Oct. 25, 1960 E. D. JONES 2,957,678

HYDRAULIC HOIST ATTACHMENT FOR TRACTORS

Filed Aug. 14, 1958 2 Sheets-Sheet 1

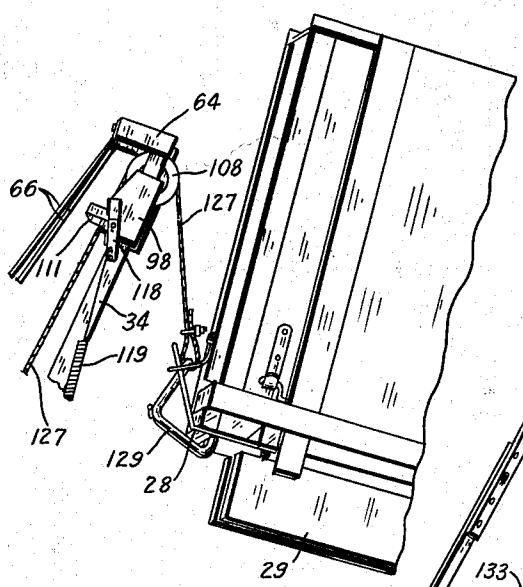


Fig. 2

Fig. 1

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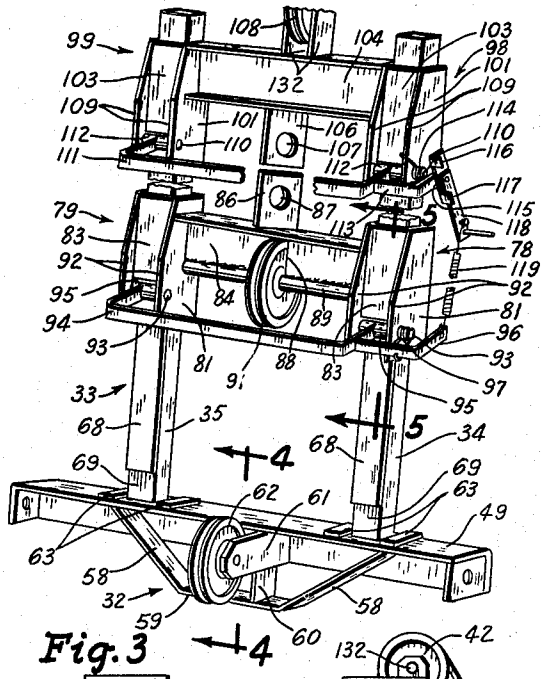


