Dec. 14, 1943. R. C. SHOEMAKER 2,336,965

FOLDING CRANE

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FIG. 2.

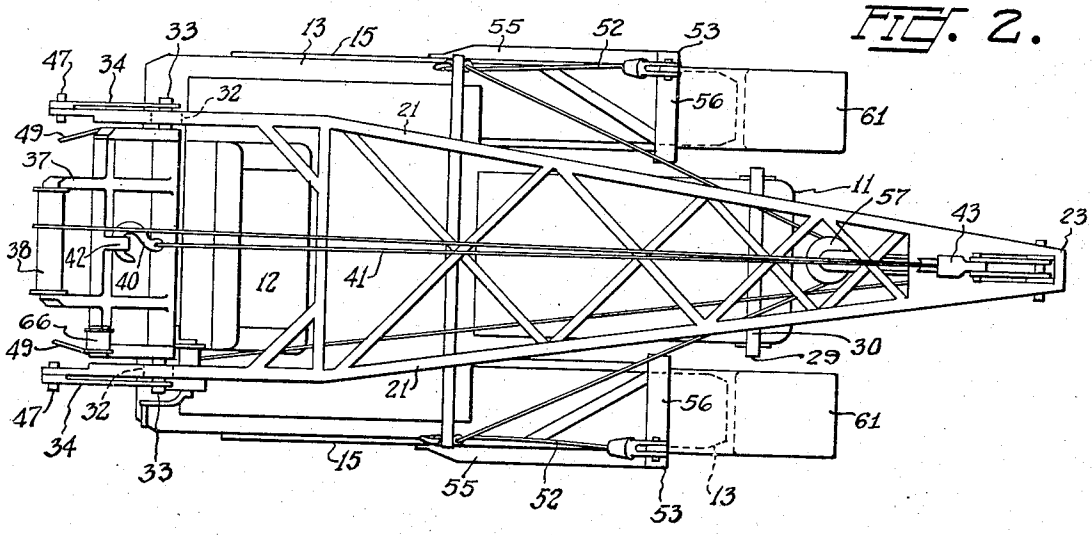
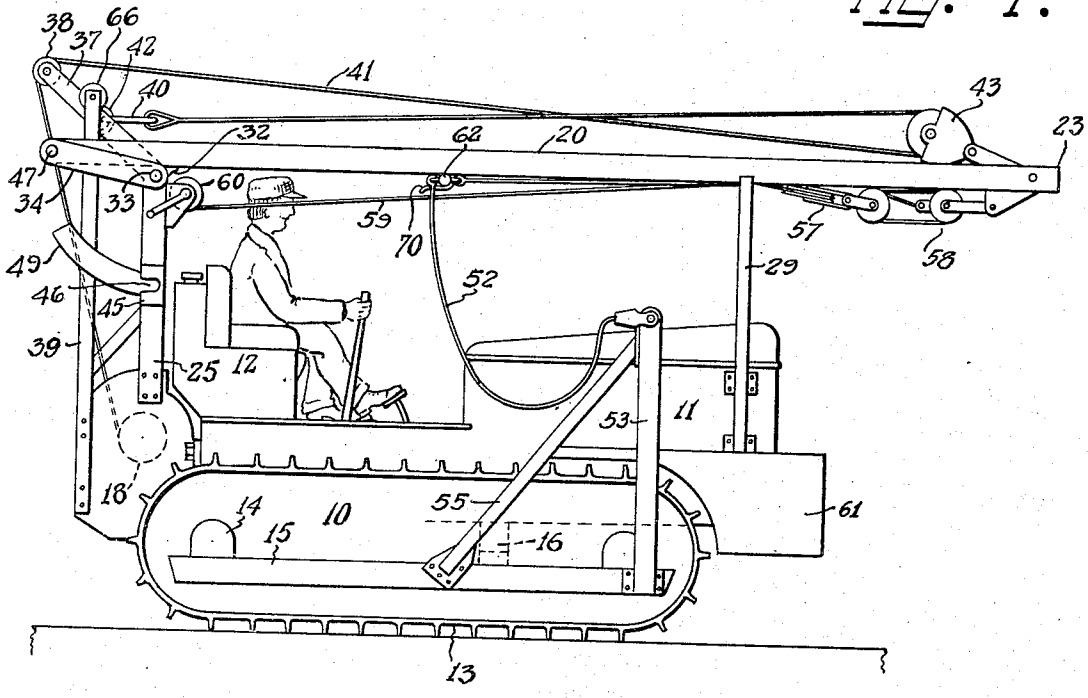


FIG. 1.



INVENTOR
ROBERT C. SHOEMAKER
BY Harold D. Cook
ATTORNEY

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FIG. 5.

