Dec. 13, 1938. R. D. KAUFFMAN 2,139,960

CRANE

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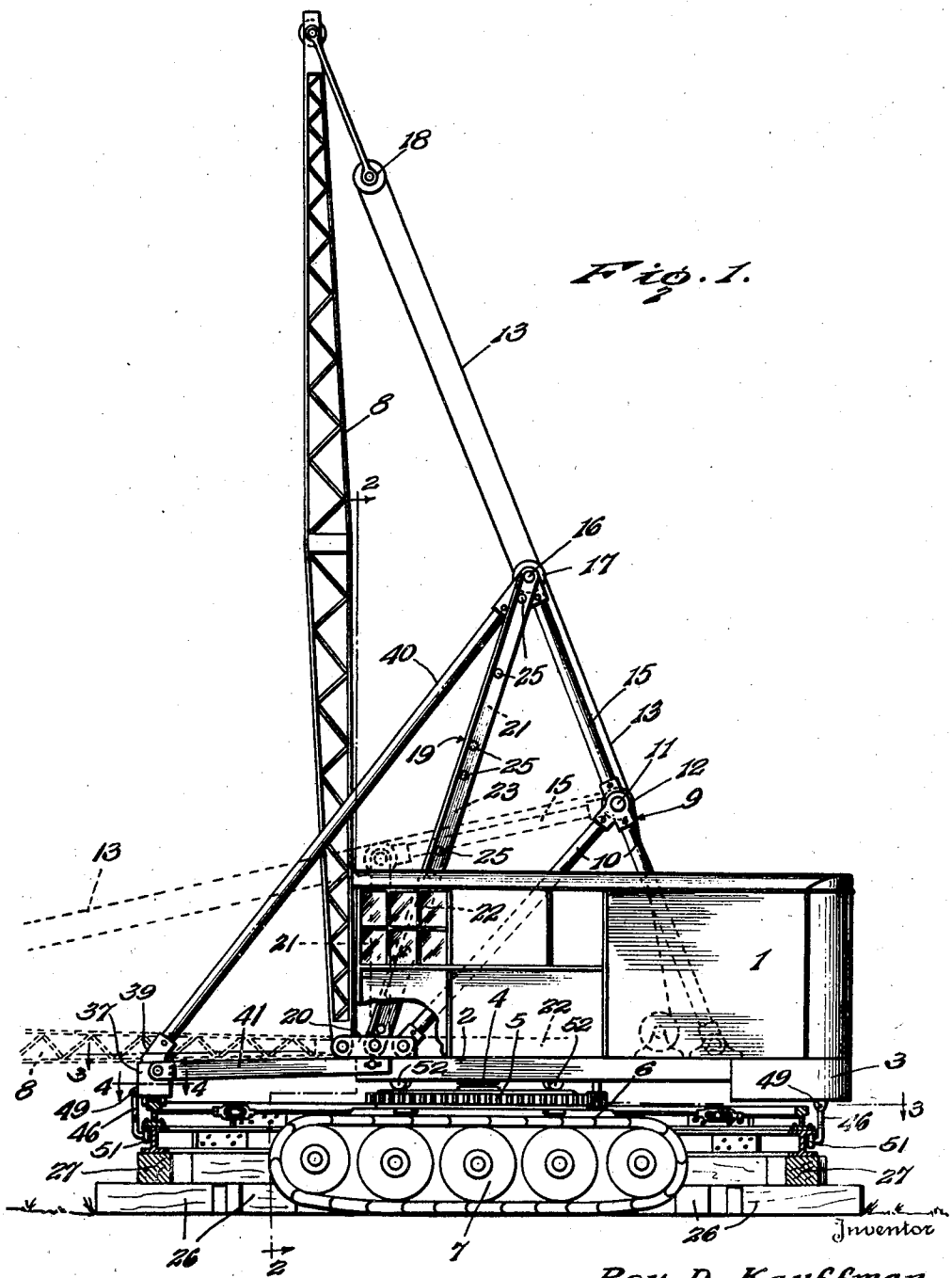


Fig. 1.

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Fig. 2.

