Jan. 8, 1935. R. E. CHOATE ET AL 1,987,052

EARTH MOVING DEVICE

Filed Jan. 16, 1932 4 Sheets-Sheet 1

FIG. 1

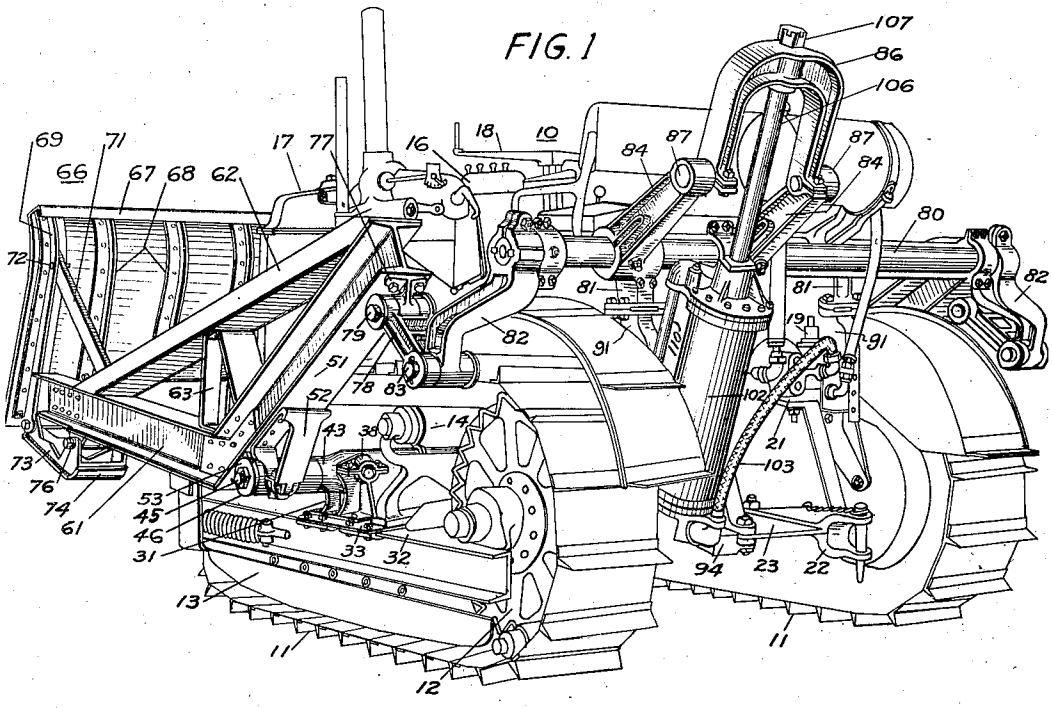
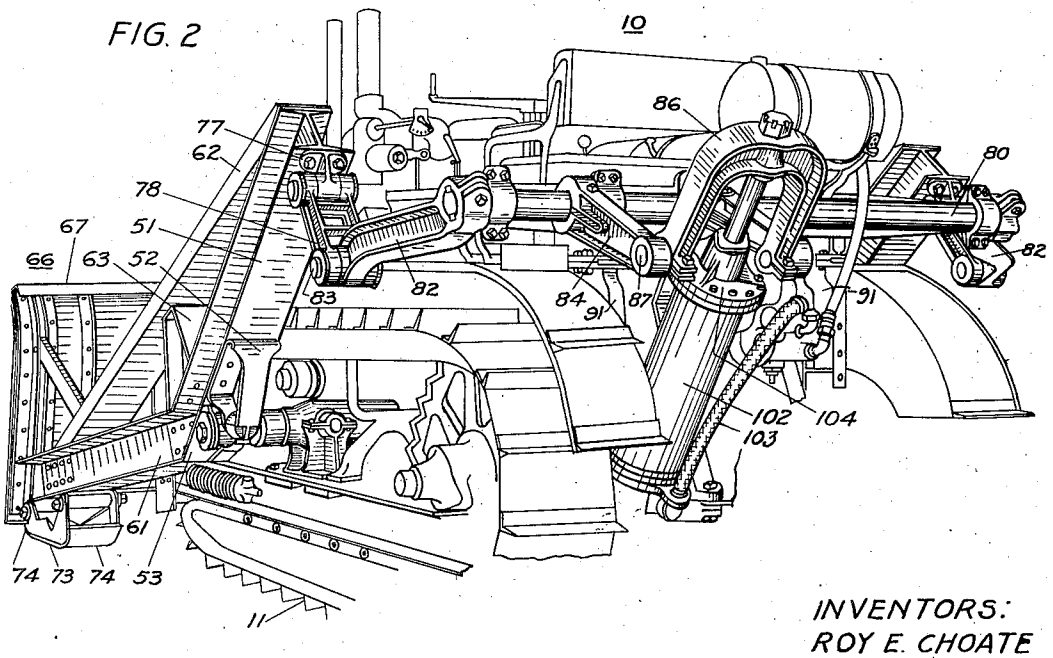