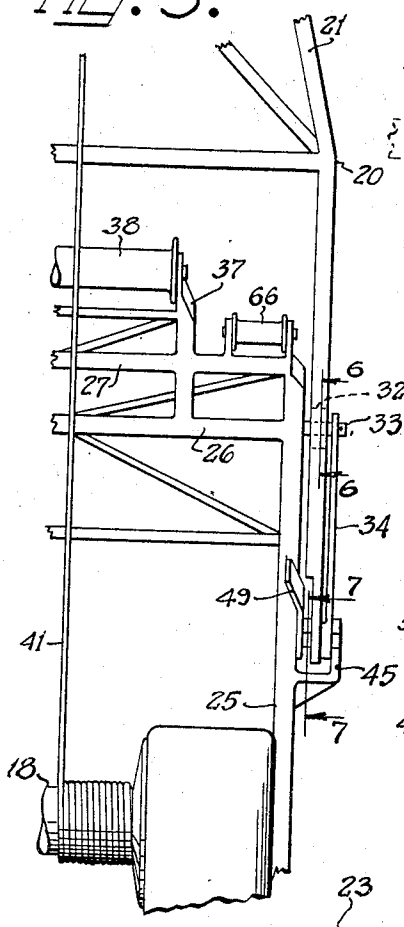


FIG. 6.

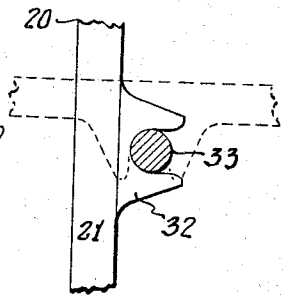


FIG. 7.

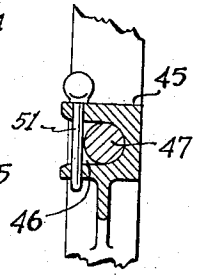


FIG. 3.

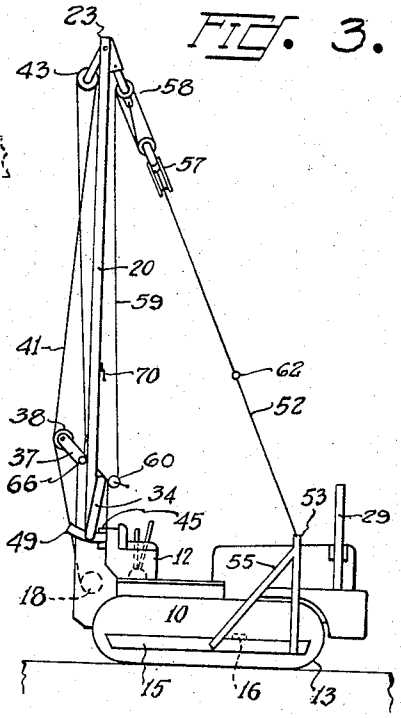
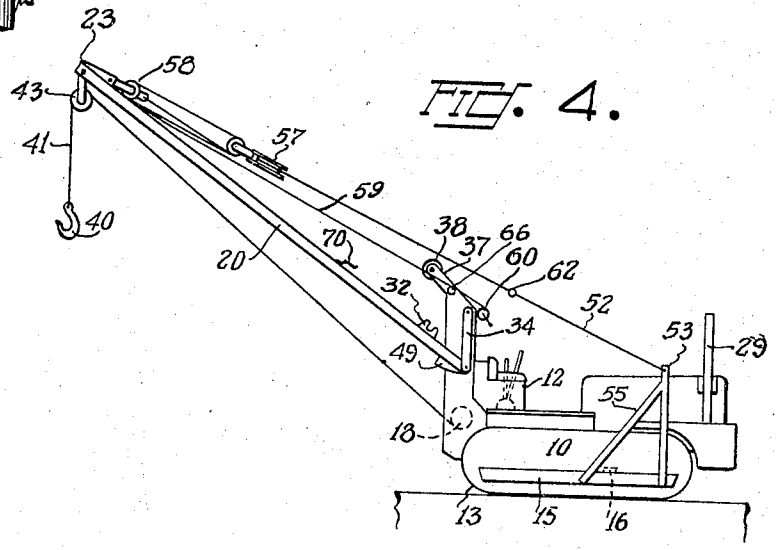


FIG. 4.



INVENTOR
ROBERT C. SHOEMAKER
BY Harold D. Cook
ATTORNEY

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FIG. 8.

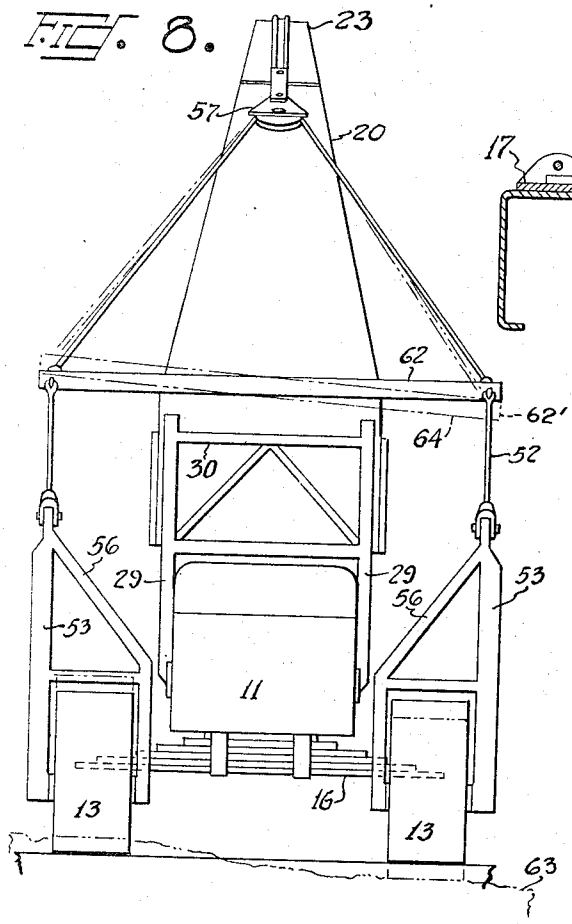


FIG. 9.