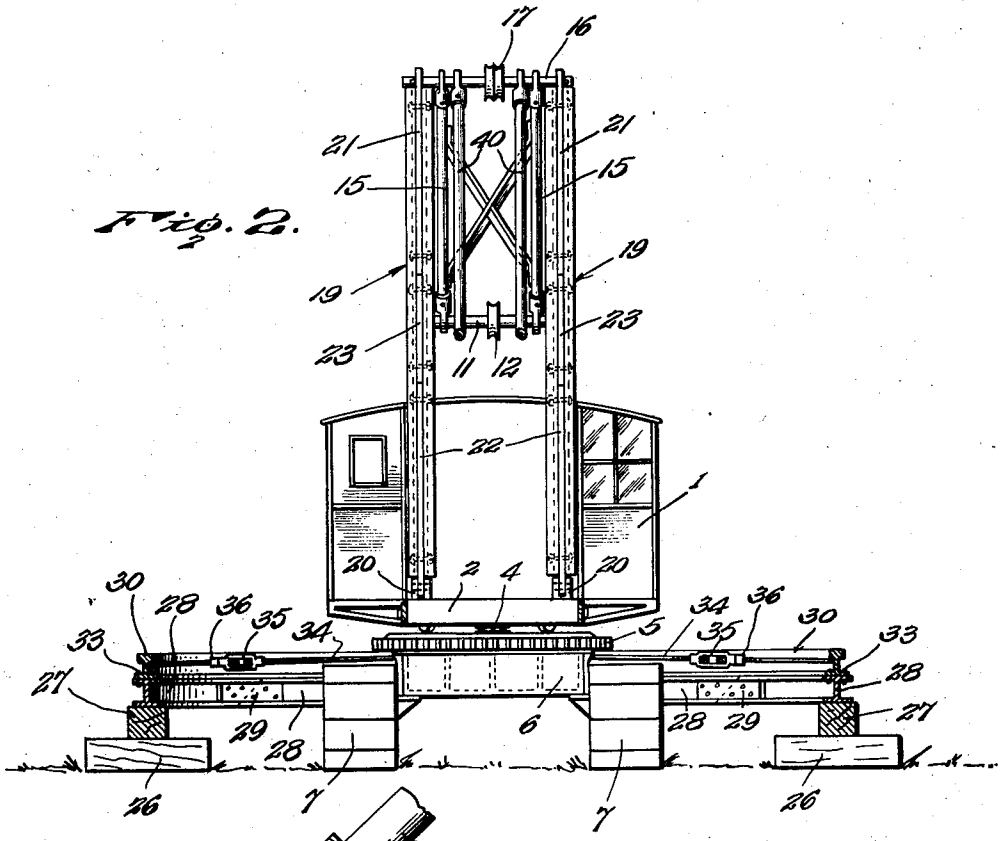
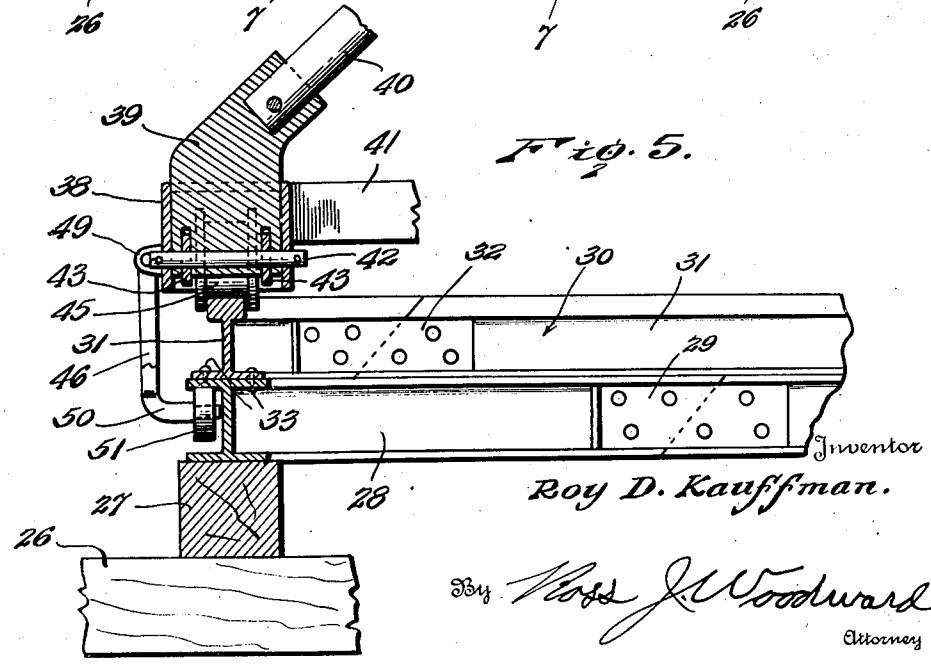


Fig. 5.