Fig. 3

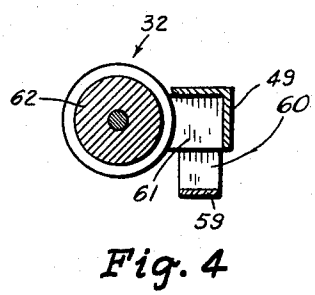


Fig. 4

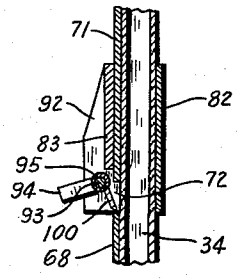


Fig. 5

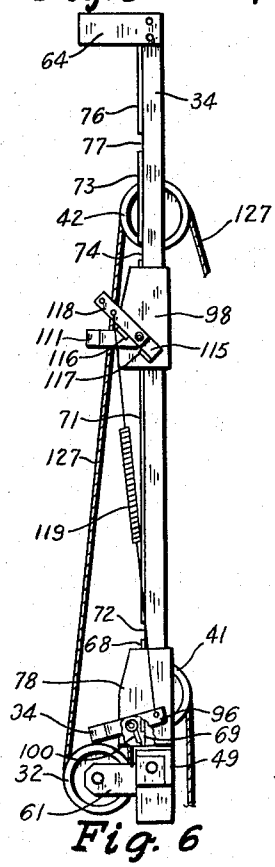


Fig. 6

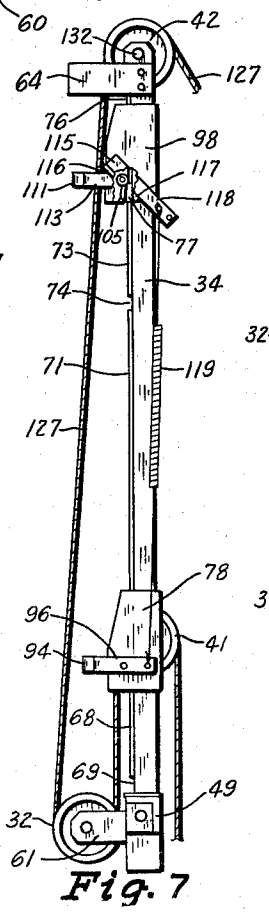


Fig. 7

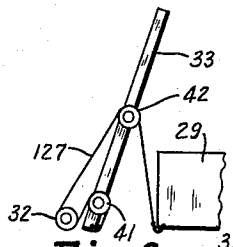


Fig. 8

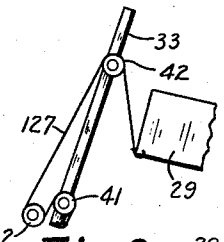


Fig. 9

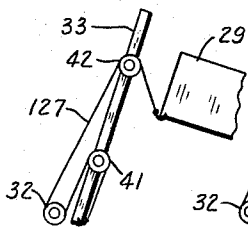


Fig. 10

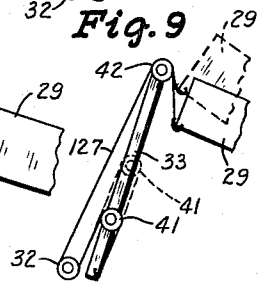


Fig. 11

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HYDRAULIC HOIST ATTACHMENT FOR TRACTORS

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5 Claims. (Cl. 254—139.1)

This invention relates to a hoist apparatus, and more particularly to a hoist apparatus adapted for attachment to a wheeled vehicle, such as a tractor.

It is an object of this invention to provide a new and improved hydraulic hoist attachment for a tractor which is adapted to lift a great variety of loads, such as the body of a wagon being towed by the tractor.

Another object of this invention is to provide a hydraulic hoist attachment for a tractor which, by virtue of its novel arrangement, has a relatively short boom structure whereby the hoist is adapted for use both within and outside of buildings.

Still another object of this invention is to provide a hydraulic hoist attachment for a tractor which employs a standard type of hydraulic piston and cylinder unit already used by many farmers for other purposes.

A further object of this invention is to provide a hydraulic hoist attachment for a tractor which utilizes a novel mounting structure whereby the hoist may be readily and quickly attached to and detached from a tractor.

Yet another object of this invention is to provide a hydraulic hoist attachment for a tractor which includes a lifting means which walks or creeps up and down a novel slide track structure whereby the travel of the hoist is high in terms of distance as compared to a relatively small stroke of the cylinder unit.

A further object of this invention is to provide a hoist attachment which is comparatively simple and inexpensive yet efficient and durable in use.

These and other objects will become readily apparent upon reference to the following description when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a perspective view of the hydraulic hoist attachment of this invention shown in assembled relation with a rear portion of a tractor;

Fig. 2 is a reduced, fragmentary perspective of the upper portion of the hoist shown being used for the lifting of a wagon box;

Fig. 3 is an enlarged, fragmentary, foreshortened perspective view of the three pulley units employed by the hoist apparatus in conjunction with the upper and lower cross heads slidably mounted on track members, certain parts being deleted for the purpose of clarity;

Fig. 4 is a detail sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is a detail sectional view taken along the line 5—5 of Fig. 3;

Fig. 6 is a side elevational view of the hoist apparatus looking toward the left as viewed in Fig. 1, with some parts deleted and other parts broken away for the purpose of clarity;

Fig. 7 is a view similar to Fig. 6, and wherein the upper and lower cross head units with their respective pulley units are shown in alternate positions relative to their positions of Fig. 6, with certain parts being deleted and other parts broken away for the purpose of clarity; and

Figs. 8 through 11 inclusive are diagrammatic views showing the steps of operation of the hoist apparatus.

Referring now to the drawings, and particularly Fig. 1, the hydraulic hoist apparatus of this invention is indicated generally at 20, and is shown in assembled relation with the rear end of a conventional tractor 21 which includes a wheel 22, an axle housing 23, a rear power take off 24, and a frame 26 for a hitch member 27. As seen in Fig. 2, the hoist apparatus 20 is adapted to lift such objects as the box 28 of a wagon 29 which may be in towed relation to the tractor 21.

