July 4, 1933. N. P. NELSON ET AL 1,917,053

PORTABLE CRANE

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Fig. 7.

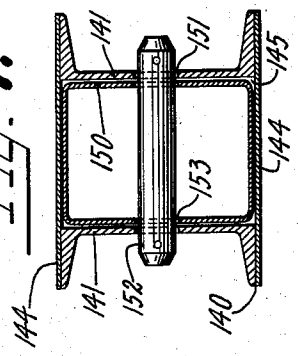


Fig. 1.

Fig. 8.

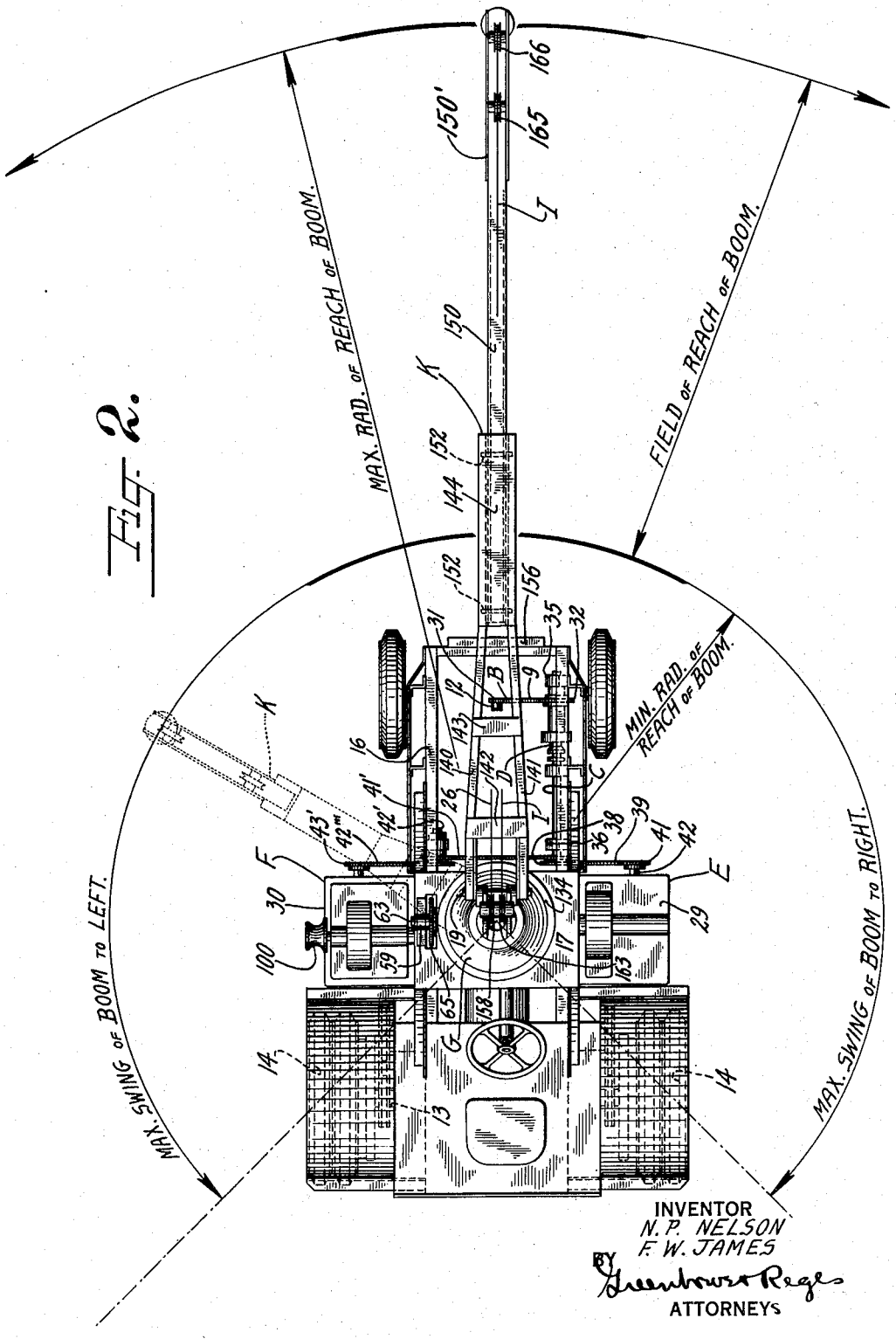
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PORTABLE CRANE

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Fig. 2.