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Fig. 3.

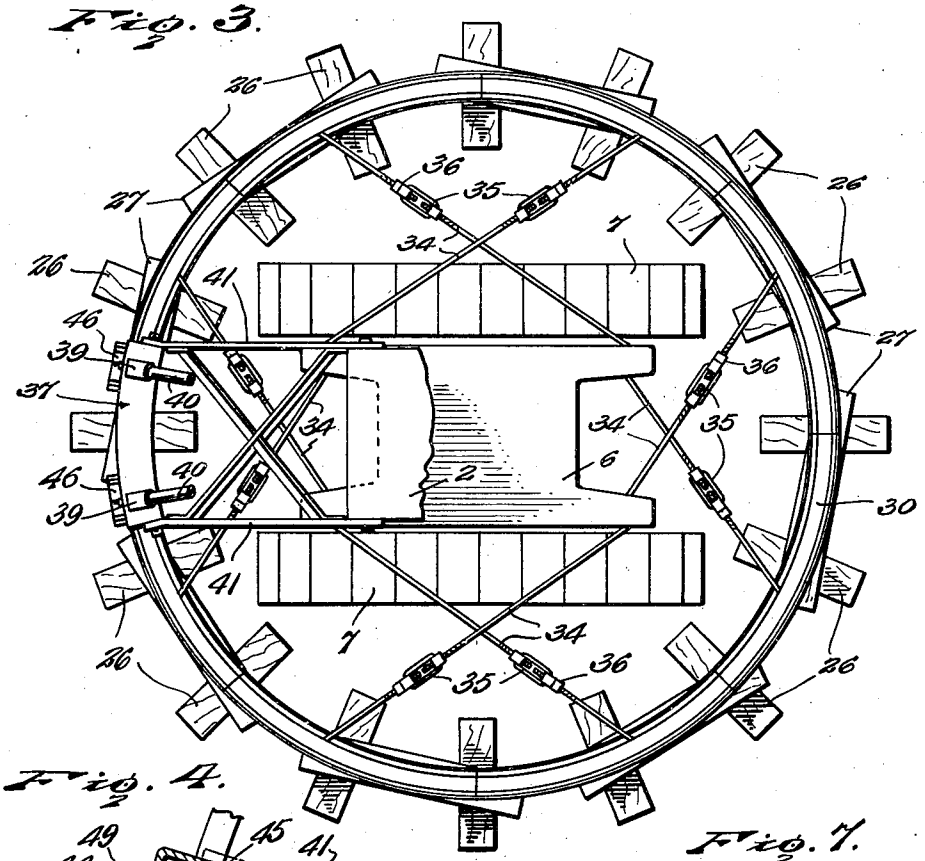


Fig. 4.

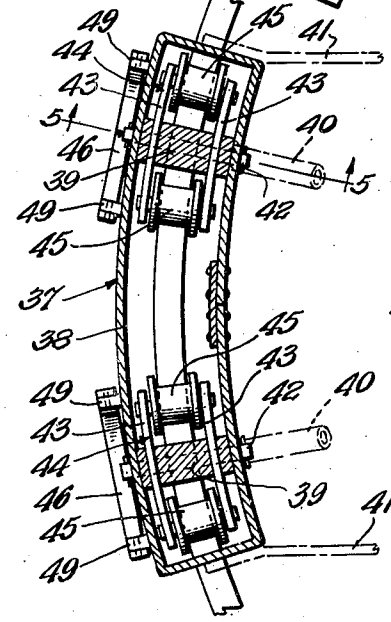


Fig. 6.

