stability arm SB is reduced to substantially the amount where the moment of the load L about balancing point B will be balanced by the weights of the rotating base 7 and the travelling base 6 about this same point. Practically, the length of the lever or crank 27 is such that a state of equilibrium will exist about balancing points B and BB. It can be readily seen that inasmuch as the entire mass of the rotating base is moved rearwardly to aid the cross stability in the transverse axis T in conjunction with the inward movement of the load L relative to the base 6, the effect of the lateral shift mechanism is two-fold. First, it moves the rotating base backwards. Secondly, it brings the load closer to the base 6. Consequently, as shown by the dotted lines in Fig. 5, the load will move in a substantially elliptical path.

In practice it is not necessary that load radius be exactly the same crosswise as lengthwise. However, it is a distinct advantage for a full circle crane to swing its capacity load in a full swing which is accomplished herein with an increase in the rated capacity of the crane.

I desire it to be understood that this invention is not to be limited to any particular form or arrangement of parts except in so far as such limitations are included in the claims.

What I claim as my invention is:

1. In a full rotating crane, the combination of a traveling base, a rotating base having a load carrying boom, means for mounting said rotating base on said traveling base for rotating and shifting movements relative thereto, and means operated by the rotation of said rotating base for shifting said rotating base relative to said traveling base during the swinging movement of the load from a position along the longitudinal axis of the traveling base to one across said axis whereby said rotating base and load are shifted rearwardly along a transverse axis of said traveling base to increase the stability of the crane when the load carrying boom is disposed transversely of said traveling base.

2. In a full rotating crane, the combination of a traveling base, a rotating base having a load carrying boom, a sub-base mounted to shift transversely of said traveling base and rotatably supporting said rotating base, means for rotating said rotating base relative to said sub-base, and means operated by the rotation of the rotating base for laterally shifting said sub-base relative to said traveling base to compensate for decreased stability of the crane as the load carrying boom swings from a position along the longitudinal axis of the traveling base to a position across said axis.

3. In a full rotating crane, the combination of a traveling base, a rotating base having a load carrying boom, a sub-base laterally slidably mounted on said traveling base and carrying said rotating base, means for turning said rotating base relative to said sub-base and said traveling base, a pivot shaft for the rotating base journalled in said sub-base, and means operatively connecting said pivot shaft with the traveling base whereby rotation of said rotating base

shifts said sub-base laterally relative to said traveling base and in a direction to effect increased stability of the load carrying boom as it moves to a position transversely of the longitudinal axis of said traveling base.

4. In a full rotating crane, the combination of a traveling base, a rotating base having a load carrying boom, a sub-base slidably mounted on said traveling base for lateral movement relative thereto and carrying said rotating base, a pivot shaft for said rotating base journalled in said sub-base, a crank mounted on said shaft and a link operatively connecting the free end of said crank with a part of said traveling base, and means for rotating said rotating base relative to said sub-base and said traveling base and as a consequence operating said crank and link to shift said sub-base laterally of said traveling base as the boom on said rotating base is swung from a position along the longitudinal axis of the traveling base to one across said axis, said shifting movement acting to move the load of the boom closer to said traveling base in the transverse position of said boom to thereby provide increased lateral stability for the crane.

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