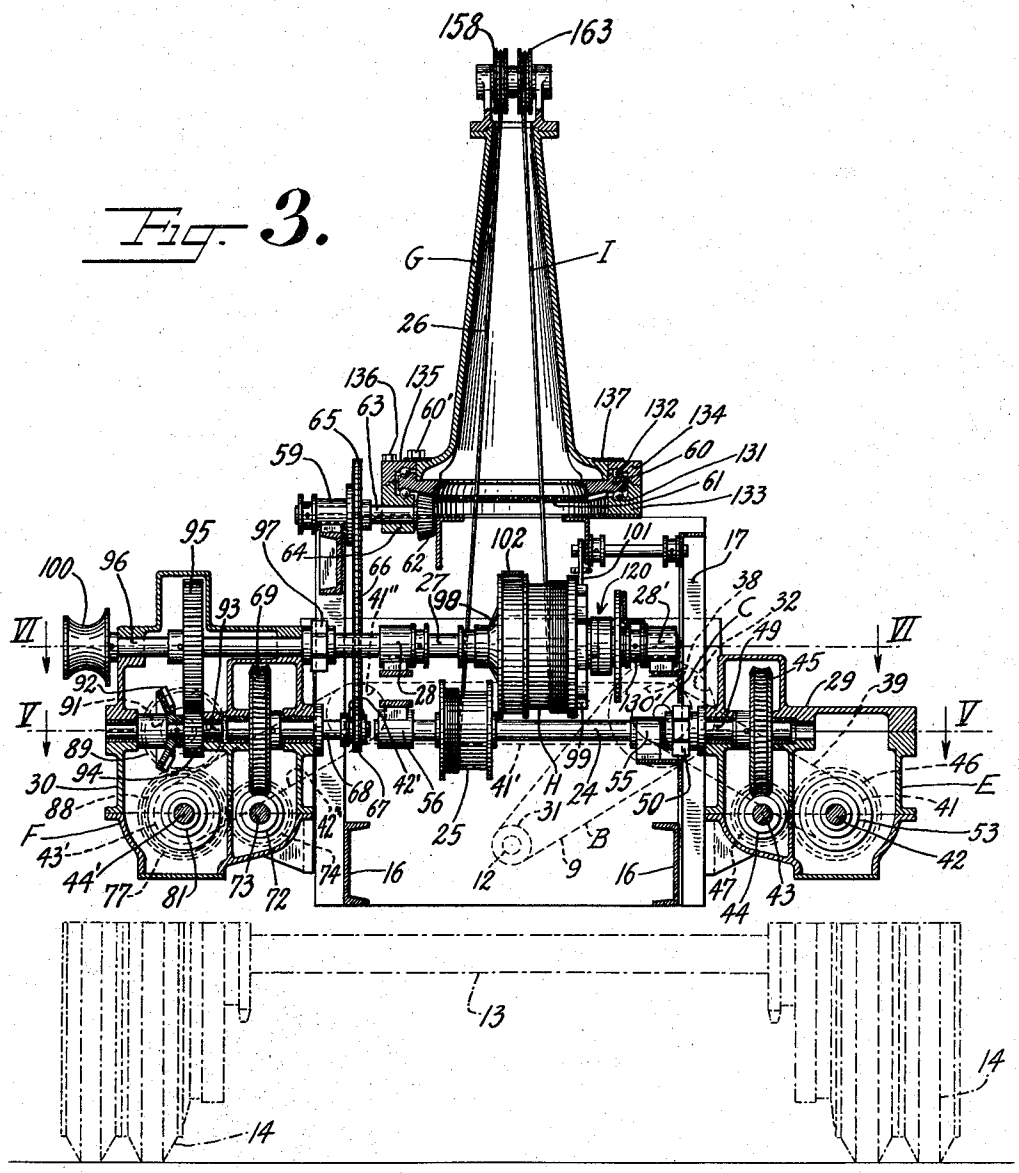
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PORTABLE CRANE

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Fig. 3.



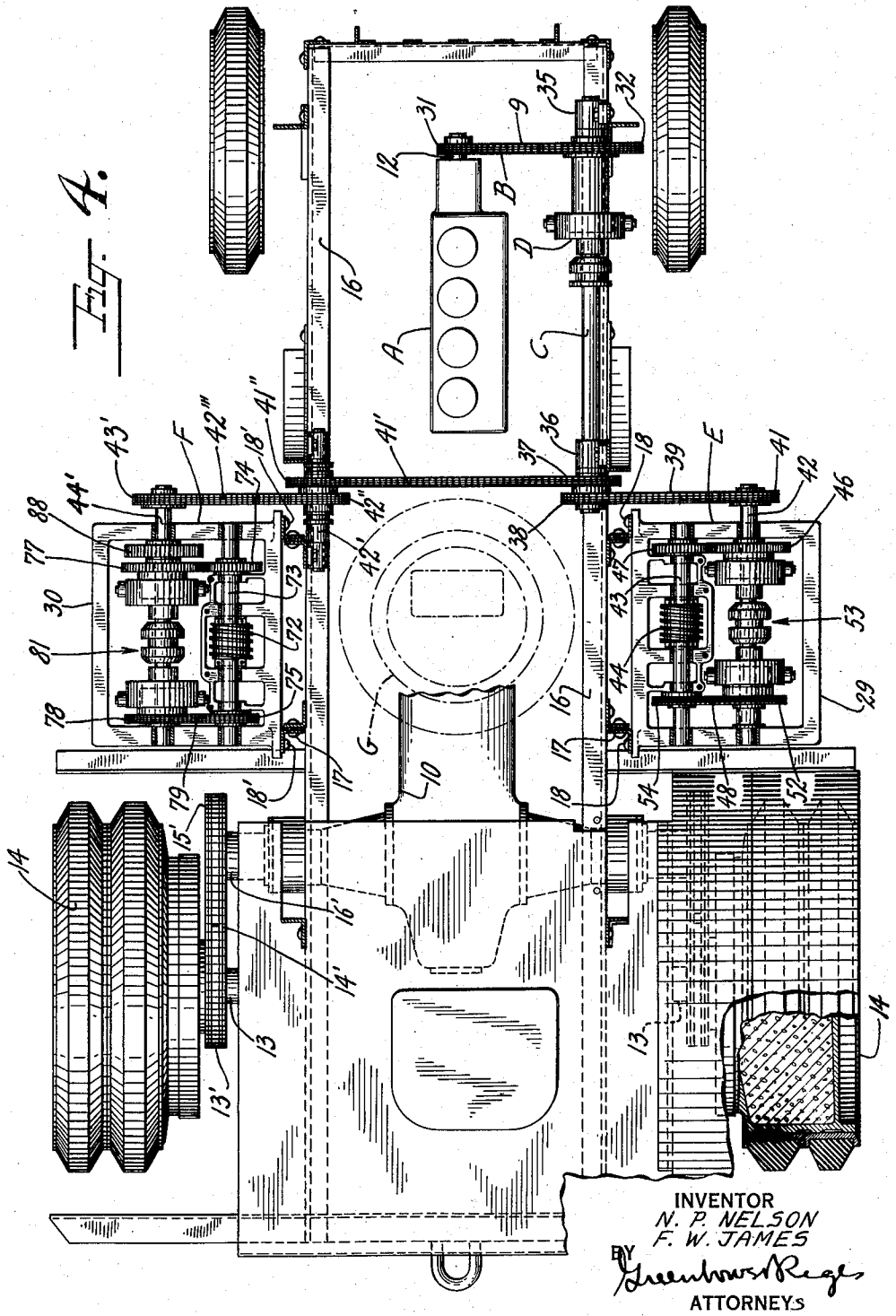
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PORTABLE CRANE