In general, the hoist apparatus 20 (Fig. 1) comprises a support or base frame 31 on which is mounted a first pulley unit 32 (Fig. 3), and an upright track structure 33 mounted on the support frame 31 includes a pair of parallel upstanding track members 34 and 35 of a tubular construction. A lifting means 36 includes a double acting piston and cylinder unit 37, and a pair of upper and lower cross head units 38 and 39 movable on the track structure 33 and each of which has mounted thereon a second and third pulley unit 41 and 42 respectively, and a cable device 43 which is trained about the three pulley units.

The support frame 31 (Fig. 1) includes a pair of parallel angle members 44 secured at their lower ends to the sides 46 of the tractor frame 26 and disposed upwardly in an inclined manner, and a transverse strap 47 which is secured across the tops of the angle members 44. A pair of straps 48 are secured at their lower ends to the outer ends of the transverse strap 47 and extend upwardly therefrom in an inclined manner to be joined at their top ends by a transversely extended angle iron 49. A pair of supporting straps 51 are extended between the upper ends of the straps 48, where they are each secured as by bolts 52, and the axle housing 23 where they are secured by bolts 53. A transverse plate 54 is secured between the upright straps 48 below the angle iron 49 and a bracing structure is provided therefor which includes an upright brace 56 and a pair of diagonal braces 57 secured between the transverse strap 47 and the transverse plate 54.

The first pulley unit 32, as best seen in Figs. 1 and 3, includes a pair of diagonal braces 58 secured at their upper ends to the angle iron 49 and at their lower ends to a base strap 59 which in turn is secured on top of the transverse strap 54. A pair of transversely spaced, parallel upright braces 60 (Figs. 1 and 4) are secured between the base strap 59 and the angle iron 49 for supporting a pair of horizontally disposed support arms 61 (only one of which is shown) extended forwardly of the braces 60 and adapted to hold a pulley wheel 62.

The slide track structure 33, in addition to the track members 34 and 35, includes two sets of shoe members 63 (Figs. 1 and 3) which secure the track members at their bases to the angle iron 49, and a U-shaped connecting member 64 secured across the tops of the track members 34 and 35. A pair of adjustable brace devices 66 extend between the connecting member 64 and the axle housings 23 (only one of which is shown) whereat each device is secured as by a bolt 67 (Fig. 1).

On the forward faces of the track members 34 and 35, a pair of transversely opposite stop plates 68 (Fig. 3) are welded slightly above the angle iron 49 so as to provide a first step 69 therebetween. A pair of transversely opposite stop plates 71, longer than the plates 68, are also secured to the faces of the track members and are spaced above the opposite stop plates 68 whereby a second step 72 is formed therebetween. Above the longer stop plates 71 are another pair of stop plates 73 spaced thereabove whereby a third step 74 is formed; and spaced above the stop plates 73 is another pair of stop plates 76 whereby a fourth step 77 is formed. The purpose for the four steps or notches 69, 72, 74 and 77

on the track members 34 and 35 will be described hereinafter.

The lower cross head 39 (Fig. 3) includes a pair of slide members 78 and 79 (Fig. 3). As both slide members are substantially the same, only one will be described in detail, with like numerals indicating like elements. The slide member 78 includes a pair of side pieces 81 placed on each side of the track member 35, a base piece 82 secured across the side pieces 81 behind the track member 35, and a front piece 83 secured across the front of the track member between the side pieces 81. The arrangement of the slide member 78 is such that it is slidable on the track member 35 .

An I-beam device 84 is secured between the slide members 78 and 79 to join them in the proper spaced relation, and an upstanding lug 86 with a hole 87 formed therein is secured on the top of the device 84. A cut out 88 is formed in the I-beam device 84, and a rod 89 is secured to the base of the device 84 so as to extend across the cut out 88. A pulley wheel 91 for the second pulley unit 41 is rotatably mounted on the rod 89 for rotation through the cut out.

It is noted that the side pieces 81 (Fig. 3) have flange portions 92 extended beyond the front piece 83 and for supporting pivot pins 93 (Figs. 3 and 5) in axial alignment. A U-shaped latch bar 94 is pivotally secured between the slide members 78 and 79 by means of tubular housings 95 each mounted on a pin 93. A latch 100 (Fig. 5) is integral with each tubular housing 95 for engagement in any one of the steps 69, 72, 74 and 77 described hereinbefore. An L-shaped arm 96 is secured to the latch bar 94 adjacent the slide member 78 as best indicated in Fig. 3, and a torsion spring 97 is mounted about the pivot pin 93 in the slide member 78 and arranged in a conventional manner to force the latch bar 94 upwardly or clockwise as viewed in Figs. 3 and 6.