FIG. 2



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FIG. 3

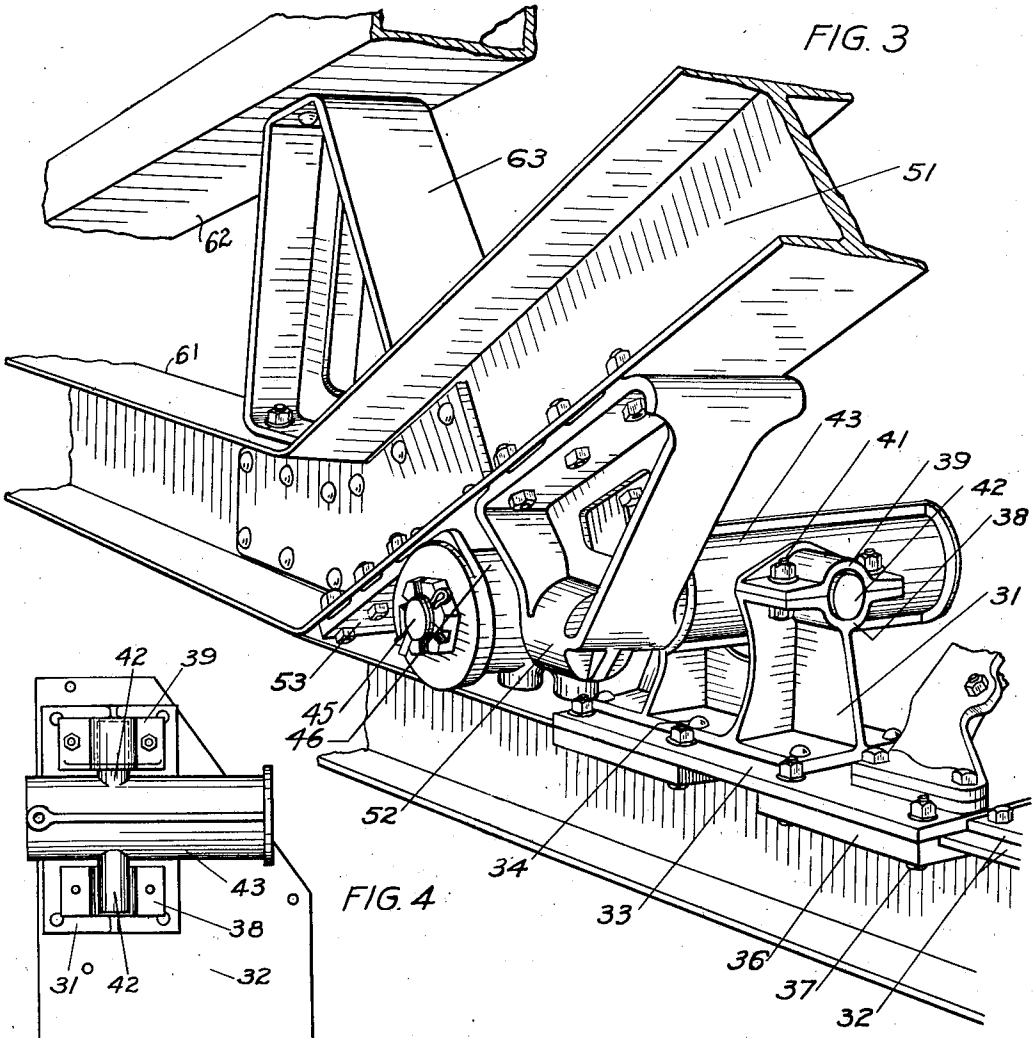


FIG. 4

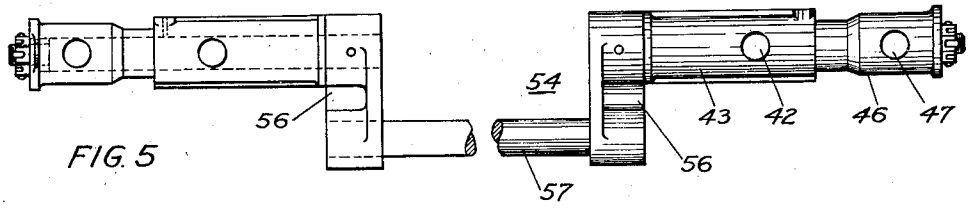