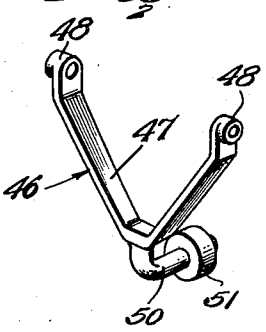
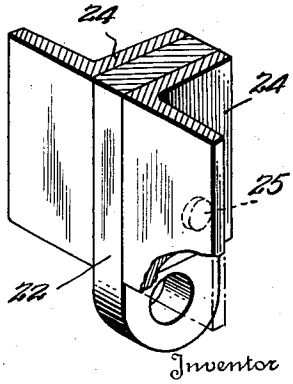


Fig. 7.



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UNITED STATES PATENT OFFICE

2,139,960

CRANE

Roy D. Kauffman, Washington, D. C.

Application August 11, 1937, Serial No. 158,604

15 Claims. (Cl. 212—69)

This invention relates to a crane of the portable type and more particularly to a crane having an improved mast construction and also an arrangement of outriggers by means of which the crane may be effectively supported in lateral spaced relation to the carriage and prevented from tilting when an extra heavy load is lifted.

At the present time cranes are formed with masts of a predetermined height and while it has been found that by increasing the height of the mast a better control of the boom with less power and strain and wear on the cable is obtained, it has also been found that when the height of the mast is increased transportation of the crane from one place to another becomes difficult due to the fact that the mast will not readily pass under trees, bridges and other obstructions.

Therefore, one object of the invention is to provide a crane having a mast which is so constructed that it may be reduced in height during moving of the crane and an adjustable upper section shifted upwardly when the crane arrives at the place of use.

Another object of the invention is to not only provide the crane with a vertically adjustable mast but also provide it with a collapsible brace or post so constructed that it may be longitudinally adjusted together with the upper portion of the mast and firmly secured in its extended position.

Another object of the invention is to provide the crane with an outrigger structure capable of being easily erected about the carriage when the crane is at the place of use and provide an auxiliary annular support greatly increasing the radius or diameter of the effective base about which a stiff leg or bracing strut for the mast swings during use of the crane. It will thus be seen that the mast will be braced at a greatly increased radial distance from the mast and beyond the carriage of the crane so that when an extra heavy load is lifted, tilting of the carriage will be prevented and the crane cannot turn over.

Another object of the invention is to so form the outrigger that it can be easily taken apart for transportation from one place to another and to also permit a track forming part of the outrigger to be left about the crane and supported by grapples during traveling of the crane under its own power. It will thus be seen that it will only be necessary to remove ground engaging elements of the outrigger and reset them in place under the track when the crane is to be moved a short distance instead of dismantling the entire outrigger.

Another object of the invention is to provide improved means for bracing the elements constituting the outrigger when it is assembled about the crane and preventing the track of the outrigger from shifting out of a position concentric to the center pin of the cab.

Another object of the invention is to provide a crane which is capable of lifting very heavy loads without being liable to turn over but is of such weight that it may be easily moved from one place to another and along roads which are restricted to vehicles and portable machinery of more than a predetermined weight. It will thus be seen that the improved crane may be used for a greater range of work, that it may be easily and quickly moved from one place to another along roads barred to heavier cranes now usually used for lifting objects of a certain weight and that when the outrigger is in place back tipping will be prevented as the rear portion of the cab just clears the track surrounding the carriage of the crane and will rest thereon if the load should be dropped or the cable snaps and the crane tilts rearwardly.

The invention is illustrated in the accompanying drawings, wherein

Figure 1 is a side elevation of the crane with the outrigger track shown in section.

Figure 2 is a vertical sectional view taken along the line 2—2 of Figure 1.

Figure 3 is a view taken along the line 3—3 of Figure 1 and looking down upon the outrigger and the carriage of the crane.

Figure 4 is a sectional view taken along the line 4—4 of Figure 1.

Figure 5 is a sectional view upon an enlarged scale taken along the line 5—5 of Figure 4.

Figure 6 is a perspective view of one of the hooks or grapples used for supporting the track of the outrigger when moving the same while in place about the crane.

Figure 7 is a perspective view of the lower portion of the collapsible post forming part of the high mast of the crane.

