

United States Patent

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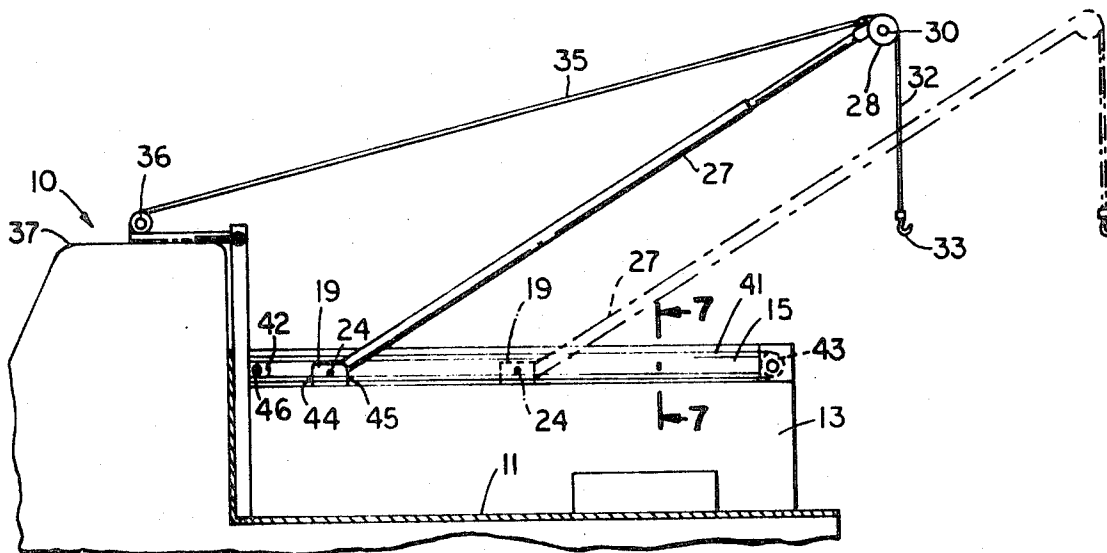
[54] FIELD SERVICE VEHICLE
17 Claims, 11 Drawing Figs.