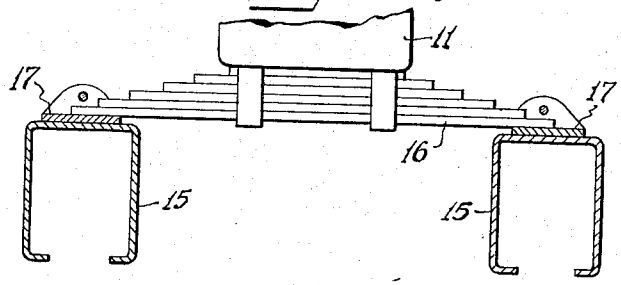
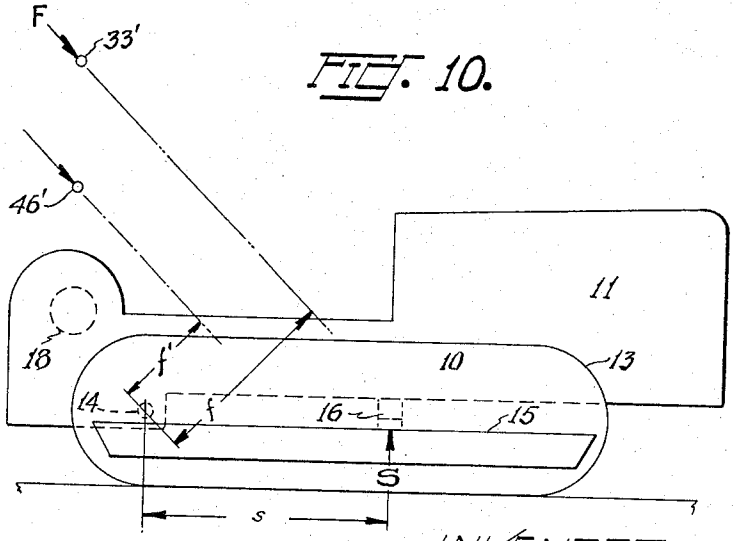


FIG. 10.



INVENTOR
ROBERT C. SHOEMAKER
BY Harold C. Cook
ATTORNEY

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2,336,965

UNITED STATES PATENT OFFICE

2,336,965

FOLDING CRANE

Robert C. Shoemaker, Portland, Oreg., assignor to Willamette Hyster Company, Portland, Oreg., a corporation of Oregon

Application May 12, 1942, Serial No. 442,613

14 Claims. (Cl. 212—8)

This invention relates to portable cranes, and more particularly to a crane structure adapted to be mounted on a vehicle and having a boom which may be transported in a generally horizontal position overlying the vehicle and which is readily erected to operative positions.

It is frequently desirable to mount a crane on a vehicle in such a manner that it may be folded down over the vehicle when its use is not required, to facilitate movement of the vehicle during such periods. In the case of a general utility tractor, that is, one which may be adapted at will for hauling, pushing, or hoisting loads, it is a problem to so mount the boom that in the inoperative position thereof it will not seriously interfere with the use of the tractor for other purposes without requiring the removal of the crane. While the boom may be carried upon a supporting structure in a generally horizontal overlying position above the head of the operator so as not substantially to interfere with his control of the vehicle, it is a difficult matter to so mount the crane that the boom can readily be lowered to such a position and also readily be erected to operative positions, and, at the same time, provide an anchorage for the crane to enable it to handle relatively heavy loads without exerting excessive stresses upon various elements of the vehicle itself.

It is an object of the present invention, therefore, to provide a new and improved crane arrangement adapted to be mounted on a vehicle such as a tractor.

Another object of the invention is to provide a new and improved crane arrangement which is adapted to be mounted upon a vehicle, and carried thereby in a substantially horizontal position overlying the vehicle at such a height as not substantially to interfere with the operation of the vehicle for normal uses, and which may readily be erected to operative positions in a short length of time.

Another object of the invention is to provide a new and improved mounting arrangement for a crane upon a vehicle whereby the crane may be lowered to an inoperative position at a suitable height above the head of an operator seated on the vehicle and readily be erected to an operative position, in which latter position the crane will be capable of handling relatively heavy loads without unduly stressing the various elements of the vehicle.

A further object of the invention is to provide a new and improved arrangement of a folding crane mounted on the end of a tractor and having a boom adapted to be carried thereby in a substantially horizontal inoperative position overlying the tractor and to be readily elevated to operative positions, in which latter positions it is so supported upon the tractor and backstayed thereto as to maintain a uniform and safe distribution of load upon the various parts of the tractor.