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Fig. 4.



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PORTABLE CRANE

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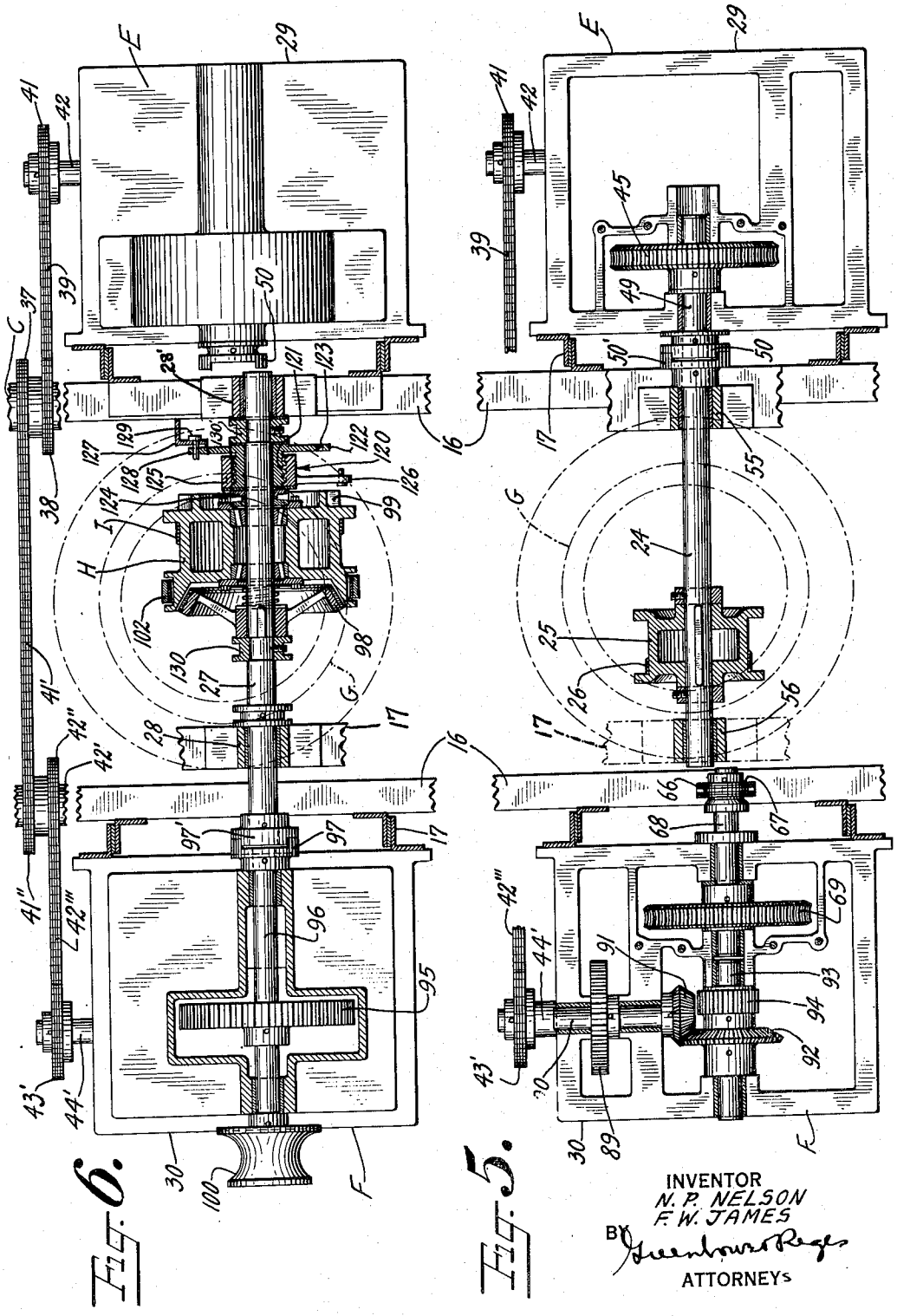


Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE

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PORTABLE CRANE

Application filed March 21, 1931. Serial No. 524,296.

This invention relates to a portable crane of the type generally termed tractor cranes by reason of the fact that they are mounted on power vehicles known as tractors.