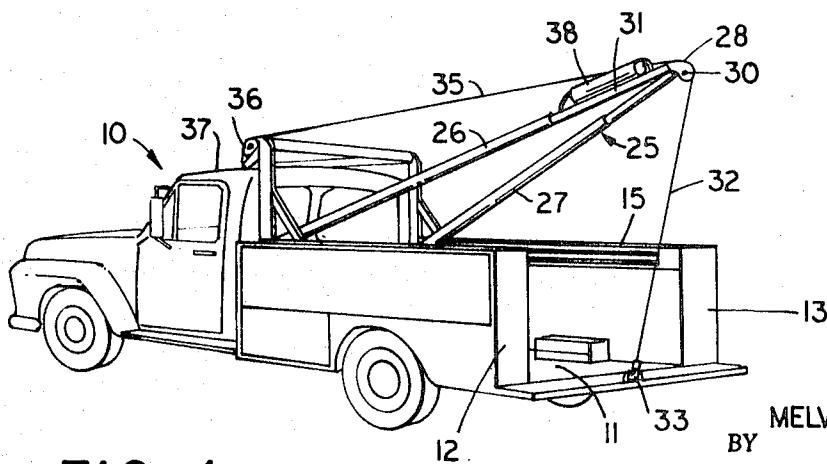
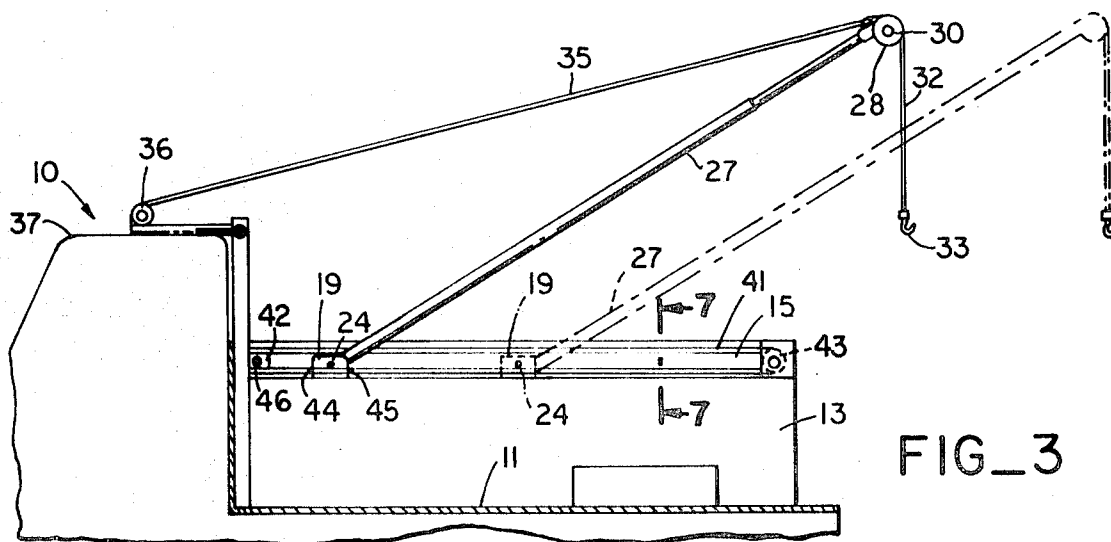
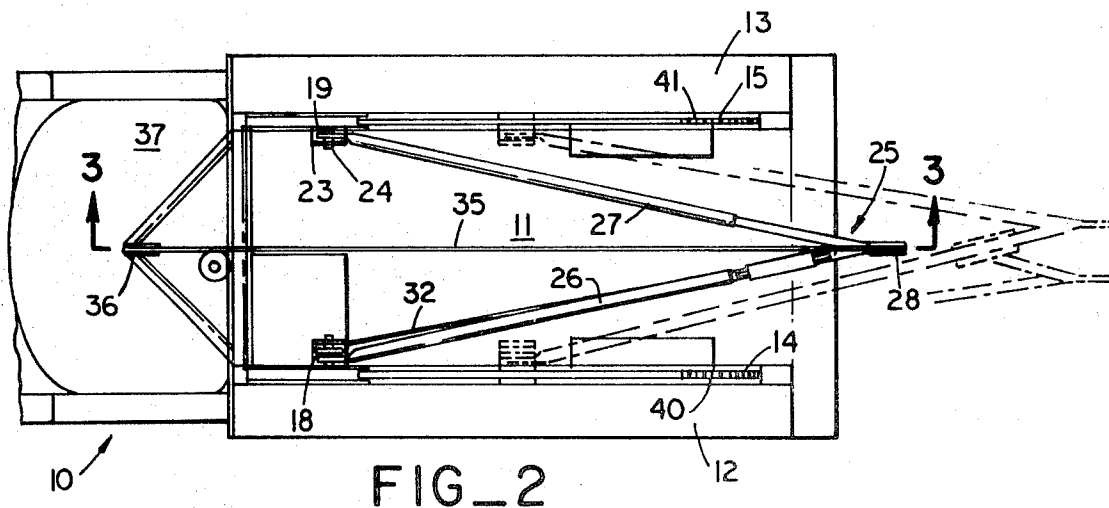
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212/8, 212/59, 254/184
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[50] **Field of Search**..... 214/77, 75
H. 75; 212/8, 8 A, 59 R

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ABSTRACT: A field service truck having a boom that is movable fore and aft relative to the truck, along a pair of tracks lying above and at the sides of the truck bed, so as not to interfere with the holding capacity of the truck bed. A boom motor and winch acts through a cable to raise and lower the boom by swinging it about its lower ends; a hoist motor and winch control a cable for raising and lowering the load picked up by the hoist; and a travel motor acts through a chain drive to move the boom fore and aft of the truck. The travel motor is connected by differentials to the hoist winch and the boom winch, so that the boom can be moved fore and aft without substantially changing its height or the height of the load.