In the illustrated embodiment of the invention, a track type tractor is provided with a folding crane arrangement comprising an upright structure fixedly attached to one end of the tractor body, and having a boom which is adapted to be supported in a generally horizontal position overlying the tractor body by means including the upright structure. The boom is carried in the inoperative position at a suitable height above the head of the operator seated on the tractor body so that it does not interfere wih his normal line of vision during control of the vehicle, or with the normal use of the tractor in operations not requiring the crane. The boom is pivotally movable about the upper end of the upright structure by means including the power driven winch provided on the tractor. Upon elevation, the lower end of the boom engages with supporting means positioned relatively low on the tractor body, about which support means the boom is pivotally movable to various angular operative positions extending rearwardly from the tractor. The upper end of the boom, when in the operative positions, is backstayed by a cable arrangement extending to the forward ends of the crawler units, provision being made for equalizing the stress between the two crawler units and for maintaining the line of pull through the cable connections in such directions as not to exert excessive strains thereupon. While the boom in the inoperative position is supported at a relatively great height above the tractor body, in the operative positions the lower end of the boom is anchored at a point on the tractor body which is sufficiently low that loading of the crane will not exert excessive rotational components of force about the rear axle of the tractor which might cause harmful stressing of the tractor spring.

Further objects and advantages of the invention will appear from the following description, taken in connection with the accompanying drawings, while the features of novelty will be pointed out with greater particularity in the appended claims.

In the drawings, Figure 1 is a side elevation illustrating a crane and tractor mounting ar-

rangement therefor constructed in accordance with an embodiment of the invention, the crane being shown folded down into a horizontal inoperative position; Figure 2 is a plan view of the arrangement shown in Figure 1; Figure 3 is a side elevational view illustrating the crane in an elevated position; Figure 4 is a side elevational view of the arrangement, illustrating the crane in an operative position extending rearwardly from the tractor; Figure 5 is an enlarged fragmentary end view illustrating the lower end of the crane and mounting arrangement in the position corresponding to that of Figure 3; Figure 6 is an enlarged fragmentary view illustrating one detail of the crane supporting arrangement; Figure 7 is an enlarged fragmentary cross sectional view illustrating one detail of the boom anchoring arrangement; Figure 8 is a front elevation of the tractor and crane arrangement illustrating particularly the details of the anchoring arrangement and front crane support; Figure 9 is an enlarged fragmentary cross sectional view illustrating the spring suspension for the front end of the tractor body; and Figure 10 is a diagrammatic sketch illustrating functional features of the arrangement of the invention.

In the drawings, the crane and mounting arrangement therefor will be described as it may particularly be adapted for use in conjunction with a tractor of the crawler type. While the various features of the invention will be described with particular reference to such a vehicle, it will become apparent as the description proceeds that the invention is not to be necessarily so limited. Thus, in its broader aspects, the crane and mounting arrangement therefor is suitable for use in conjunction with any suitable vehicle which, in this particular instance, is represented by the tractor indicated generally at **10**.

Referring to the drawings, the tractor **10**, as shown, comprises a body **11** having a prime mover engine (not shown) mounted in the forward end thereof and having an operator's seat **12** on the rear end from which the operation of the tractor may be controlled. A cable winch drum **18** is mounted upon the rear end of the tractor body, being suitably connected with the prime mover engine for operation thereby. The tractor body **11** is supported upon a pair of crawler units **13** arranged on the opposite sides thereof, the body being pivotally mounted at the rear end relative to the crawler units about an axle unit **14** through which driving connection is made between the prime mover engine and crawler treads. The crawler units **13** include longitudinal frame members **15** extending between the front and rear carrier wheels (not shown) for the tractor treads. The front end of the tractor body is resiliently supported upon the corresponding adjacent ends of the framework of the crawler units in some such manner as illustrated more clearly in the enlarged fragmentary view of Figure 9. The resilient supporting arrangement illustrated includes a compression leaf spring **16** extending transversely of the tractor, the opposite ends thereof being supported upon saddles **17** provided upon the upper surface of the frame members **15** of the crawler units. The body **11** is suitably attached to the central portion of the spring **16** whereby the weight of the forward end thereof is transmitted to the forward ends of the crawler units. The tractor thus far described is of more or less conventional design adapted for general utility, the crawler units being flexibly mounted relative to the body.

Referring more particularly to the plan view of Figure 2, the boom **20** comprises a pair of side rails **21** which, at their lower extremities, extend generally parallel with each other for a considerable distance and then converge toward the tip end **23** where they are rigidly united together. Suitable cross bracing is provided between the side members **21** for imparting desired rigidity to the boom structure.