In tractor cranes as heretofore constructed it has usually been the practice to provide a crane mechanism and to adapt the same to the tractor. Inasmuch as tractors are manufactured as standard equipment for a variety of uses, it is obvious that they are not fundamentally designed for carrying crane mechanism and although many makes of tractors are practical for this purpose certain limitations are imposed on the crane mechanisms in order to adapt them to such use.

It is evident that a crane must operate to raise, carry and lower heavy loads, moreover the loads must be handled in positions which impart forces tending to dislodge or tip the entire operating mechanism and tractor. In consequence of the above it is often necessary to chock the axles of the tractor to give it stability, especially if the ground is uneven.

It has also been found that although the crane operating mechanism is of relatively great weight, this weight has never been put to the best advantage as an aid in counterbalancing the handled load since owing to the manner of arrangement, the weight of the crane operating mechanisms has heretofore been confined to a relatively small area in a crowded unit so that if it acted to balance a load handled on one side of the tractor there remained the tendency to tip when the load was moved from the counter-balance of such mechanism.

Furthermore as commonly constructed a tractor does not provide a sufficient base or ground support i. e. the base spread, which serves to oppose the undesirable tendency to tip, is inadequate and whereas it is desirable to have what may be termed a three point support; tractors, as heretofore made by reason of the location of the wheels give a substantially square support or narrow base and also lack the desirable weight to anchor the mechanism in position during operation.

The present invention provides not only a crane adapted to be carried on a tractor but adapts a tractor to meet the requirements of a crane mechanism to enable it to be operated in an efficient and practical manner whereby the range of service is widened by the handling of loads.

In accomplishing the above we provide a tractor preferably of the wheeled type which may follow the pattern of any selected commercial tractor. This tractor is, however, modified by a rearrangement of the wheel base in that the two rear wheels are spaced a greater distance from the front wheels and are moved laterally so that they are spaced a relatively great distance apart. For the purpose of providing a more firm foundation for the tractor it is desirable to have a base of great weight. Ordinarily it would be difficult and cumbersome to add mass to the carriage to give weight.

In accordance with the present invention we have utilized the wheels to carry a mass of heavy material by making the wheel bodies in the form of hollow drums into which concrete and other heavy material is introduced giving rigidity to the supporting structure which in addition to the large supporting base area serves to act as a solid foundation for the crane.

For the purpose of otherwise balancing the hoisting apparatus as a whole the crane mechanism is divided into several units which are disposed in such positions as to give a symmetrical distribution of the weight so that the center of gravity will come about on the center line of the crane, allowing the machine to carry as great a load on one side as on the other.

From the foregoing it will be seen that the crane mechanism and the supporting vehicle cooperate to provide a combination of elements giving a new and advantageous result.

Briefly the tractor is provided with a frame which carries the crane mechanism. This mechanism includes a mast and boom which are mounted on the frame and positioned in the rear of the tractor engine. The crane operating mechanism is divided into two units; a "hoisting" unit including mech-

anism for swinging the mast and operating a hoisting drum; and a "topping" unit for raising and lowering the boom. These units are disposed at opposite sides of the mast while the weighted rear wheels are disposed on the side of the mast opposite to the engine.

From the above it will be evident that together with the provided base spread the mast and boom will be aided in operation by the weight of the forwardly disposed engine, the laterally disposed machine units and the rearwardly disposed weighted wheels. All of which elements cooperate to produce a hoisting apparatus having the necessary stability for effective and efficient operation.

As above mentioned the several units as well as other co-related mechanisms are in accordance with the present invention mounted on a frame. It has been found in practice that ordinarily, supporting frames are subject to serious distortion under the stress of forces imposed during the oblique loads encountered in crane service and this distortion throws the shafting, gears and other mechanisms out of alignment, heating and destroying their bearings and causing rapid deterioration of the machinery.

In the present invention the above disadvantages are avoided by disposing the several co-related mechanisms in flexible relation with the motion translating connections whereby warping or distortion of the frame on which the mechanisms are mounted will not effect smooth and efficient operation of the said mechanisms.

An object of the invention is therefore to produce a complete automotive crane for the expeditious, economical and convenient handling of heavy loads.

Another object is to produce a combined crane and motor vehicle wherein the crane mechanism is operated by the power plant of said vehicle.

Another object is to produce an automotive crane in which all crane operations may be performed by power simultaneously and completely independent of each other and of the traction of the crane.

Another object is to produce an automotive crane in which the alignment of the operating mechanisms is maintained in spite of warping of the framework of the crane under heavy loads.

Another object is to provide a portable crane having its supporting carriage arranged to oppose the tendency to tip by reason of the force imparted by the potential energy of suspended loads.

Another object is to provide a carriage for a crane mechanism wherein the carriage spread and the weight thereof operates in conjunction with the said mechanism during its operation in handling heavy loads in the absence of tipping.

Other objects and advantages will be more fully understood from the following description together with the accompanying drawings in which,

Fig. 1 is a side elevational view of the present crane mechanism applied to a tractor;

Fig. 2 is a plan view of the crane and tractor shown in Fig. 1;

Fig. 3 is an enlarged vertical sectional view taken through the mast of the crane on line III—III in Fig. 1, and showing internal driving elements;

Fig. 4 is an enlarged sectional view taken on line IV—IV in Fig. 1;

Fig. 5 is an enlarged sectional plan view taken on the line V—V in Fig. 3;

Fig. 6 is an enlarged sectional plan view taken on the line VI—VI in Fig. 3;

Fig. 7 is an enlarged sectional view taken through the boom on the line VII—VII in Fig. 1;

Fig. 8 is a front elevation of the chassis of the crane showing connection to tractor front axle.