FIG. 5

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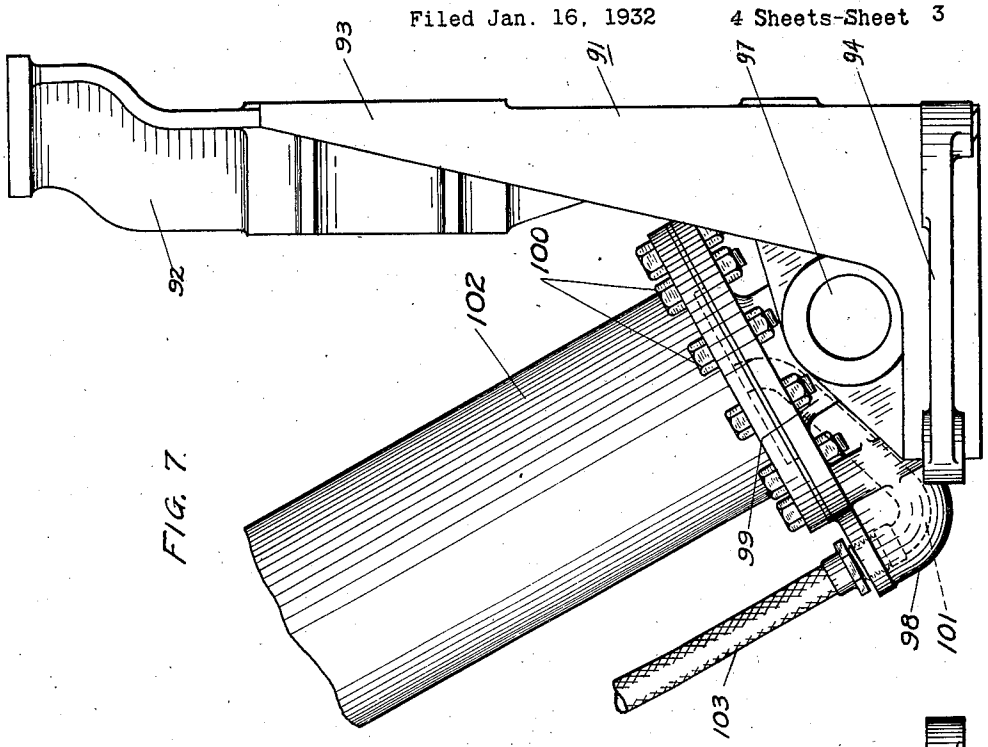


FIG. 7.

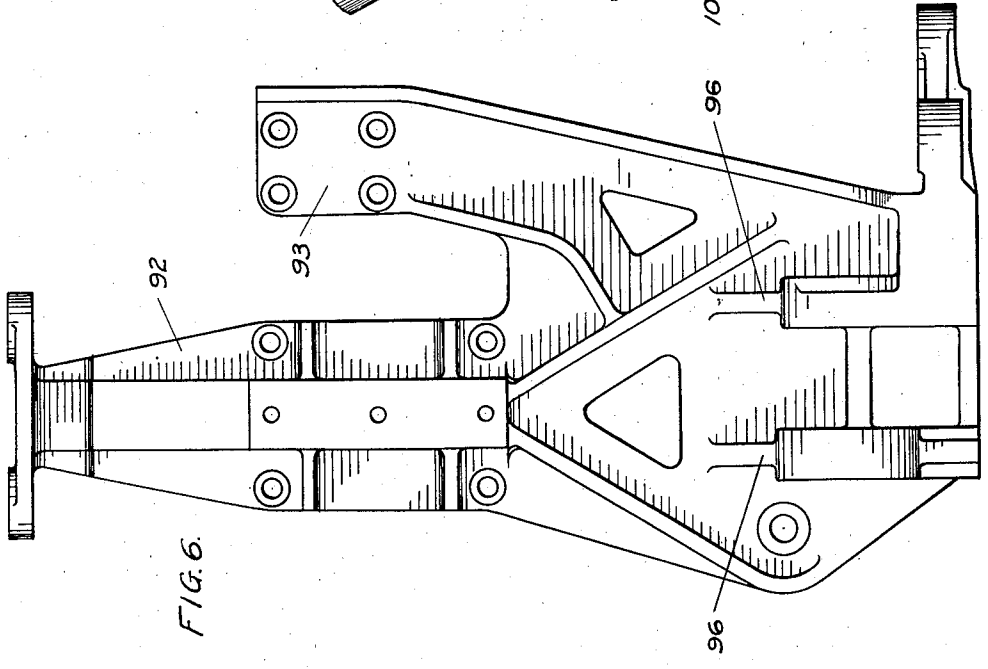


FIG. 6.