Fixedly attached to the rear end of the tractor body is an upright structure comprising a pair of vertically disposed members **25**, the lower ends of which may, for example, be secured to the opposite sides of the housing of the winch unit **18** rigidly mounted on the rear end of the tractor body. The uprights **25** may suitably be braced by transverse members **26** and **27** extending therebetween adjacent the upper end thereof. The uppermost ends of the uprights **25** extend to a point substantially higher than the head of an operator seated upon the tractor seat **12** for reasons which will become clear as the description proceeds. Referring to Figure 1, the lower, or left end of the boom **20** in the horizontal position rests upon the upper end of the uprights **25**, while the forward end of the boom is supported at substantially the same height as the opposite end by means including uprights **29** extending upwardly from the opposite sides of the front end of the tractor body, the uprights **29** being secured together adjacent their opposite ends by a cross member **30** which provides a cradle support for the upper end of the boom when in the lowered, or inoperative position. In this position the lower extremities of the boom side members **21** extend somewhat beyond the upper ends of the uprights **25** so that, broadly speaking, the boom **20**, in the horizontal position thereof, is supported intermediate its opposite ends upon the upper ends of the upright members **25**. The supporting arrangement for the boom on the upright structure includes U-shaped saddles **32** secured to the lower edges of the boom side members **21**, as shown more clearly in the fragmentary view of Figure 6, and which saddles are adapted cooperatively to engage with pins **33** extending outwardly from the outer surfaces of the upright members **25** adjacent the upper extremities thereof, about which the boom **20** pivots during movement between operative and inoperative positions. The lowermost ends of the boom side members **21** and **22** are connected by links **34** to the outermost ends of the pins **33**.

Extending upwardly and rearwardly from the upper ends of uprights **25**, at a substantially 45 degree angle, is a bracket arm **37** having an idler roller or pulley **38** arranged between the extremities thereof. The bracket arms **37** may be suitably braced by means of upright members **39**, the lower ends of which are also fixedly attached to the housing of the winch unit **18**. For raising the boom **20** from the horizontal or inoperative position to the elevated position as illustrated in Figure 3, the hook **40** at the end of the cable **41** is suitably anchored to a part of the upright structure, indicated at **42**. The cable **41** extends through the block **43** attached to the tip **23** of the boom, and is then trained over the idler roller **38** and extends downwardly to the drum of the winch unit **18**. Upon energization of the winch unit the cable is reeled in to effect pivotal movement of the boom to the elevated position. Since the upper ends of the bracket arms **37** supporting

the idler roller 38 extend somewhat above the pins 33, a pull may be had in a proper angular direction upon the upper end of the boom for effecting pivotal movement thereof to the elevated position.

As the boom approaches the vertical position the lower end of the boom side members 21 are cooperatively engaged by support means provided therefor at a relatively low point upon the tractor body. As shown in the specific illustrated embodiment, this support means is provided upon the upright members 25 by brackets 45 rigidly attached thereto and defining sockets 46 for cooperatively receiving the ends of the pins 47 provided in the lower extremities of the boom side arms 21. The sockets 46 are spaced below the supporting pins 33 by a distance corresponding to the length of the links 34, and the pins 47 automatically come into registry with the sockets 46 upon elevation of the boom. In order further to guide the pins 47 into the sockets 46, arcuate guide plates 49 are provided, these being secured at one end to the outer surface of the upright members 25 near the brackets 45 and extending upwardly therefrom in the path of travel of the extremities of the boom side arms. After the pins 47 have become seated in their respective sockets 46, they may be secured in place by means of locking pins 51 dropped through cooperative openings in the outer ears of the bracket arm portions defining the sockets 46 as shown more clearly in the enlarged sectional view of Figure 7.

For guying the upper end of the boom 20 in the elevated positions thereof, a cable 52 is provided, the opposite ends of which are secured to the upper ends of posts 53 secured to the frame members 15 of the crawler units adjacent their foremost ends. The posts 53 are suitably braced against deflection in the rearward direction by means of braces 55, and further steadied against deflections laterally of the tractor by additional braces 56 as shown more clearly in the front view of Figure 8. The cable 52 extends through an equalizer block 57 which in turn is secured through suitable tackle 58 to the tip of the boom 20, the tackle cable 59 being attached to a hand operated drum 60 secured to the upright structure. For preventing the pull on the cable 52 from drawing the upper ends of the posts 53 together and thus exerting a lateral twist upon the crawler units, a spreader bar 62 is provided between the opposite sides of the cable 52; as shown more clearly in Figure 8. By virtue of the fact that the cable is trained through the equalizer block 57, the load is uniformly distributed between the two crawler units through the cable 52, irrespective of the relative positions of the two units. Assuming that the forward ends of the two crawler units are positioned at different elevations, due to the uneven ground condition indicated by the dotted lines 63, the cable 52 will run through the block 57 to automatically adjust the length of the opposite sides thereof in accordance with the distance from the boom tip to the upper ends of the posts 53, as indicated by the dotted line position 62' of the spreader bar 62.

It will be observed that the backstay cable 52 is anchored to the foremost ends of the crawler units rather than to the forward end of the tractor body. If the cable 52 were anchored to the forward end of the tractor body, it would be obvious that upon loading of the crane the tractor body would tend to rotate backwardly about the rear axle 14, unstressing the front spring 16 and tending to raise its opposite ends from the saddles provided therefor on the crawler frames. If the ends of the springs were securely attached to the crawler frames, then the spring 16 would be stressed in the reverse direction with the entire weight of the forward ends of the crawler units being supported by the lowermost leaf of the spring 16. Such unnatural stressing of the spring 16 might readily break the spring, even when attempting to raise a relatively light load by the crane. On the other hand, by anchoring the backstay cable to the forward ends of the crawler units themselves, the weight of the forward ends of the crawler units, as well as that of the tractor body, is availed of for counterbalancing the load transmitted through the backstay. If necessary, additional counterweights, such as are indicated at 61, may be mounted upon the forward end of the crawler frames in any suitable manner.