The present invention may be applied to power units of various types. The selected embodiment of the invention however is shown and described herein in connection with the tractor commercially known as the McCormick-Deering No. 20 industrial tractor, from which it derives power to perform all its several motions as hereinafter set forth.

In the following description the three crane motions proper will be referred to as follows: the up-and-down motion of the suspended load and the corresponding motion of the line on which the load is suspended will be called "hoisting"; the angular elevation or descent of the boom will be called "topping", and the axial rotation of the mast, boom and load will be called "swinging."

The forward and reverse travel of the vehicle on which the crane is mounted are not considered as crane motions and are accomplished by means of the usual mechanisms contained in the vehicle, and will be referred to in the ensuing description as the "travel."

For purposes of clearness a brief outline of the primary operating units is now given, before proceeding to their detailed descriptions. Referring to the drawings and particularly Fig. 4 the source of power for operating both travel and crane motions is the engine A, having a power take-off B to rotate a crane master shaft C. The master shaft C is provided with a master clutch D by which the entire crane mechanism may be disconnected from the engine at will. A chain drive from the shaft C operates a topping unit E at the right hand side of the machine for raising and lowering a boom K (see Fig. 2). Another chain drive from the

master shaft C operates a swinging unit F at the left hand side of the machine, the unit F containing mechanism for swinging a mast G and also for operating a hoisting drum H for a cable I to lift the load. The operating units E and F each include a housing in which the movable parts are journaled and run in oil, and each housing with its contents is removable without disturbance to the remaining mechanism.

In greater detail, the crane here shown is mounted on a four-wheeled tractor 10 provided with the driving engine A and equipped with the usual clutch and transmission at the rear of the engine for controlling and actuating the traction wheels 14 which turn on a fixed rear axle 13 and effect the travel motion of the crane.

For the purpose of giving the crane mechanism greater length or wheel spread the tractor is modified to include the fixed rear axle 13 which is provided with a chain sprocket 13′ connected by a chain 14′ to a chain sprocket 15′ on the differential axle 16′ of the tractor. The rear wheels 14 are as shown in Fig. 4 constructed with a hollow body and are filled with a suitable weighty material as for example iron concrete; thus the rear wheels cooperate with the other elements to provide a symmetrical distribution of weight to attain the operating advantages hereinabove set forth.

The front axle of the tractor is pivoted at its center 11 and from this point an inverted arched structure 16′ extends transversely upward and outward supporting forwardly the stringers 16 of a frame 17 on which the crane mechanisms are assembled. Rearwardly the stringers 16 support the rear axle housing of the tractor and are supported by the rear axle 13, and in this manner both the tractor 10 and the frame 17 are given three-point support and relieved of warping strains while the tractor is on uneven ground.

The forward extension of the engine crank shaft 12 carries a sprocket 31 which imparts motion to an endless chain 9 driving the sprocket 32 on the master shaft C, the parts 12, 31, 9 and 32 comprising the power take-off B. The master shaft C is disposed longitudinally of the tractor and substantially parallel to the engine crank shaft 12, being journaled in bearings 35, 36 attached to the frame 17. The sprocket 32 turns freely on the shaft C which revolves only upon closing the master clutch D disposed to engage the sprocket 32.

At the rearward end of the master shaft C sprockets 37 and 38 are disposed, carrying an endless chain drive 39 to a sprocket 41 which drives the topping unit E on the right hand side of the crane, and also a transverse endless chain drive 41′ to a sprocket 41″ on a countershaft 42′ on the opposite side of the frame 17, from which countershaft a further sprocket 42″ and chain 42‴ drive a sprocket 43′ and the swinging unit F on the left hand side of the frame 17.

It will be now understood that the engagement of the master clutch D sets in motion the three chain drives, the sprockets 41 and 43′ and the shafts 42 and 44′ on which these sprockets are mounted. The disengagement of the master clutch D cuts off power from the chain drives and avoids unnecessary wear on the crane operating mechanism when not in actual use.

It will be noted also that with the engine running continuously any suitable travel speed may be imparted to the tractor by means of the usual clutch and transmission at the rear of the engine, while any desirable crane motions may be driven by power taken from the continuously running master shaft C; and further that the transmission gears may be shifted without interfering with any crane operations that may be going on and that crane operations may be performed without interfering with the gear-shifting which adjusts the travel of the tractor.

The topping unit E contains three shafts 42, 43 and 49 as shown in end elevation in Fig. 3. The two lower shafts 42, 43 with their pertinent parts are better shown in the plan view, Fig. 4, where it will be seen that the input shaft 42, driven by sprocket 41 is journaled near its ends in the housing 29. Turning freely on this input shaft 42 is a gear 46 and a sprocket 52, each provided with hubs for a friction clutch 53 which is disposed to engage the sprocket 52 at one end of its stroke and the gear 46 at the other end of its stroke, with an intermediate position in which it engages neither. Parallel and adjacent the input shaft 42 is a worm shaft 43 also journaled in the housing 29 and carrying a flat-pitched worm 44, a gear 47 meshing with the gear 46, and a sprocket 54 connected by endless chain 48 with the sprocket 52.

Above the worm shaft 43, at right angles thereto and disposed transversely of the crane is a short shaft 49, also journaled in the housing 29 as better shown in Figs. 3 and 5 and carrying a worm gear 45 within the housing and a crab coupling 50 without, the worm gear meshing with and being driven by the worm 44 below it.