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EARTH MOVING DEVICE

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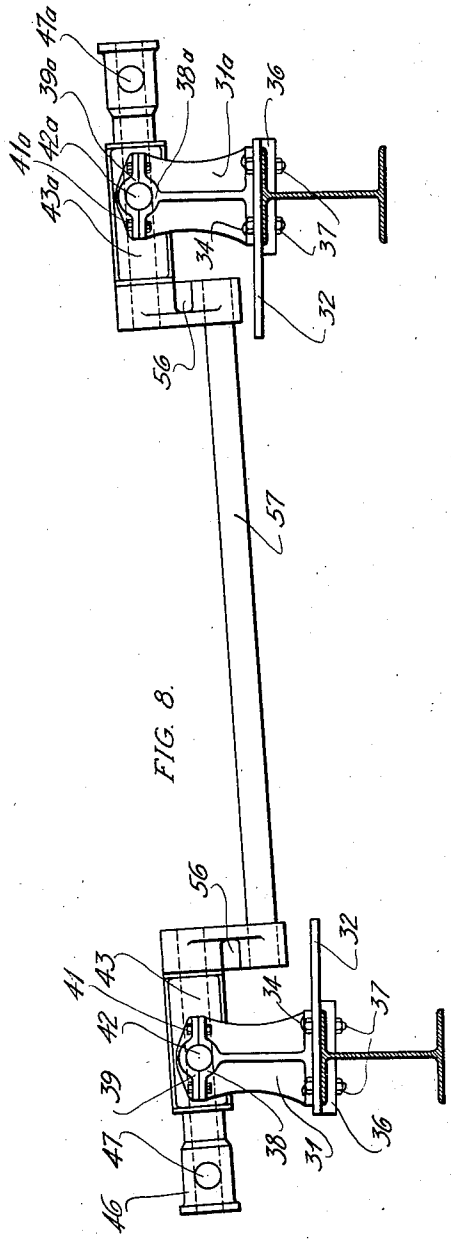


FIG. 8.

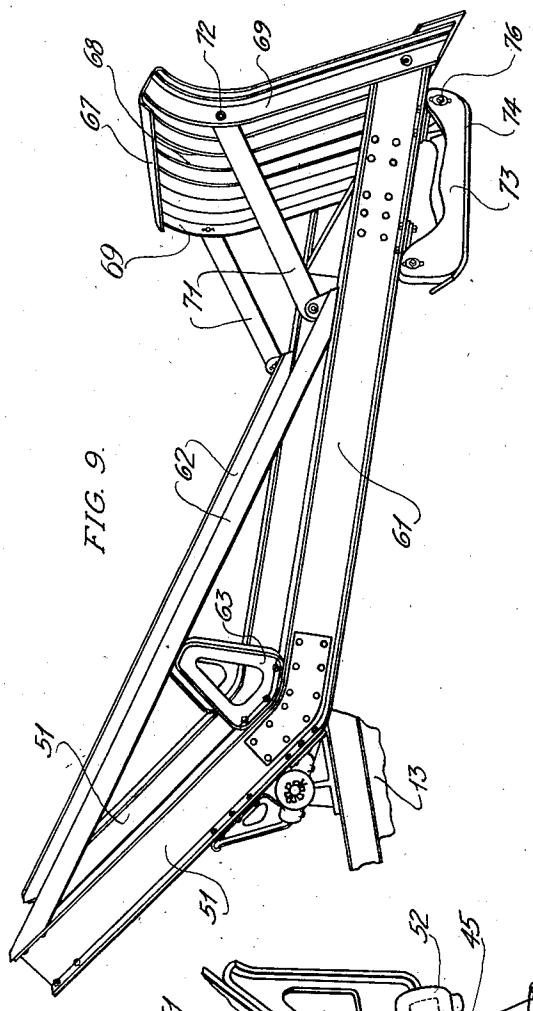


FIG. 9.

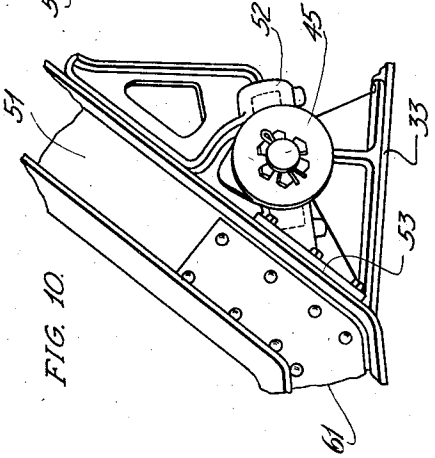


FIG. 10.

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UNITED STATES PATENT OFFICE

1,987,052

EARTH MOVING DEVICE

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Application January 16, 1932, Serial No. 587,108

8 Claims. (Cl. 37—144)

Our invention refers to earth moving devices, the term "earth" being taken in its broad sense to include snow, ice, and the like, and has particular relation to a means and structure for mounting and manipulating a plow, or like device, on a tractor.

It is known to the art to mount a plow or like device on a tractor by means of a framework which is pivotally engaged for vertical movement with reference to the tractor and to move this frame and hence the plow by means of a hydraulic jack.