In the usual operation of the crane the boom is lowered rearwardly to some such position as indicated in Figure 4. In pivoting from the vertical position to the rearwardly extending angular position of Figure 4, the saddles 32 move freely away from the pins 33 on the uppermost ends of the upright members 25. In moving the boom to the rearwardly extending position it is necessary only to unwind the hand drum 60 to permit slack in the tackle 58 as the power driven winch unit 18, acting through the cable 41, pulls the boom over the dead center position. From that point on, the angular position of the boom may be determined entirely by manipulation of the hand drum 60. In the operative position of the boom 20 the backstay cable 59 is trained over roller 66 provided upon the upper end of the upright structure.

It will be observed that as soon as the boom has been moved to an elevated operative position, the position of the boom is controlled by the backstay cables 52 and 59, and the hook 40 may be detached from the frame member 42 and becomes immediately available for attachment to any load which it is desired to lift thereby. Rotation of the boom to the horizontal inoperative position overlying the tractor is precluded by the pins 51 which lock the pins 47 in the sockets 46.

For lowering the boom from an initial operative position, such as shown in Figure 4, to the horizontal position as shown in Figure 1, the boom is first lifted by means of the hand drum 60 to the vertical position as shown in Figure 3. The hook 40 at the end of the cable 41 extending from the winch unit 18 is then anchored to the fixed frame portion 42. The pins 51 are then removed from the brackets 45 to permit the pins 47 at the lower extremity of the boom side rails 21 to shift from the sockets 46 upon further tightening of the backstay line 59, thus rocking the upper end of the boom over dead center and transferring the load thereof onto the cable 41. By gradually easing out the cable 41 from the winch unit 18, the boom may be pivoted about the pins 33 at the upper end of the upright members 25 until the tip of the boom comes to rest upon the cross bar 30 of the forward supporting structure 29. As the boom 20 is lowered to the horizontal position, the spreader bar 62 is hooked under the clips 70 provided upon the forward sides of the opposite side rails 21 of the boom, and the hand drum 60 is rotated so as to wind up the slack of the backstay line 59, thereby

holding the tackle 58 snugly against the underneath side of the boom as shown in Figure 1, and out of the line of vision of the operator.

In the horizontal position the boom is substantially entirely supported above the head of the operator so as not to interfere with his line of vision. The boom is, furthermore, supported so as not to interfere with other conventional uses of the tractor. Once the boom has been lowered to the horizontal position, the cable extending from the winch drum 18 may be disconnected therefrom and hooked onto any load which does not require use of the crane. It will be understood that in certain locations overhead clearances might not tolerate the erection of the boom, and that the load can satisfactorily be handled by use of the winch drum alone and with the cable trained over the roller 38 provided on the upper end of the bracket arm 37, thus providing an upward lift on the cable of considerable distance.

While it is desirable from the standpoint of operation and control of the tractor with the boom in the inoperative, or lowered position to support the boom in such position at a considerable height above the tractor body, it is undesirable for numerous reasons to pivotally support the lower end of the boom at such a height above the tractor body when handling loads therewith. When operating the crane, that is, for handling loads therewith, it is desirable to support the lower end of the boom reasonably low upon the tractor body so as to simplify the backstaying of the boom and also so as to minimize stresses which may otherwise be transmitted to certain parts of the tractor body through unduly long lever arm reactions. Referring to the diagrammatic sketch of Figure 10, assume first that the boom is pivotally supported at some point 33' which is located at a considerable distance above the axle 14, and that the boom is adjusted to some such rearwardly extending position as indicated by the arrow F. Now assume that a load is applied to the end of the boom and that a force F is transmitted longitudinally of the boom to the tractor body through the point 33'. The force F acting in the direction indicated has a moment arm f about the rear axle 14 of the tractor, the moment Ff tending to rotate the main body of the tractor about the axle 14. The distance from the axle 14 to the spring 16 supporting the forward end of the body is represented by s, and the reaction of the spring against the rotational force due to loading of the crane is represented by the force vector S. The moment of the spring, which will be called the resisting moment, may, therefore, be represented as Ss. For equilibrium the resisting moment must equal the applied moment and, therefore,

$$Ff=Ss \qquad \text{(Equation A)}$$

Solving Equation A,

$$S=F\times f/s$$

Inasmuch as s is constant, it is therefore apparent that the stress S in the spring 16 is directly proportional to the moment arm f of the boom thrust. Now, by lowering the pivotal support for the heel of the boom from the position 33' to a point such as 46', it is apparent that the moment arm f of the boom thrust is proportionately reduced to some much smaller value such as f'. Thus it is obvious that the stress S in the tractor spring 16 is very materially reduced by the lowering of the support for the heel of the boom in the operative positions therefor. In the diagrammatic representation of Figure 10, this is visually illustrated by a comparison of the lengths of the moment arms f and f'. The magnitude of the forces involved is such that the tractor spring, which is not normally designed for the application of external loads other than those due to the weight and inertia of the forward portion of the main tractor body, would, by application of a normal capacity load on the boom, be stressed beyond its safe limit and would not only be undesirably deflected, but may actually be stressed beyond its elastic limit and be permanently damaged.