Separate from the shaft 49 and substantially coaxial with it is a transverse shaft 24, journaled in bearings 55, 56 supported in the frame 17, and carrying intermediate its length a drum 25 on which the topping line 26 is reeled, and fitted at its right hand end with a crab coupling 50′ which engages and is driven by the mating coupling 50 on the end of the shaft 49.

The operation of the topping unit is as follows:

With the engine A running and the master clutch D engaged, power is transmitted

through the chain drive 9, shaft C, chain drive 39 and sprocket 41 to the input shaft 42. So long as the friction clutch 53 remains in its intermediate or neutral position, no motion is transmitted to the worm and subsequent mechanism. When, however, the clutch is shifted forward it engages the free gear 46, driving the gear 47 and worm 44, the worm gear 45, the shafts 49 and 24 and the drum 25 in such manner as to reel in the cable 26 and raise the boom K. When the clutch is thrown to the other end of its stroke it engages the sprocket 52. The chain 48 now drives the worm 44 in the opposite direction, reversing the motion of the drum 25 and unwinding the cable 26 and allowing the boom to descend. By virtue of the self-locking feature common to all flat-pitched worm gearing the boom will remain in whatever position it may occupy upon disengagement of the clutch 53.

The lower portion of the swinging unit F on the left hand side of the crane as shown in Fig. 4 contains the input shaft 44′ with free gear 77 and free sprocket 78 engaged by the double friction clutch 81, and a worm shaft 73 with worm 72, gear 74, sprocket 75 and chain 79 arranged as in the topping unit E and reversing the motion of the worm 72 in the same manner. In mesh with the worm 72 is the worm gear 69 shown in Fig. 5 carried on the shaft 68 and journaled in the housing 30. The protruding end of the shaft 68 carries the sprocket 67, adapted to receive an endless chain 66 which may be driven in either direction by the above mechanism, the reverse rotations of the sprocket 67 being used for swinging the mast in a manner later to be described.

On the input shaft 44′ of the swinging unit F there is also, in addition to the parts already described, a spur gear 88, keyed to it and turning with it. This gear 88 meshes with and drives a spur gear 89 directly above it which latter gear is shown in Fig. 5 mounted on a short shaft 90, journaled in the housing 30 and carrying at one end a bevel pinion 91. Driven by the bevel pinion 91 is a bevel gear 92 mounted on the shaft 93 which also carries a spur pinion 94. Directly above and meshing with the spur pinion 94 is a spur gear 95 shown in Fig. 6 keyed to a hoist output shaft 96 which is journaled in the upper portion of the housing 30 and which carries on its left hand extremity a capstan head 100 and on its right hand extremity a crab coupling 97.

For clearness it should be noted that while shafts 93 and 68 are in alignment they are entirely separate, shafts 93 and 96 running contemporaneously with the input shaft 76, while shaft 68 runs only when activated by the engagement of the clutch 81.

Separate from the hoist output shaft 96 and substantially coaxial with it is a transverse shaft 27 journaled in bearings 28 and 28′ supported on the frame 17 and carrying at its left hand end a crab coupling 97′ which engages and is driven by the mating coupling 97 on the end of the shaft 96. Intermediate the length of the shaft 27 is the hoisting drum H adapted to receive the hoisting line I. The drum H is free on the shaft 27 as to both rotation and axial sliding, and is provided at one side with a friction cone 98 keyed to the shaft 27 and at the other side with a thrust box 120 adapted to press the drum against the friction cone for the purpose of imparting rotary motion from the shaft 27 to the drum H. A roller bearing 124 is placed between the thrust box and the drum to reduce the friction between the two rotating parts, and the drum is further provided with a ratchet 99 and pawl 101 (see Fig. 3) and a brake 102 for supporting the load under different conditions of service as is usual in hoisting machinery of this class.

The thrust box 120 consists of two parts, an externally-threaded hub or adjuster 121 disposed concentric with the shaft 27 and provided with a circular flange 122 in which are a circle of holes 123 concentric with the hub, and an internally threaded nut 125 screwing onto said hub 121 and provided with a lever 126 for rotating it, the angular rotation of the lever and nut producing an axial motion of the nut and engaging the drum H with the friction cone 98.

Adjacent the flange 122 is a plate 127 supported on the frame 17 and perforted with several holes 128 in the manner of a vernier. By rotating the hub 121 with its flange 122, the holes 123 in the flange may be successively brought into alignment with the vernier holes 128 in the plate 127 and a bolt 129 inserted to hold the adjustment. This construction allows a very convenient single adjustment to be made both to regulate the stroke of the operating lever 126 and to take up the wear of the friction cone 98, while the disposition of the thrust nut 125 permits it to be made of generous dimensions and great strength. The whole drum and thrust mechanisms are included between two set collars 130 and 130′ mortised into the shaft, which prevent any of the thrust pressures acting against the bearings and frames.

The housings 29 and 30 of units E and F are attached to the sides of the frame 17 by bolts 18, 18′ and lie outside the frame in an accessible position. It will be seen that all driving connections to these units are flexible and will remain operative even under considerable deflections and mis-alignments, said connections being the chain drives 39, 42‴ and 66, and the crab couplings 50 and 97. Now when a heavy load is handled by a crane there is inevitably a very considerable distortion of the framework of the crane,

particularly when the load is suspended in a position oblique to the principal axes of the structure.