We have observed, however, that a mounting of the usual character is not entirely satisfactory because the tractor is surrounded by a framework which prevents use of the tractor for hauling other equipment because parts of the plow-mounting and manipulating structure interfere with the draw bar and hauled equipment, or the parts thereof dig into the earth at times, and that a tractor cannot turn in a short radius because of the parts of the device. We have also observed that structures of the usual type are subject to considerable strain at the pivotal mounting of the plow-supporting framework because of warping and other undue stress at the bearings. The frameworks are often loose and wobbly, and stresses are set up in the tractor which should not be present. From these and other causes failures sometimes occur.

We have, therefore, conceived of a new and novel structure for supporting, operating, and manipulating a plow with reference to a tractor, and have devised means for overcoming the objections hereinbefore noted.

It is a general object of the present invention to provide a novel and improved form of earth moving device.

More particularly it is an object of the invention to provide, in an earth moving device of the type in which a plow or the like is mounted upon a tractor or other prime mover, a novel mounting therefor and a novel means for manipulating and holding the plow with reference to the tractor.

An object of the invention is to provide in a device of the above character a mechanism and structure whereby the plow may be raised to an extremely high position or dropped to a level well below the lowest portion of the tractor.

Another object of the invention is to provide hydraulically-actuated means for controlling the plow in a device of the above character.

Another object of the invention is to provide a device of the above character so constructed and so operated that the plow may be raised to a position well out of the way and the tractor used for hauling other equipment without interference by the mechanism utilized in operating the plow.

Another object of our invention is to provide, in a plow mounting for a tractor, a means for positioning a plow located at the front of the tractor, by a hydraulic device operatively connected to the rear of the motor.

Another object of the invention is to provide means for taking directly the stresses, particularly the spreading stress, occasioned by the hydraulic ram acting on the plow raising mechanism.

Another object of the invention is to provide a plow-manipulating structure which is close to the chassis in order to minimize stresses in all directions.

Another object of the invention is to provide an extraordinarily stiff plow-supporting frame so arranged that all the parts thereof are well above the ground at all times and out of the way, and such that the tractor may be turned in a short radius.

Another object of the invention is to provide a pivotal mounting for the plow-supporting frame such that wrenching and twisting of the tractor or frame does not injure the parts of either structure or of the mounting and in which a cross shaft or cross tie assists in taking unbalanced forces acting on the plow.

A feature of the invention is that the plow may be pushed down and held in that position.

A still further object of the invention is to provide a device of the above character which is simple, rugged, and reliable.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specification, wherein is disclosed a single exemplary embodiment of the invention with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Figure 1 is a view in perspective of a tractor upon which a plow is mounted by means of a structure built according to our invention. The plow is shown in the raised position.

Figure 2 is a view in perspective of the tractor, the plow, and the supporting and operating devices shown in Figure 1, but with the plow in a lowered position.

Figure 3 is a view in perspective of a portion of the structure used for supporting the plow and of the means whereby the structure is supported upon the frame of the tractor. The view is in enlarged detail, and portions of the structure have been broken away to better show the parts thereof.

Figure 4 is a top plan view of the mounting or bracket used in supporting the plow-supporting structure with reference to the frame of the tractor.

Figure 5 is a side elevational view of the shaft utilized in supporting the plow-supporting structure with reference to the sub-frame of the tractor.

Figure 6 is a view in end elevation of a bracket utilized for mounting the hydraulic jack which operates and controls the plow with reference to the tractor.

Figure 7 is a view in side elevation of a portion of the hydraulic jack, and of the bracket used for mounting the hydraulic jack on a tractor.

Figure 8 is a view partly in elevation and partly in section showing how the cross axle of a device constructed according to our invention accommodates itself to unequal vertical displacement of the sub-frame members of a tractor.

Figure 9 is a view in perspective of a pair of side frames and a plow blade mounted on the side frames, as these members appear when disassociated with the tractor, and

Figure 10 is a detailed view in perspective of the frame and shaft structures shown in Figure 3 but taken substantially at right angles to the frame and on the opposite side of the tractor to better illustrate the position and structure of the parts.

The present invention deals particularly with a plow mounting of the type wherein a supporting framework is mounted for pivotal movement on the tractor, and wherein the plow is mounted upon the front end of this frame and a hydraulic jack is operatively engaged to the rear of the frame and to the bed of the tractor. It is quite apparent, however, that the structure or portions thereof may be used or modified for use for other purposes. For instance, the structure might readily be provided with a shovel instead of a plow in order that material might be carried about by the tractor.

Referring now to the drawings and more particularly to Figures 1 and 2 there is shown at 10 generally a tractor of the type in which a pair of continuous treads 11 are mounted for movement on pairs of suitably-sprocketed supporting wheels 12 which are effective to rotate the treads to drive the tractor.