The upper cross head 38 (Fig. 3) is similar to the lower cross head 39 and includes a pair of slide members 98 and 99 each constructed for sliding movement on the respective track members 34 and 35. As both slide members are the same, only one will be described, with like reference numerals indicating like elements. The member 99 includes a pair of side pieces 101, a base piece 102 secured across and behind the track member 35 to the side pieces 101, and a front piece 103 secured across the front of the track member between the side pieces 101. An I-beam device 104 is secured to and extended between the side pieces 101 for securing together the slide members 98 and 99 in the proper transversely spaced relation and includes a depending lug 106 with a hole 107 formed therein. A pair of upstanding supports 132 are secured to the top of the device 104 and a pulley 108 for the third pulley unit 42 is mounted for rotation thereon.

The flange portions 109 at the front of the side pieces 101 have transversely aligned pivot pins 110 secured thereto, and a U-shaped latch bar 111 is pivotally mounted on the pins 110 by means of a tubular housing 112 at each end of the bar 111. A latch 105 is integral with each housing 112, again for engagement in a step 69, 72, 74 and 77 as will be described hereinafter. An L-shaped arm 113 is secured to the latch bar 111 adjacent the slide member 98 as best indicated in Fig. 3, and a torsion spring 114 is mounted on the pivot pin 110 at the slide member 98 and engaged with the arm 113 for forcing the arm and also the latch bar 111 downwardly or counterclockwise as viewed in Fig. 3.

A trip support 115 (Fig. 3) is secured to the arm 113 in an inclined manner and includes an upper rest 116 and a lower rest 117 in spaced relation. A trip lever 118 is pivotally secured to the middle of the trip support 115. A coil spring 119 (Fig. 1) is secured between the trip lever 118 and the L-shaped arm 96 of the lower cross head unit 39.

The double acting piston and cylinder unit 37 (Fig. 1) includes a cylinder 120 fluid connected at each end by conduits 133 and 134 to the hydraulic unit (not shown) of the tractor 21. A yoke 121 is secured at the base thereof for connection by a pin 122 to the upstanding lug 86 of the lower cross head unit 39, the pin 122 being inserted through the hole 87 of the lug. A piston rod 123 is extensible upwardly from the cylinder 120 and has a yoke device 124 secured at its upper end for connection with the depending lug 106 of the upper cross head unit 38, a pin 126 being passed through the yoke device 124 and the hole 107 of the lug 106.

The cable device 43 (Fig. 1) includes a cable 127 which is secured by a hook 128 to the upright brace 56 of support frame 31. The cable 127 is then trained over the second pulley 91, under the first pulley 62, and then upwardly and over the third pulley 108. At the depending end of the cable 127, a lift member 129 is secured. Of note, the type of lift member is optional, it being seen in Fig. 2 that the lift member 129 is adapted for the particular use of the hoist lifting the box 28 of a wagon 29.

A standard 131 (Fig. 1) is adapted for connection to the support frame 31, when a heavy load is being lifted, so as to prevent the front of the tractor 21 being raised during the lifting operation.

In the operation of the hoist apparatus, the lift member 129 is at its lowest position when the apparatus 20 is in the position shown in Fig. 8. This position is also shown in Figs. 1 and 6 at which time the cylinder unit 37 is nonactuated whereby the cross heads 38 and 39 and thus the pulley units 41 and 42 are at their closest-together positions. As noted in Fig. 6, the trip lever 118 is in its "up" position on the support 115 whereby the coil spring 119 is under tension and the lever 118 is acting against the upper rest 116 of the support 115.

The tension of the coil spring 119 acts in two different ways on the respective latch mechanisms of the upper and lower cross head units 38 and 39, respectively. First, as viewed in Fig. 3, the tension of the spring 119 on the arm 96 of the lower cross head latch bar 94 is counteracting and actually overcoming the torsion spring 97, the latter normally tending to pivot the bar 94 outwardly or clockwise, as viewed in Fig. 3 to release the latch 100 (Fig. 6) from its engagement in the first step 69. Second, such tension by spring 119 on the arm 113 of the upper cross head latch bar 111 aids the torsion spring 114 which is tending to pivot the arm 114 downwardly or counterclockwise, as viewed in Fig. 3, to engage the latch 105 (Fig. 6) in a step. At the position of the lifting means 36 in Figs. 6 and 8, it is to be noted that the upper cross head unit 38 is not in a position for its latch 105 to engage a step, so the latch 105 merely rests on a stop plate 71.