By enclosing the more delicate and intricate operating mechanisms in substantial supporting housings 29 and 30 we secure their permanent lubrication, protection from damage and exclusion of dirt, and by making all driving connections to these housings flexible we relieve these mechanisms from all warping strains due to deformation or distortion of the frame and so maintain them in permanent alignment. Furthermore the symmetrical disposition of these units E and F on either side of the frame equalizes the loading of the chassis, enabling the crane to handle as great a burden on one side as on the other and permitting the operator to swing his loads from side to side with full confidence in the stability of the machine. The unit E with all its contained parts (and similarly the unit F) may be readily dismounted from the assembly by disconnecting the chain drives and the attaching bolts 18, and may be removed for inspection, adjustment or repair, without disturbing any of the remaining mechanism. At the same time its removal affords additional access to the drums 25 and H with their pertinent parts for inspection or repair there required.

The mast assembly (see Fig. 3) consists of the mast proper, G, a trumpet-shaped structure expanded at its lower end where it is supported in a double ball bearing hereafter described, and terminating at its upper end in a rooster carrying head sheaves 158, 163 for the lines 26 and I. Attached to the lower end of the mast G is a ring 60 strongly bolted to the mast G by a plurality of bolts 60'.

The lower part of the ring 60 carries a bevel gear 61, while its outer part is fashioned above and below into races to receive the two ranges of balls 131 and 132. The outer cylindrical edge of the ring 60 is turned to a fixed diameter.

Mounted on the substantially horizontal frame 17 is a base ring or lower race 133, fashioned on its upper surface to receive the lower range of balls 131, and bored immediately above the race to receive the outer edge of the ring 60, relieving the balls from severe impact blows (as from starting the traction) while under load. An upper race ring 134 is finished on its lower face to receive the upper range of bearing balls 132 and is interlocked with the lower race 133 by a counterbore 135, while both race rings are clamped together and to the frame 17 by a plurality of bolts 136. The upper range of balls serves to allow easy rotation of the mast during tipping action under heavy loads.

An annular cover plate 137 protects the joint between the revolving mast G and the stationary upper race preventing the entrance of dirt or rain. While balls have been selected in this instance to furnish the anti-friction element of the mast bearing, it is evident that rollers could be arranged for the same end and are equivalent for the purpose of this machine, providing easy rotation to the mast and preventing its tilting under load.

The mechanism used for swinging the mast consists of a shaft 63 journaled in a bearing 59 on the frame 17 and in another bearing 64 formed in the lower face of the lower race 133.

This swinging shaft 63 carries a sprocket 65 to receive the endless chain 66 transmitting reversible motion from the sprocket 67 on the swinging unit output shaft 68, and also a bevel pinion 62 meshing with the bevel gear 61 at the base of the mast G, by which the reversible rotary motion from the swinging unit F is transformed into azimuth rotation of the mast, the boom and the load.

It is evident that the crane may be required to work in a great variety of clearances, sometimes raising loads to a considerable height and in other cases working under roofs, ceilings or trestles of limited headroom. To accommodate the crane to these various conditions the boom K is made in two parts telescoping into each other, readily adjustable as to length, and so arranged that the boom can be lengthened or shortened in a few minutes time.

The boom assembly K is pivotally connected at its lower end by the heel pin 140' to the lower part of the mast G, see Figs. 1 and 2 and its distal end is suspended by the topping line 26 acting through the bridle 108. The lower portion 140 of the boom K is of open box section, somewhat spread at its lower end to afford a wide attachment at a heel pin 140'. The sides of this box section are channels 141 held in spaced relation by cover plates 142, 143 and 144 above and below, the outermost cover plates 144 forming with the channels 141 a rectangular tube 145 of relatively great length in proportion to its transverse dimensions.

The upper portion of the boom, called the spar, 150 is a welded steel tube of rectangular cross section, its upper end being bent and reinforced and fabricated into a gooseneck 150', and its lower end adapted to slide in the tubular upper end 145 of the lower boom 140. Holes 151 are provided in the channels 141 of the lower boom 140 to receive pins or bolts 152, while in the spar 150 a plurality of holes 153 are provided which may be successively aligned with the holes 151 in the channels 141 and the pins 152 inserted to fix the spar at its adjusted length. A bracket 156 is provided on the front of the frame 17 on which the boom may be rested while changing its length.

The topping line 26 leads from the topping

drum 25 upward through the interior of the mast G, over the head sheave 158 and is rove in several parts between a sheave 159 on a bridle 160 and a sheave block 110 on the mast head in the usual manner. The hoisting line I leads from the hoisting drum H upward through the interior of the mast G, over the head sheave 163, over a guide sheave 164 carried by the bridle 160, over a guide sheave 165 on the gooseneck 150′ and around a peak sheave 166, depending thence to receive its load.

It will be evident from the foregoing that the present invention provides a crane mechanism wherein speed in handling and hoisting and hoisting heavy loads is readily attained. With the present mechanism hoisting speeds of 200 feet per minute for loads of 1000 pounds is practical, which in addition to the unusual height and reach of the telescopic boom afford advantages not heretofore available in this character of equipment.

As pointed out in the specification the direct drive from the tractor engine allows for crane movements independent of the transmission and clutch controlling the travel of the tractor. The hoisting, topping and swinging may therefore be performed simultaneously with either the forward or backward travel of the tractor without interference with the tractor operating mechanism. This is of great advantage in expediting the locating or spotting of the load to be transported. Furthermore it is evident that by reason of the master clutch associated with the crane mechanism, such mechanism may be cut out at will thus saving the movable parts from unnecessary wear.