The above discussion assumes that the force F' is equal to the force F, whereas, by a rigorous analysis it can be shown that the force F is considerably greater than force F', particularly on low boom operations. This can readily be understood by reference to Figure 4 and imagining that the crane be pivoted at the point 33' rather than at the point 46'. If such were the case, it will readily be seen that guy cable 52 passes such a small distance above the point 33' that any appreciable load applied to the end of the boom would induce extremely high stresses in the guy cable with an accompanying boom thrust far in excess of that which would be developed by the same loading if the boom were supported at point 46' in a lower position. If the stress reduction due to the short load moment arm, as first discussed above, is multiplied by the reduction effected by increasing the angle between the backstay cable and the boom, it is apparent that the stresses in the tractor spring are decreased in geometric progression as the boom pivot point is lowered from a point adjacent the upper extremities of the upright members 25 toward some lower point positioned near the rear axle of the tractor. Just what the distance should be between the axle and the pivotal support for the heel of the boom may depend upon various factors. In any event, the pivotal support for the heel of the boom should be low enough in order that when the boom is lowered to the lowest normal operative position and loaded with a normal rated capacity load, the lever arm of the force acting about the rear axle of the tractor is so short that the resultant moment imposes a load on the front spring of the tractor which is safely within its maximum capacity.

Having described the principles of my invention in what is considered to be a preferred embodiment thereof, it is desired that it be understood that the various specific details described are merely illustrative, and that the invention may be carried out in other ways.

I claim:

1. A vehicle, a boom mounted on said vehicle and carried thereby in a generally horizontal inoperative position overlying said vehicle and adapted to be elevated to a generally vertical operative position, means for supporting said boom while in said inoperative position at a relatively great distance above said vehicle, and means for transferring the point of application of boom thrust from said relatively high position to a relatively low position adjacent the vehicle axle upon erection of said boom from inoperative to operative positions, said boom being pivotally movable from said inoperative position to various angular operative positions extending rearwardly from the tractor.

2. A tractor comprising a body, a rigid upright structure attached to said body, a boom mounted on said tractor and adapted to be carried thereby in a generally horizontal inoperative position

overlying said body and being further adapted to be elevated to an upstanding operative position, means for pivotally supporting said boom upon the upper end of said upright structure so as to be movable thereabout to said operative position, means mounted adjacent the lower end of said upright structure for engaging and pivotally supporting the lowermost end of said boom in said operative position, said boom in said operative position being movable free of the pivotal supporting means on the upper end of said upright structure.

3. A tractor comprising a body, an upright structure mounted on said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position overlying said tractor body and in a plane substantially above the head of an operator seated on said tractor, said boom being pivotally movable about a point intermediate its ends adjacent the upper end of said upright from said horizontal inoperative position to an upstanding operative position, and support means positioned below the upper end of said upright for engaging and pivotally supporting the lowermost end of said boom in said operative position, said boom in said operative position being movable free of the uppermost end of said upright structure.

4. A tractor comprising a body, an upright structure mounted on said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position overlying said body and in a plane substantially above the head of an operator seated on said tractor, said boom being pivotally supported intermediate its ends upon said upright structure for pivotal movement between said horizontal inoperative position and a substantially vertical operative position, and support means fixedly secured relative to said body for engaging and pivotally supporting the lowermost end of said boom in said operative position.

5. A tractor comprising a body, track type crawler units on the opposite sides of said body, said body being pivotally supported at the rear end on said crawler units, said body being resiliently supported at the forward end on said crawler units, a boom mounted on said tractor body and adapted to be carried in a substantially horizontal inoperative position overlying said body and to be elevated to an upstanding operative position, means for supporting the lower end portion of said boom for pivotal movement between said inoperative and operative position, and means mounted below said first means for engaging and pivotally supporting the lowermost end of said boom in the operative positions thereof.

6. A tractor comprising a body, track type crawler units on the opposite sides of said body, said body being pivotally supported at one end on said crawler units, said body being resiliently supported at the opposite end on said crawler units, an operator's seat on said body, an upright structure fixedly attached to said body adjacent the said one end thereof and extending upwardly to a point above the head of an operator on said seat, a boom mounted on said tractor adapted to be carried in a generally horizontal inoperative position overlying said body, means for elevating said boom to a vertical operative position, said boom being pivotally supported intermediate its ends adjacent the upper end of said upright structure when in the horizontal position, said boom pivoting about the upper end of said upright structure in movement from horizontal to vertical positions, and supporting means adjacent the lower end of said upright structure adapted to be pivotally engaged by the heel of said boom when said boom is in the operative position.

7. A tractor comprising a body, an upright structure mounted upon one end of said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position overlying said body, means for pivoting said boom about the upper end of said upright structure from said horizontal inoperative position to an upstanding operative position, and support means positioned on said body below the upper end of said upright structure for engaging and pivotally supporting the heel of said boom when elevated to said operative position, and means connecting the heel of the boom and said upright structure for preventing displacement of said boom therefrom during movement of said boom between operative and inoperative positions.