This improved crane has a cab 1 which is of a conventional construction and provided with the usual base or lower casting 2 and counterweight 3, the base being mounted by the usual pivot 4 to turn about the ring gear of the carriage 6 which has the usual tractors 7 by means of which the crane is moved from one place to another. A boom 8 is pivotally mounted at the front of the cab and intermediate the length of

the cab there has been provided a mast having an A-frame 9, the legs 10 of which diverge downwardly and are mounted adjacent front and rear ends of the cab. A cross bar or shaft 11 extends transversely of the upper end of the A-frame and carries a guide pulley 12 for engagement by the cable 13 which is wound upon the drum of the usual hoist mounted within the cab. Arms 15 are pivoted at the top of the A-frame and at their upper ends are connected by a cross rod 16 serving as a mounting for the lower multiple pulley 17 about which the cable engages, the upper multiple pulley 18 for the cable being connected with the upper or outer end of the boom in the usual manner.

The arms 15 or upper section of the mast must be supported in its raised position when the crane is in use, and in order to do so, there have been provided collapsible posts or props 19 which have their lower ends connected with the castings 20 to which the boom and the forward legs of the A-frame are connected. While the posts may be of telescoping construction, they have been illustrated as consisting of bars, each having upper and lower sections 21 and 22 and an intermediate section 23 against opposite side faces of which angle bars 24 are detachably secured by fasteners 25 which may be bolts or other easily removable fasteners. It will thus be seen that while the upper section of the mast will be supported in an elevated position when the crane is in use, the posts may be collapsed and the upper section swung downwardly to a lowered substantially horizontal position when it is desired to lower the boom to a position in which it projects forwardly from the crane and move the crane from one place to another. The fact that the mast is provided with the upper section imparts added height to the mast which creates less thrust upon the boom and hence less strain upon the cable. A boom of less than customary weight can, therefore, be used for lifting a load of a certain weight and a greater weight can be lifted with a cable of a certain strength, the difference in the weight of the load being the difference in weight between that of the lighter boom and the heavier boom customarily used. The fact that a light weight boom can be used also makes it easy to control the boom. When it is desired to lower the upper section of the mast, it is merely necessary to raise the boom to such a height that tension will be removed from the post 19 and the post can then be collapsed and the mast lowered to the position indicated by dotted lines in Figure 1. When so lowered the hinge point of the mast is changed from the top of the upper section to the shaft 11 at the top of the lower section or A-frame. By raising the boom to its substantially vertical position, the upper section 15 of the mast will be carried upwardly with it and the sections of the post 19 can be again secured to each other to provide a post of the proper height to support the upper section of the mast in its raised position. It will thus be seen that the crane has been provided with a mast which can be used as a high mast or adjusted to provide a low mast which can pass under trees, bridges and other obstructions while moving the crane from one place to another.

While the safety factor of a crane provides sufficient strength to lift loads a great deal heavier than rated strength of the crane, it is dangerous to lift too great a load as too great a load is liable to cause the crane to turn over in the direction of the load or if the cable should snap and the load drop, the back lash caused by sudden releasing of the load is liable to cause the crane to tilt over rearwardly. Certain cranes have been made with an auxiliary boom at the back of the cab which carries a counter-weight serving as means for counter-balancing the weight of the load lifted by the main boom and thus permit a light weight crane to lift a heavy load but have not been found satisfactory as the auxiliary boom projects rearwardly from the cab and prevents use of the crane in a confined space. It has also been found that if the cable should snap or the load slip, the weight of the counter-weight will cause the crane to tilt rearwardly and turn over when the weight of the load is suddenly released.

In order to permit the lifting of extra heavy loads with safety this improved crane is provided with an outrigger which extends the bearing point under full load from a point at the front end of the tractors 7 to a point well in advance of the front end of the tractors. Thus the diameter of the circle over which the bearing point moves will be materially increased and a heavy load may be lifted without danger of the crane tilting and turning over. This is clearly illustrated in Figures 1, 2 and 3.

Referring to these figures it will be seen that the outrigger consists of a circular track which rests upon the ground in encircling relation to the carriage of the crane. This track is erected about the crane at the place where the crane is to be used and when erecting the track a number of bolsters 26 which are preferably wood although other materials may be used are set in place in radiating relation to the periphery of a circle having the pivot 4 as its center. Cross beams 27 are set in place upon the upper faces of pairs of these bolsters, as shown in Figure 3, and upon these cross beams are disposed metal H-beams which are arcuate longitudinally and when connected by the splice plates 29 form a circular bed for a circular rail 30 which is also formed of arcuate sections 31 connected by splice plates 32. Referring to Figure 5 it will be seen that the sections of the rail 30 have their connected ends disposed in staggered relation to the connected ends of the H-beams so that the rail sections will be well supported. Bolts 33 are passed through the contacting flanges of the H-beams and rail sections to firmly hold the rail in place upon the bed and prevent it from shifting out of its proper position thereon. It will thus be seen that the track may be easily and quickly erected and also easily taken apart when it is desired to move the crane from one place to another.