The tractor is supported on sub-frames 13 which connect the two wheels on each side and afford support for the chassis 14 of the tractor upon which are mounted the motor 16 used in driving the tractor, the radiator 17, control mechanism 18, the hydraulic control mechanism 19, and hydraulic pump mechanism 21. A draw bar 22 extends rearwardly from a suitable platform 23 at the rear of the tractor.

The tractor and hydraulic control mechanism per se are not the subject matter of the present invention except in their connection with the plow-supporting and actuating mechanism hereinafter more particularly described, but the mechanism and structure of the tractor are described in order to show how the plow is mounted thereon.

The mounting by which the plow-supporting structure is mounted on the tractor will now be described. This mounting and the plow-supporting structure are better shown in Figures 3, 4, 5, 8, 9, 10, and 11 taken in connection with Figures 1 and 2. Two mountings are used, one on each side of the tractor, and since the mountings are substantially duplicates of each other except that they are complementary and except for a difference in one point hereinafter mentioned, only one will be completely described.

An upwardly extending bracket 31 is mounted upon a horizontally extending portion 32 of the sub-frame structure 13. The plate 33 to which the bracket is secured is clamped upon the sub-frame by means of plates 36 and bolts 37. The bracket 31 is bifurcated, and is suitably recessed at its upper end to provide a pair of bearings 38. Caps 39 are adapted to be bolted on the bracket to constitute the upper halves of the bearings.

A pair of stub shafts or trunnions 42 are pivotally journalled within the bearings of the bracket, and the trunnions are secured to and extend at right angles one on each side of a sleeve 43 which extends inwardly between the wheels and beneath the upper portion of the tread. It may be readily understood that this pivotal mounting of the sleeve in bracket 31 permits it to oscillate about the longitudinal axis of the bearings of the bracket to permit it to align itself with reference thereto to the sub-frame structure. The trunnions are preferably loosely mounted within their bearings to permit free movement thereof both in rotation and in limited transverse movement. Of course this structure is duplicated at the other side of the tractor by bracket 31*a*, trunnions 42*a*, and sleeve 43*a*.

A heavy shaft, which may be designated generally by the numeral 45 is journalled within the sleeves 43 and 43*a* and this shaft is provided with a pair of shorter, cylindrical, freely-rotatable sleeves 46 at either end thereof to which trunnions 47 are secured. The ends of the shaft are capped by large disc-like washers and nuts to hold the washers in place.

A pair of I beams 51, which are parts of the plow-supporting side frames, are mounted for pivotal movement about the axis of the shaft 45 by means of pairs of complementary brackets 52 and 53, having enlarged portions at their lower ends adapted to act as bearings for the trunnions 47.

The shaft 45 extends entirely beneath the motor and main portion of the tractor 10, but, in order that it may clear the motor and other parts of the tractor, the shaft is divided into two short shafts 50, and an offset portion 54 is provided by securing crank throws 56 to the inner ends of the shafts 50 and joining them by means of a sub-shaft 57 which passes beneath the motor. The stub shaft 57 may be secured to the outer ends of the crank throws 56 in any desired manner as by means of rivets, welding, and the like.

The only difference in the two mountings is that in one case the long sleeve 43 is fastened tightly to the shaft 45 in order to prevent the shaft from moving too much to one side. The other sleeve 43*a* is free to move on the shaft to accommodate differential movements of the two sub-frames 13.

It will be noted that not only is the shaft 45 permitted to align itself with respect to the tractor by means of the sleeves 43 and brackets 31, but the plow supporting framework is allowed to align itself with respect to the shaft 45 by means of the pivotal mountings 47 of the brackets

52 and 53. It is apparent that this mounting presents tremendous advantages in permitting self-alignment of the plow-supporting structure with reference to the tractor and that it thereby avoids excess stress on any one part of the mounting caused by unequal loading, warping, and the like.

The plow-supporting structure proper, shown more particularly in Figure 8 includes a pair of side frames 55 and 55*a*, more or less triangular in shape, which are disposed one on each side of the tractor. The side frames include a pair of rearwardly and upwardly extending beams 51 and a pair of horizontally and forwardly extending beams 61 which are secured to the front ends of the I beams 51, and the structure is braced to resist bending and torsional stress by means of channel irons 62 which are secured to the beams 51 and 61 by means of rivets or the like. Saddles or struts 63 assist in furnishing stiffness to the structures, and the whole structure, by reason of the combination of the sloping and horizontally-extending beams and the bracing not only assumes the character of a truss well adapted to carry and sustain heavy loads, but also supplies means located well above the ground whereby suitable leverage may be applied for raising and lowering the plow 66, which is secured to the front end of the structure.

The beams 51 and 61, channel 62, and strut 63 may be considered as forming side frames or frames 55 while the pair of frames, the cross shaft 45, and the plow and its various braces may be considered as the plow supporting framework 65.