8. A tractor comprising a body, crawler units on the opposite sides of said body, said body being pivotally supported at the rear end about an axle extending therefrom to said crawler units, a compression spring supporting said body at the forward end on said crawler units, an upright structure fixedly attached to said body adjacent one end thereof, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position and in a plane substantially above the head of an operator seated on said tractor, means pivotally supporting said boom intermediate its ends adjacent the upper end of said upright structure, means for moving said boom about said pivotal supporting means from said horizontal inoperative position to a substantially vertical operative position, support means on said body adapted to be pivotally engaged by the lowermost end of said boom when moved to said operative position, said boom being movable upon said support means to angular operative positions extending from one end of said body, guying means connecting the tip of said boom when in the operative position to the opposite end of said tractor, the height of said support means above said axle being such that the component of rotational force about said axle with normal capacity load on said boom when extending outwardly at an angle from the end of said body is less than the maximum load capacity of said compression spring.

9. A tractor comprising a body, crawler units on the opposite sides of said body, said body being pivotally supported at the rear end by an axle extending therefrom to said crawler units, compression spring means supporting the forward end of said body on said crawler units, an operator's seat on said body, an upright structure fixedly attached to one end of said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position and in a plane substantially above the head of an operator on said seat, means for pivotally moving said boom about the upper end of said upright structure from said horizontal position to an operative position, support means positioned on said body below the upper end of said upright structure adapted to be pivotally engaged by the lowermost end of said boom when moved to the operative position, said boom being movable away from the upper end of said upright structure about said support means to angular operative positions extending from one end of

said body, a guying cable for said boom attached to the opposite ends of said crawler units, said cable extending through an equalizer block secured to the upper end of said boom, a spreader bar extending between opposite sides of said cable for predetermining the line of pull upon said crawler units therethrough, and means on said boom for supporting said spreader bar and said block in the horizontal position of said boom.

10. A tractor comprising a body, an upright structure fixedly attached to one end of said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position and in a plane substantially above the head of an operator seated on said tractor, means for pivotally moving said boom about the upper end of said upright structure from said horizontal position to an operative position, support means positioned on said body below the upper end of said upright structure adapted to be pivotally engaged by the lowermost end of said boom when moved to the operative position, a guying cable for said boom attached to the opposite ends of said crawler units, said cable extending through an equalizer block secured to the upper end of said boom, a spreader bar extending between opposite sides of said cable for predetermining the line of pull upon said crawler units therethrough, and means on said boom for supporting said spreader bar and said block in the horizontal position of said boom.

11. A tractor comprising a body having a winch on one end thereof, an upright structure fixedly attached to said one end of said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position overlying said body, means pivotally supporting said boom intermediate its ends on the upper end of said supporting structure for pivotal movement thereabout from said horizontal inoperative position to a substantially vertical operative position, a bracket arm fixedly attached to said upright structure and extending upwardly and rearwardly therefrom, a roller on the end of said arm, a cable attached to said winch extending over said roller and connected to the upper end of said boom for effecting elevation of said boom from said horizontal to said vertical position.

12. A tractor comprising a body, a winch on said body having a hoist cable wound thereon, an upright structure fixedly attached to one end of said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position overlying said body, means pivotally supporting said boom intermediate its ends adjacent the upper end of said upright structure, an arm fixedly attached to the upper end of said upright structure and extending upwardly and rearwardly therefrom, said arm having a guide pulley provided on the outer end thereof, said hoist cable adapted to be trained over said guide pulley and be operatively connected to the end of said boom for effecting elevation of said boom to a substantially vertical operative position, support means mounted on said body below said first mentioned pivotal support means adapted to be pivotally engaged by the lowermost end of the said boom when elevated to the vertical operative position, and backstays connecting the upper end of said boom to the forward end of said tractor for limiting pivotal movement of said boom on said support means.

13. A tractor comprising a body, track type crawler units on the opposite sides of said body, said body being pivotally supported at the rear end about an axle extending to said crawler units, compression spring means supporting the forward end of said body on said crawler units, an operator's seat on said body, an upright structure fixedly attached to said body adjacent the rear end thereof, a boom, means including said upright structure for supporting said boom in a generally horizontally inoperative position overlying said body and in a plane substantially above the head of an operator on said seat, said boom being mounted for pivotal movement adjacent the upper end of said upright structure between said inoperative position and an upstanding operative position, support means on said body adapted to be pivotally engaged by the lowermost end of said boom when in the operative position, said boom being pivotally movable upon said support means to angular operative positions extending rearwardly from said tractor, backstay means connecting the upper end of said boom to the forward end of said crawler units, the height of said support means above said axle being such that the component of rotational force about said axle with normal capacity load on said boom when extending angularly outwardly from said tractor is less than the maximum load capacity of said spring.

14. A tractor comprising a body, a winch on said body having a hoist cable wound thereon, an upright structure fixedly attached to one end of said body, a boom, means including said upright structure for supporting said boom in a generally horizontal inoperative position overlying said body, means pivotally supporting said boom intermediate its ends adjacent the upper end of said upright structure, said hoist cable adapted to be operatively connected to the end of said boom for effecting elevation of said boom to a substantially vertical operative position, support means mounted on said body below said first mentioned pivotal support means adapted to be pivotally engaged by the lowermost end of the said boom when elevated to the vertical operative position, and backstays connecting the upper end of said boom to the forward end of said tractor for limiting the pivotal movement of said boom on said support means.

ROBERT C. SHOEMAKER.