It is necessary to maintain the track concentric to the pivot 4 and the ring gear 5 and, in order to do so, there have been provided tie rods or spokes 34 which extend between the rail sections and end portions of the bed frame of the carriage 6 of the crane. These spokes resemble the spokes of a bicycle wheel and upon referring to Figure 3 it will be seen that certain of the spokes extend longitudinally of the carriage from opposite ends thereof while others extend laterally of the carriage from its opposite sides, the side spokes being of greater length than the end spokes. Therefore, proper placement of the spokes when assembling the track will be made easy. Each spoke consists of end sections or rods connected by a turn buckle 35 and there have

also been provided abutment nuts 36 which are welded or otherwise firmly held in set positions upon the spoke sections after the track has been initially set up. By having the nuts firmly secured in place the proper adjustment for the spokes can be easily obtained as it is merely necessary to tighten each turn buckle until it makes contact with a cooperating abutment nut and the track will define a perfect circle having the pivot 4 as its center.

A carriage 37 runs upon the track, and referring to Figures 3 and 4 it will be seen that this carriage is arcuate longitudinally to conform to the curvature of the track and has a metal casing 38 in end portions of which are mounted castings or blocks 39. The castings project upwardly through the top of the casing or housing 38 and are secured to lower ends of stiff-leg struts 40 which extend diagonally between the carriage and the upper end of the upper section of the mast, as shown in Figure 1, and constitute braces for the mast. Side bars 41 connect ends of the carriage with the forward end portion of the base 2 of the cab 1 of the crane. These side bars 41 are formed of strong metal which will not be liable to be bent by strain and, together with the struts 40, maintain the carriage 37 in its proper position over the track. The blocks 39 are mounted in the casing 38 by pins 42 which also pass through the side bars 43 of the trucks 44 and pivotally mount the trucks so that the wheels 45 of the trucks will be maintained in contact with the rail 30 as the car or carriage moves about the track. The car follows along the track as the cab of the crane is turned about its pivot and, together with the stiff-leg struts, will act in a very efficient manner to brace the mast and cab and prevent the crane from tilting forwardly and turning over when a heavy load is lifted during use of the crane. Attention is also called to the fact that as the cab is turned, its rear end portion follows the track a very short distance above the rail 30. Therefore, if the cable should snap or the load slip, rearward tilting and overturning of the crane will be prevented by the rear end of the cab striking the rail.

When it is desired to move the crane from one place to another the entire track may be taken apart and reassembled after the crane has been moved to the new location. Instead of disassembling the entire track, the rail 30 and its bed of H-beams may be left in place about the crane and only the cross beams 27 and bolsters 26 removed and transported to the new location. When this is to be done supporting means must be provided to prevent the weight of the rail and its bed from bending the spokes. The supporting means consists of grapples 46 which are located at the back of the cab and adjacent opposite ends of the outer side wall of the car 37. Each of the grapples is formed as shown in Figure 6, and referring to this figure it will be seen that the grapple is formed of strong metal and has a V-shaped hanger 47, the arms of which are formed with bearings 48 to receive pins for pivotally connecting the grapple with mounting lugs 49 carried by the rear of the cab and end portions of the car 37. At the lower end of the hanger 47 each grapple is provided with an arm or stem 50 which is bent to extend laterally therefrom and carries a roller 51 for engaging under the outer portion of the upper flanges of the H-beams. The grapples will thus serve to support the rail and its bed at diametrically opposite points and remove the weight thereof from the spokes. In view of the fact that the grapples carry rollers, frictional binding will be prevented and if it is necessary or desirable to turn the cab while moving the crane from one place to another this can be easily done. During use of the crane the grapples will be swung upwardly to a raised position where they will be out of the way and secured with wire or in any other desired manner.