The truss-like frames are, of course, in duplicate, one on each side of the tractor, and they are, as can be seen by inspection of the drawings, tied together by the cross shaft 45 at the central portion and by the plow structure at the front. The shaft 80, crank arms 82, and links 78 hereinafter described, assist in stiffening the structure. The result is that a bridge-like structure is formed well adapted to meet stresses and forces from all directions. The side frames 55 and cross shaft 45 may be considered as forming an H-shaped plow supporting framework.

Another advantage of the plow-supporting structure just described is that the beams 51 and 61 are well above the ground at all times whatever the position of the plow, and therefore do not dig into the ground nor prevent the tractor from making short turns.

The plow itself is comprised of the usual reinforced plate, having a suitable flanged portion 67 at the upper end for stiffness and other angle irons 68 for stiffening the structure. A pair of complementary stiffening angle irons 69 afford a means whereby a supporting bar 71 may be bolted to the back of the plow at 72. This bar is bolted by other suitable bolts or connections to the beam 61. A rectangular shoe 73 having beveled ends 74 is secured to the underside of the beam 61, as by means of bolts 76, to permit the plow to be skidded along the ground without digging in, whenever this is desirable.

A suitable bracket 77 is bolted to the rear end of each beam 51, and each bracket is provided with an eye so that H-shaped links 78 may be pivotally engaged to the brackets as by means of the pins 79. A long crank shaft 80 extends entirely across the rear portion of the tractor structure, and is journalled for rotation in brackets 81 which are secured to L-shaped brackets 91, hereinafter described, which are in turn secured to the tractor chassis. Offset cranks 82 are mounted on either end of the shaft 80, and the cranks are pivotally attached to the H-shaped links 78 by means of pinned pivotal connections 83. Other crank arms 84 are fastened on the shaft 80 somewhat to one side of the center line of the tractor and an upwardly extending yoke 86 is pivotally secured to the cranks 84 by means of pinned connections 87.

One of the L-shaped brackets 91 (Figs. 6 and 7) is arranged with a suitably flanged arm 92 to which the corresponding bracket 81 is secured and an arm 93 which may be secured to a rearwardly extending portion of the tractor. A horizontally extending plate 94 of bracket 91 is secured to the draw bar plate 23. Flanges 96, which connect the horizontally and vertically extending portions of the bracket, afford a journal in which a shaft 97 may be mounted. A lower cylinder cap or head 98 is provided with a boss 99 through which the shaft 97 passes, and therefore the cap may be oscillated with respect to the bracket by pivoting it about the shaft 97. The head or cap 98 is provided with a suitable channel 101 so that oil or other fluid may be introduced into the hydraulic jack cylinder 102. A flexible connection 103 leading from the hydraulic pump and hydraulic control means 21 and 19, respectively, furnishes a conduit for the oil. The hydraulic cylinder 102 is bolted to the cylinder head 98 in a suitable manner, as by means of the bolts 100. An upper cylinder cap 104 is bolted to the upper end of the cylinder 102, and a piston (not shown) within the cylinder is operatively engaged to a piston rod 106 which is rigidly attached to the yoke 86 by passing it through the uppermost portion of the yoke and securing it thereto by means of a nut 107.

It may be readily understood that when fluid is introduced into the cylinder 102 by means of the conduit 103 leading from the hydraulic control mechanism and the hydraulic pump, a piston within the cylinder is caused to move upwardly to drive the rod 106 upwardly, to cause upward motion of the yoke 86 and cranks 84. The upward motion of the cranks 84 causes a downward and rearward movement of the offset cranks 82 and downward motion of the rear end of the plow supporting framework. This downward movement of the rear portion of the framework causes an upward movement of the front portion of the framework to raise the plow 66.

Conversely, the introduction of fluid into the upper portion of the cylinder 102 by means of the conduit 110 causes a downward movement of the yoke 86 and cranks 84 and forward and upward movement of the offset cranks 82 to cause upward movement of the rearwardly extending portion of the plow-supporting framework and consequent downward motion of the plow.

It is to be noted that the plow-supporting framework is entirely outside of the tractor, and that the mechanism is not interfered with by any part of the tractor, so that an extremely high lift of the plow and a drop well below the link belt tread may be secured.

It is to be noted also that the hydraulic cylinder is located well to one side of the hydraulic control mechanism and draw bar structure, so that it does not interfere with use of the tractor for hauling other vehicles. The hydraulic cylinder 102, by reason of its pivotal mounting, and by reason of its connection with the cranks 84, assumes an almost upright position when the plow is raised. By arranging the plow-supporting

structure and actuating structure in this manner these structures are well out of the way with reference to the draw bar, and with reference to any tongue or other connection used for hauling other vehicles, no matter how sharply the tractor may be turned with respect to the following vehicles. This feature of the invention is of particular importance because it permits the tractor to be used whenever necessary for hauling other vehicles without dismounting the plow from the tractor.