As above set forth crane mechanism is divided into units and so constructed and arranged as to be disposed in definite symmetric relation so that the crane may pick up loads from either side without danger of overbalancing the machine.

From the foregoing it will be evident that the present crane mechanism lends itself to broad application and by reason of the operating relation of the several unit mechanisms into which the crane is divided great flexibility of service is attained. For example by reason of the independency of the operation of the crane mechanisms from the tractor travel mechanism it is possible to travel and hoist, or stop and still keep on hoisting or start and keep on hoisting. Heretofore tractor crane mechanisms did not have this advantage and when the tractor stopped its travel it was necessary to stop hoisting or when the tractor started to travel it was necessary to stop hoisting.

The above advantage attained by the present is the result of having the crane operating mechanism independent of the mechanism which imparts travel motion to the tractor. In the present invention the tractor is provided with the usual clutch for controlling the travel but this clutch in no way controls or affects the clutch which controls the operation of the crane mechanism.

Although a preferred embodiment may be shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A crane mechanism comprising a framework, a hoisting drum, a topping drum, a hollow mast rotatably supported on said framework, a rigidly inclosed reversing mechanism for operating said topping drum, a rigidly enclosed mechanism for operating said hoisting drum, means for removably attaching said enclosed mechanisms to said framework and flexible means for removably connecting said mechanisms to the respective drums.

2. In combination with a tractor, a frame supported on said tractor, a mast mounted on said frame substantially midway between the ends thereof, a boom for said mast, a boom operating mechanism mounted on said frame at one side of said mast, a hoisting and swinging unit mounted on said frame on the opposite side of said mast, and means connecting said mechanisms with the engine of said tractor.

3. In combination with a tractor, a frame supported on said tractor, a mast mounted on said frame substantially midway between the ends thereof, a boom for said mast, a boom operating mechanism mounted on said frame at one side of said mast, a hoisting and swinging unit mounted on said frame on the opposite side of said mast, a master drive shaft, bearings on said frame for rotatably supporting said shaft, driving means for connecting said shaft to said units and driving means connecting said shaft to the engine of said tractor.

4. A crane comprising a power source, a master drive shaft, a clutch for said shaft, topping mechanism, a counter drive shaft for said mechanism, means connecting said counter shaft with said master drive shaft, a secondary shaft for said mechanism, means for connecting said counter and secondary shafts to effect a rotation of said secondary shaft in one direction, means for connecting said counter and secondary shafts to rotate said secondary shaft in an opposite direction, a topping drum, means connecting said drum with said secondary shaft and means for controlling the direction of rotation of said secondary shaft.

5. A crane comprising a power source, a master drive shaft, a clutch for said shaft, topping mechanism, a counter drive shaft for said mechanism, means connecting said counter shaft with said master drive shaft, a secondary shaft for said mechanism, means

for connecting said counter and secondary shafts to effect a rotation of said secondary shaft in one direction, means for connecting said counter and secondary shafts to rotate said secondary shaft in an opposite direction, a winding drum, means connecting said drum with said secondary shaft and a clutch on said counter shaft.

6. A crane comprising a power source, a master drive shaft, a clutch for said shaft, topping mechanism, a counter drive shaft for said mechanism, means connecting said counter shaft with said master drive shaft, a secondary shaft for said mechanism, means for connecting said counter and secondary shafts to effect a rotation of said secondary shaft in one direction, means for connecting said counter and secondary shafts to rotate said secondary shaft in an opposite direction, a winding drum, means connecting said drum with said secondary shaft and means operable to terminate the rotation of said secondary shaft.

7. A crane mechanism comprising a frame a plurality of individually operable mechanisms supported on the outer sides of said frame and on opposite sides thereof, a mast supported on said frame above said mechanisms, a boom for said mast, drums below said mast and between said mechanisms, means connecting said drums with said mechanisms and cables leading from said drums to said mast.

8. A crane mechanism comprising a frame, a hollow mast mounted on said frame, winding drums mounted within said frame and below said mast, reversible driving mechanisms for said drums, means for mounting said mechanisms on the outer opposite sides of said frame, cables leading upwardly from said drums through said mast, and means for transmitting motion from said mechanisms to said drums.

9. A crane mechanism comprising a plurality of individually operable units, a frame, means for supporting said units on the outer opposite sides of said frame, a hollow mast supported on said frame and above said units, winding drums below and in operable relation to said mast, cables leading from said drums through said mast and means for the transmission of motion from said units to said drums.

10. A portable crane mechanism, comprising a tractor, a supporting frame subject to flexure under stress to which the crane is subjected, a mast mounted on said frame, cables for lifting loads guided by said mast, a plurality of operating units to actuate said cables, a rigid housing for each of said units, means for independently mounting said housings on said frame and flexible means for translating motion to said units whereby said housings may have relative movement without causing detrimental friction in said last mentioned means.

11. A portable crane mechanism comprising a tractor, a supporting frame subject to flexure under the stress to which the crane is subjected, a plurality of crane operating units, a rigid housing for each unit to support the operative elements of the units, means for independently mounting said housings on said frame and means for flexibly connecting said units with the engine of said tractor whereby said housings may have free relative movement when said frame is flexed under stress of heavy loads carried by said crane.

In testimony whereof we affix our signatures.

NELS PETER NELSON.
FREDERIC WILTON JAMES.