It should also be noted that use of the outrigger removes strain from the pivot 4 and the rollers 52 and weight will be applied at the car 37 instead of on the rollers this being due to the fact that upward pull exerted at the junction of the upper ends of the stiff-leg struts with the upper end of the mast causes such a reaction through the braces 19 and 40 as to transfer stress to the car 37, thus relieving the king pin 4 and the rollers 50 of the stresses usually borne thereby in a crane of a conventional construction when a load is handled.

I have, therefore, provided a crane of such construction that very heavy loads which would ordinarily require use of a great deal larger crane may be lifted without danger of the crane turning over and have further provided a general utility crane which may be used for light work without the outrigger or for heavy work by applying the outrigger to it. I have also provided a general utility crane which will be economical as it takes the place of a light crane and a heavy crane and may be quickly moved from one place to another and, in addition, moved along roads over which heavy cranes are not allowed to travel.

Having thus described the invention, what is claimed as new is:

1. In combination with a crane including a carriage and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom, demountable means for preventing tilting of the crane comprising an annular structure surrounding the carriage in spaced relation thereto and adapted to be supported upon the ground, and a bracing structure carried by and extending outwardly from the cab and traveling with the cab while bearing upon the annular structure as the cab is turned about its axis.

2. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage, demountable means for preventing said machine from turning over comprising an annular track for encircling the carriage and having a knock-down ground-engaging supporting means, and a rigid brace extending from the cab and moving with the cab while traveling along the track as the cab is turned about its axis.

3. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage, demountable means for preventing said machine from turning over when subjected to a load of excessive weight comprising a ground-supported track extending in an arcuate path about the carriage outwardly therefrom in spaced relation thereto concentric to the pivot of the cab, and a rigid brace extending from the cab and moving with the cab while traveling along the track when the cab is turned.

4. In combination with a lifting machine including a carriage and a cab mounted to swing above a vertical axis over the carriage, demount-

able means for preventing said machine from turning over when subjected to the weight of a load comprising a circular track for surrounding the carriage in outward spaced relation thereto, a knock-down ground-engaging supporting structure for said track, a rigid bracing structure carried by said cab and extending outwardly therefrom radially of the track and moving with the cab while resting upon and traveling along the track when the cab is turned about its axis, and means for suspending the track from the cab and the bracing structure when the ground-engaging supporting structure is dismantled.

5. In combination with a lifting machine including a carriage and a cab mounted to turn about a vertical axis over the carriage, dismountable means for preventing said machine from turning over when lifting a load comprising a circular track surrounding the carriage and spaced outwardly therefrom concentric to the axis of the cab, ground-engaging supporting means for said track, bracing means extending between the track and carriage for maintaining the track concentric to the axis of the cab, and a bracing structure carried by said cab and extending outwardly therefrom radially of the track and resting upon the track and moving with the cab while traveling along the track when the cab is turned about its axis.

6. In combination with a lifting machine including a carriage and a cab mounted to turn about a vertical axis over the carriage, demountable means for preventing said machine from tilting over when lifting a load comprising a circular track surrounding the carriage and spaced outwardly therefrom concentric to the carriage and the axis of the cab, a knock-down, ground-engaging supporting means for said track, spokes extending between the track and carriage with their ends secured thereto, said spokes being adjustable longitudinally to dispose and maintain the track concentric to the axis of the cab, and a bracing structure carried by said cab and extending outwardly therefrom radially of the track and moving with the cab while resting upon the track and moving along the track as the cab is turned about its axis.

7. In combination with a lifting machine including a carriage and a cab mounted to turn about a vertical axis over the carriage, means for preventing said machine from tilting over when lifting a load comprising demountable annular track surrounding said carriage, said track consisting of ground-engaging bolsters, cross beams resting upon said bolsters, a circular bed-rail resting upon said cross beams and formed of detachably connected arcuate sections, and a tread rail mounted upon said bed-rail and formed of detachably connected arcuate sections, spokes extending between said tread rail and said carriage and maintaining the track concentric to the axis of the cab, and a bracing structure carried by said cab and extending outwardly therefrom radially of the track and resting upon the tread rail of the track and traveling along the same when the cab is turned about its axis.