The hydraulic jack preferably operates positively in both directions so that the plow may be pushed up or down and held in that position.

It is apparent that the brackets 91 and 81 take directly the spreading stress set up by the hydraulic jack, thus preventing this stress from coming on the tractor chassis where it does not belong. It is also apparent that the yoke and cross shaft structure employed permits mounting the cross shaft close to the tractor chassis to minimize the stresses, side and otherwise, in the supporting brackets and in the chassis.

It is apparent that the structure may be considerably modified without departing from the spirit and scope of the invention. For instance the hydraulic jack may be mounted in other positions on the tractor to actuate the cross shaft 80, or two or more jacks may be arranged to operatively engage the rear ends of the beams 51 directly to manipulate the plow. Instead of using beams 51 and 61, one continuous beam may be utilized and the actuating mechanism changed accordingly.

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

1. In a device of the character described, a tractor, a plow framework mounted upon the framework of the tractor and having a cross shaft extending beneath the main body of the tractor, and means for pivotally mounting the plow framework on the tractor framework comprising brackets on the tractor, a pair of sleeves pivotally mounted on the brackets for motion about a horizontal axis which is transverse to the longitudinal axis of the shaft the shaft being rotatably mounted within the sleeves, and brackets secured to the plow framework and the outer ends of the shaft having transversely-extending pivot pins thereon which are pivotally engaged in the brackets on the plow framework whereby the plow framework may align itself to support the load according to the various stresses put upon it.

2. A means of pivotally mounting one framework upon another comprising pairs of brackets on each framework and a shaft extending between the brackets, sleeves journalled upon the shaft and having transversely extending pivot pins adapted to engage one of the pairs of brackets and the shaft having another pair of pivot pins adapted to engage the other pair of brackets.

3. In a device of the character described, a tractor, a framework pivotally mounted intermediate its ends and surrounding three sides of the tractor, the front end of the framework projecting in front of the tractor, a plow mounted on the front end of the framework, and the framework being bent upwardly at its rear, a shaft rotatably mounted at the rear of the tractor and extending substantially across the tractor, a pair of cranks on the end of the shaft, a pair of links extending downwardly from the rear ends of the framework to the cranks on the shaft, a second pair of cranks located to one side of the center line of the tractor on the shaft extending rearwardly, a yoke pivotally mounted on the second named pair of cranks, a hydraulic cylinder pivotally mounted on the tractor and having the end of its piston rod secured to the yoke, the cylinder being also located to one side of the center line of the tractor, whereby upward movement of the piston and piston rod of the hydraulic ram produces downward movement of the rear end of the framework and upward movement of the plow, and whereby downward movement of the piston rod produces upward movement of the rear of the framework and downward movement of the plow.

4. In an earth moving device, a tractor, side frames pivotally mounted one on each of the sub-frames on opposite sides of the tractor and a cross tie passing beneath the main portion of the tractor having one end thereof pivotally secured to one sub-frame and having the other end secured to the other sub-frame to permit both pivotal and longitudinal movement with respect thereto whereby the sub-frames are free to move differentially but whereby the side frames on opposite sides of the tractor are tied to each other.

5. A means of pivotally mounting a pair of side frames on a tractor to permit differential vertical movement of the pair of side frames comprising a cross shaft extending beneath the chassis of the tractor, means for pivotally engaging the frame members on the cross shaft, and means for pivotally engaging the ends of the cross shaft on the sub-frames of the tractor including transversely extending pivots on the shaft.

6. A means of pivotally mounting a pair of side frames on a tractor to permit differential vertical movement of the pair of side frames comprising a cross shaft extending beneath the chassis of the tractor, means for pivotally engaging the frame members on the cross shaft, and means for pivotally engaging the ends of the cross shaft on the sub-frames of the tractor including transversely extending pivots, sleeves on the shaft to which the pivots are engaged, and brackets on the sub-frames for engaging the pivots.

7. In a device of the character described, a tractor, a plow, a plow supporting framework pivotally engaged on the tractor, and means for actuating the plow supporting framework including a cross shaft at the rear of the tractor, a pair of rearwardly extending lever arms on the cross shaft, a hydraulic jack one end of which is pivotally engaged to the tractor, a yoke connecting the free ends of the lever, and the ram of the hydraulic jack being engaged to the yoke.

8. In a device of the character described, a tractor, a plow, a plow supporting framework pivotally engaged on the tractor, and means for actuating the plow supporting framework including a cross shaft at the rear of the tractor, a pair of rearwardly extending lever arms on the cross shaft, a hydraulic jack pivotally engaged to the tractor in a substantially vertical position with the ram extending upwardly, and a yoke engaged to the ram and having its ends engaged to the free ends of the lever arms.

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