The first phase of the operation occurs when the cylinder unit 37 is actuated to fully extend the piston rod 123 upwardly (Fig. 1). The arrangement is such that at the end of a full stroke of the rod 123, the latch 105 of the upper cross head unit 38, which is moved by the rod 123 upwardly on the track members 34 and 35, is in front of the third step 74 (Fig. 6). As the latch 105 is forced downwardly by the torsion spring 114 and the coil spring 119, it immediately engages the third step 74 (Fig. 6), in the manner identical to that illustrated for the lower cross head latch 100 in Fig. 5. Thus, as viewed in Fig. 9, the movement of the upper cross head 38 has raised the third pulley unit 42 the full distance of the piston rod stroke. It is obvious that such movement of the pulley unit 42 in effect, causes an upward movement of the lifting member 129 which is twice the moved distance of the pulley 42 and the rod 123. Thus, for the stroke of the piston rod, the lifting member 129 moves upwardly twice the distance of such stroke, obtaining thereby a compound lifting action.

The second phase of the operation occurs when the cylinder unit 37 is again actuated to retract the piston rod

123. With the latch 105 releasably locked in the third step 74, retraction of the piston rod 123 takes place by movement of the cylinder 120 upwardly relative to the piston rod. Of note, the engaging bias by the springs 97 and 119 on the latch 100 of the lower cross head unit 39 is overcome by the action of the cylinder 120, the latch pivoting outwardly so as to run up over the short stop plates 68.

At the end of the full stroke of the cylinder's upward movement, the latch 100 is located in front of the second step 72 (Fig. 5) and is forced into engagement therewith by the coil spring 119 overcoming the action of the torsion spring 97. The result of the second phase is depicted in Fig. 10, whereby the upward movement of the cylinder 120 carries the lower cross head unit 39 and thus the second pulley unit 41 upwardly to effect another compound lifting action on the load 29.

The third phase of the operation is a repeat of the first phase whereby the piston rod 123 is again extended from the stationary cylinder 120, now locked in the second step 72. The upper cross head unit 38 is moved upwardly on the track members 34 and 35 until the latch 105 engages the fourth step 77 (Fig. 7) At this position, the upper pulley 42 is at its highest location on the slide track structure 33 (Fig. 11).

The fourth and last phase of the lifting operation is a repeat of the second phase whereby the cylinder unit 37 is again actuated to retract the piston rod 123, the result however being an upward movement of the cylinder 120 relative to the rod. Thus, as depicted by the dotted lines in Fig. 11, the lower cross head unit 39 and the pulley unit 41 carried thereby move upwardly with the cylinder 120 to raise the load 29 to its highest position.

In this final non-extended position of the cylinder unit (Fig. 11), it is noted the latch 100 is not engaged in a step but is merely resting on a stop plate 71. Also of note, the import of which will be obvious during the following lowering operation of the apparatus 20, the location of and the distance between the lower pair of steps 69 and 72 and the upper pair of steps 74 and 77 and the distance between the latches 100 and 105 at their non-extended and extended positions is such that each actuation of the cylinder unit causes a movement of either cross head unit whereby the respective latch carried thereby is moved slightly farther or longer than the distance necessary to effect a latching action. In the disclosed embodiment, the extra movement is approximately one-quarter inch.

To lower the load 29, it is first necessary for the hoist operator to pivot the trip lever 118 downwardly (Fig. 7) to where it contacts the lower rest 117 of the trip support 115. This action causes the coil spring 119 to lose all of its tension and allows the upper torsion spring 114 of its own force to maintain the latch 105 engaged in the stop 77.

The first phase of the lowering operation is an actuation of the cylinder unit 37 to extend the piston rod 123. Due, however, to there being no resistance to such extension, as the cylinder 120 is not locked to the track structure 33, the result is a downward movement of the cylinder 120 to engage the lower latch 100 in the stop 72. While this downward movement of the cylinder 120 is taking place, the coil spring 119 is being placed under tension.