8. In combination with a crane including a portable carriage having traction means at opposite sides thereof and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom, demountable means for preventing tilting of the crane comprising an annular ground-supported track encircling said crane in spaced relation to the carriage and its traction means, means for maintaining said track concentric to the carriage and the axis of the cab, and a bracing structure consisting of an arm carried by and extending forwardly from the cab, a car at the front end of said arm resting upon and traveling along the track about the carriage when the cab is turned about its axis, and a strut extending between the car and the upper end portion of the mast.

9. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom at its front end, means for preventing said crane from tilting over when lifting a load comprising an annular ground-supported track encircling said carriage in spaced relation thereto and held concentric to the pivot for the cab, and a bracing structure consisting of a car for traveling along said track, bars extending from ends of said car and secured to the front end of the cab, and stiff leg struts extending upwardly from said car at an incline over the front end of the cab and secured at their upper ends to the upper end of said mast.

10. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom at its front end, means for preventing said crane from tilting over when lifting a load comprising an annular ground-supported track encircling said carriage in spaced relation thereto and held concentric to the pivot for the cab, and a bracing structure consisting of bars extending forwardly from opposite sides of the front end of the cab, a car disposed over said track and having a frame secured at its ends between outer ends of said bars, blocks in said frame, trucks pivoted to said blocks within the frame and extending longitudinally of the frame and carrying wheels resting upon said track, and stiff-leg struts extending upwardly from said blocks at an incline over the front of the cab and at their upper ends secured to the upper end of the said mast.

11. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom at its front end, means for preventing said crane from tilting over when lifting a load comprising an annular ground-supported track encircling said carriage in spaced relation thereto and held concentric to the pivot for the cab, and a bracing structure extending forwardly from the front end of the cab and having a car at its front end traveling upon said track, a strut being provided between the car and the upper end of the mast, and grapples carried by the car and the rear portion of the cab for engaging under and supporting the track for transportation with the crane when the ground-engaging supporting means for the track is removed.

12. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom at its front end, means for preventing said crane from tilting over when lifting a load comprising an annular ground-supported track encircling said carriage in spaced relation thereto and held concentric to the pivot for the cab, a bracing structure extending forwardly from the front end of the cab and having a car at its front end traveling upon said track, a strut being provided between the car and the upper end of the mast, and grapples pivoted to the car and the rear portion of the cab and depending therefrom and having laterally extend-

ing stems at their lower ends carrying rollers for engaging under the track and supporting the track in an elevated position about the crane for transportation with the crane when the ground-engaging supporting means for the track is removed.

13. In combination with a lifting machine including a carriage and a cab mounted to swing about a vertical axis over the carriage and carrying a mast and a boom at its front end, means for preventing said crane from tilting over when lifting a load comprising an annular ground-supported track encircling said carriage in spaced relation thereto and held concentric to the pivot for the cab, a bracing structure extending forwardly from the cab and traveling upon the track as the cab is turned and having a brace between its outer end and the top of the mast, and means carried by the bracing structure and the rear portion of the cab for supporting the track for transportation with the crane when the ground-engaging supporting means for the track is removed.

14. In a lifting machine, a carriage, a cab mounted to turn about a vertical axis over the carriage, a boom at the front of the cab, and a mast rising from the cab back of the boom and comprising a lower section of A-frame formation and having sets of upwardly converging front and rear legs at sides of the cab, a casting connecting upper ends of each set of legs, a cross shaft extending between the castings for the legs transversely of the cab, an upper section for the mast having side bars pivoted to the upper end of the lower section at the castings thereof and extending upwardly in alinement with the rear legs, a cross shaft extending between upper ends of the side bars of the upper section, and collapsible posts for the upper section rising from the carriage between the boom and lower ends of the front legs of the lower section at a rearward incline and having their upper ends mounted at upper ends of the side bars of the upper section.

15. In a lifting machine, a carriage, a cab mounted to turn about a vertical axis over the carriage, a boom at the front of the cab, a mast rising from the cab back of the boom and comprising a lower section of A-frame formation, an upper section having its lower end pivoted to the upper end of the lower section, a collapsible support for the upper section rising from the carriage between the boom and the front end of the lower section at a rearward incline and having its upper end secured at the top of the upper section, said support consisting of posts each having upper and lower sections and an intermediate section, and side bars disposed at opposite sides of the post and detachably secured against side faces of the sections thereof to firmly hold the sections in alinement with each other.

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