Thus, as the lower latch 100 moves adjacent the step 72, the tension of the spring 119 overcomes the releasing tension of the torsion spring 97 and snaps the latch 100 in place. The tension of the spring 119 at the upper cross head 38 now tends to overcome the locking action of the torsion spring 114 and effect a release of the latch 105. Due, however, to the weight of the load 29, the latch 105 is held in place.

Here then is where the extra movement of the moving cross head unit becomes of importance. As the latch 100 is in place, it is seen that an additional further extension of the cylinder 120 relative the piston rod 123 must of necessity now effect a slight upward movement of the rod 123 and the upper cross head unit 38. This movement then takes the weight of the load 29 off the latch 105 and permits the tension of the coil spring 119 to overcome that of the torsion spring 114 and kick the latch 105 outwardly, thus releasing it from the step 77. At the end of the first phase of the lowering operation, the pulley units 41 and 42 are at their full line positions as shown in Fig. 11.

For the second phase of the lowering operation, the cylinder unit 37 is actuated to move the piston rod 123 back into the cylinder 120. During this phase, the latch 100 of the lower cross head unit 39 acts to support the lifting mechanism 36. With the downward movement of the piston rod, the upper cross head unit 38 and the third pulley unit 42 also move downwardly therewith to a position depicted in Fig. 10, whereby the load 29 is lowered again in a compound manner, i.e., twice the distance of the piston rod movement.

As the upper cross head unit 38 moves downwardly to its position adjacent the third step 74, the coil spring 119 again loses all of its tension. Thus, as the latch 105 moves adjacent the step 74, the torsion spring 114 now acts normally to engage the latch 105 therein. Concurrently with this action at the upper cross head unit, the releasing of tension on the spring 119 also permits the lower cross head torsion spring 97 to tend to act normally to force the arm 96 outwardly and thus effect a release of the latch 100 from the second step 72. Due again, however, to the weight of the load 29, the latch 100 is held in place. After the latch 105 has been engaged, the extra movement of the piston rod 123 relative the cylinder housing 120 actually causes a slight lift of the housing 120 whereby to transfer the load from the latch 100 to the latch. With this transfer of weight, the force of the torsion spring 97 releases the latch 100. Therefore, at the end of the second downward phase of operation (Fig. 10), the upper latch 105 is engaged in the step 74 and the lower latch 100 is released from the step 72.

It may thus be seen that the next or third phase of the downward movement occurs when the piston and cylinder unit 37 is actuated whereby to force the cylinder 120 downwardly from the stationary piston 123 which is locked in place due to the locking position of the upper cross head latch 105. During this downward movement of the cylinder 120, the coil spring 119 is again placed under tension whereby by the time the latch 100 of the lower cross head unit 39 reaches the first step 69, the torsion spring 114 of the upper cross head unit 38 has again been overcome so as to allow a release of the latch 105 from the third step 74, except for the weight of the load. Again, the extra movement of the cylinder, now bottomed via the lower cross head 39 on the angle iron 49, causes a slight upward movement of the piston 123 to permit the latch 105 to be released. As depicted in Fig. 9, the lower pulley unit 41 is now at its lowermost position, with the load 29 also having been lowered by this third phase of the lowering operation.

The fourth phase of the lowering operation is a repeat of the second phase. The cylinder unit 37 is actuated to force the piston rod 123 into the cylinder 120, whereby the upper pulley unit 42 is brought to its lowermost position (Figs. 1, 6 and 8), the load 29 also being brought to the lowest position thereof permitted by the hoist apparatus 20.

Although a preferred embodiment of this invention has been described herein, it is to be understood that various modifications and alterations may be made therein within the full intended scope of this invention, as defined in the appended claims.

I claim:

1. A hoist apparatus adapted for attachment to a tractor which has a source of fluid under pressure comprising,

frame, means attachable to the rear of the tractor, a first pulley unit secured to said frame means, an elongated track structure secured to said frame means and extended upwardly therefrom, said track structure having formed thereon a plurality of longitudinally spaced catch devices, pressure operable, extensible lifting means adapted to move up and down said track structure and operatively connected to said fluid pressure source, said lifting means including a pair of cross head units slidably mounted on said track structure for movement relative to each other, each of said cross head units having a pulley unit mounted thereon, and a latching device on each cross head unit selectively engageable with a catch device, means connected between said latching devices for effecting a sequential releasing and engaging action relative to said catch devices, and a cable device secured at one end to said frame means and trained about said pulley units whereby the load end of said cable device depends from the upper end of said lifting means, such that movement of each cross head unit effects a movement of greater distance by said load end.

2. A hoist apparatus adapted for attachment to a tractor which has a source of fluid under pressure comprising, frame means attachable to the rear of the tractor, a first pulley unit secured to said frame means, an elongated track structure secured to said frame means and extended upwardly therefrom, said track structure having formed thereon a plurality of spaced catch devices, lifting means adapted for longitudinal movement on said track structure and including a pair of upper and lower cross head units slidably engaged on said track structure, a latching device secured to each cross head unit for selective engagement with a catch device, a fluid pressure type extensible unit operatively connected to said fluid pressure source and connected between said cross head units for sequentially moving each cross head unit relative to the other, a second pulley unit mounted on said lower cross head unit, a third pulley unit mounted on said upper cross head unit, a cable device secured at one end to said frame means and trained about said pulley units with the load end thereof depending from the uppermost third pulley unit whereby movement of each cross head unit effects a movement of greater distance by said load end, and means connected between said latching devices for controlling the engagement and disengagement of each respective latching device relative said catch devices, whereby said lifting means is movable as a unit on said track structure.

3. A hoist apparatus adapted for attachment to a tractor which has a source of fluid under pressure comprising, frame means attachable to the rear of the tractor, a pulley unit secured to said frame means, a track structure including a pair of elongated track members secured to said frame means and extended upwardly therefrom in a parallel manner, longitudinally spaced catch means formed on said track members, pressure operable lifting means including a pair of spaced cross head units each of which is slidably mounted on said track members and movable relative to each other, a pulley unit attached to each cross head unit, a cable device secured at one end to said frame means and trained about said three pulley units with the load end thereof depending from the uppermost pulley unit whereby movement of each cross head unit effects a movement of greater distance by said load end, and interconnected latching means attached to each cross head unit for coaction with said catch means, whereby said lifting means is movable as a unit on said track structure.

4. A hoist apparatus comprising a base frame means, a first pulley means secured to said frame means, an elongated track structure secured at one end to said frame means, longitudinally spaced catch means formed on said track structure, a fluid pressure type cylinder unit operable by a source of fluid pressure external said apparatus and including a cylinder and associated piston, a second pulley means connected to said cylinder and operatively mounted for sliding engagement on said track structure, a third pulley means connected to said piston for said cylinder and operatively mounted for sliding engagement on said track structure, said third pulley means located further from said first pulley means than said second pulley means, a pair of interconnected latching units secured to said second and third pulley means for coaction with said catch means, whereby upon successive actuations of said cylinder unit, the pair of latching units are alternately in respective engaged and released positions relative to said catch means to provide for a sequential movement of said second and third pulley means on said track structure, and cable means secured at one end to said base frame means and trained about said first, second and third pulley means whereby the load end thereof depends from said third pulley means such that for each sequential movement of said second and third pulley means said load end moves a distance greater than such movement.

5. A hoist apparatus adapted for attachment to a tractor which has a source of fluid under pressure comprising, frame means attachable to the rear of the tractor, a first pulley unit secured to said frame means, a track structure secured to said frame means in a substantially upright manner, a plurality of catch means formed on said track structure and spaced longitudinally thereon, a pair of separated, longitudinally spaced pulley mounting units slidably mounted on said track structure, a second pulley unit mounted on the lowermost pulley mounting unit and which is always positioned above said first pulley unit, a third pulley unit mounted on the uppermost pulley mounting unit, a cable device secured at one end to said frame means, trained over said second pulley unit, trained under said first pulley unit and trained over said third pulley unit so that the load lifting end thereof always depends from said third pulley unit, latching means interconnecting said pair of pulley mounting units for coaction with said catch means and adapted to retain the pulley mounting units against downward movement, and a hydraulic piston and cylinder unit connected between said pulley mounting units and adapted for connection to said tractor source of fluid pressure, whereby upon an actuation of said hydraulic unit to extend said piston from said cylinder, said third pulley unit is movable upwardly relative to said track structure thus effecting a compound lifting action on said cable device, and upon another actuation of said hydraulic unit to return said piston, said third pulley mounting unit is retained in place on said track structure while said second pulley mounting unit is moved upwardly on said track structure to effect another compound lifting action on said cable device.

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