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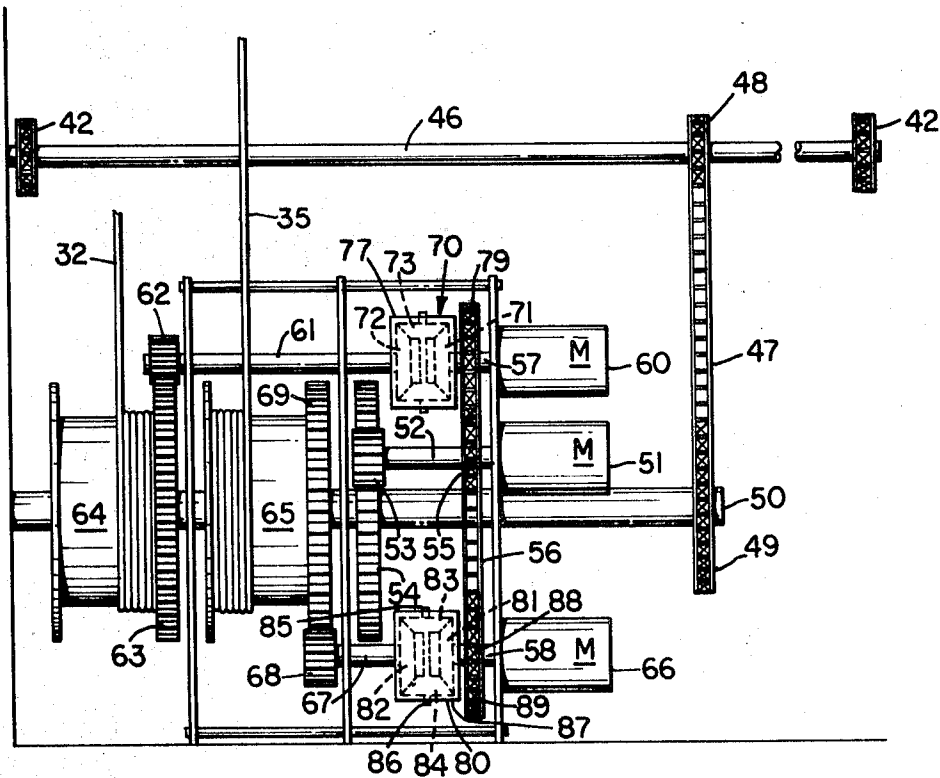


FIG_4

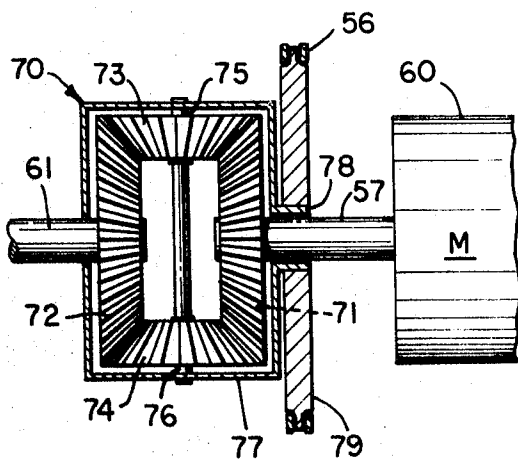


FIG_6

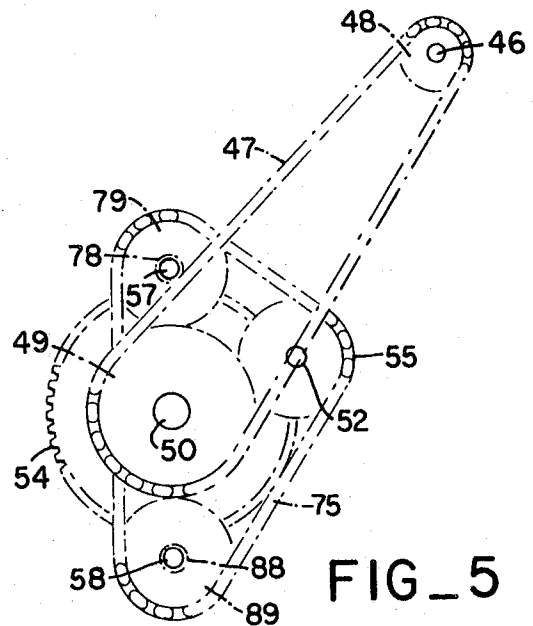


FIG_5

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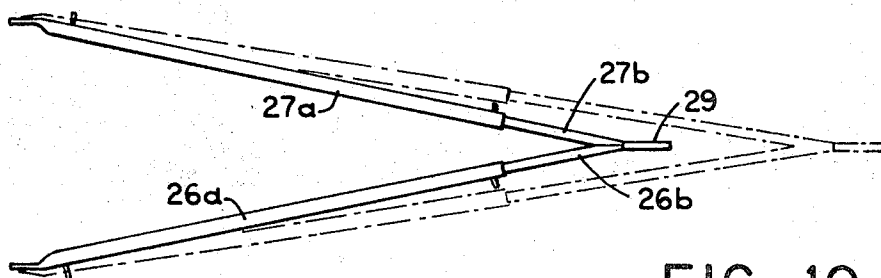


FIG. 10

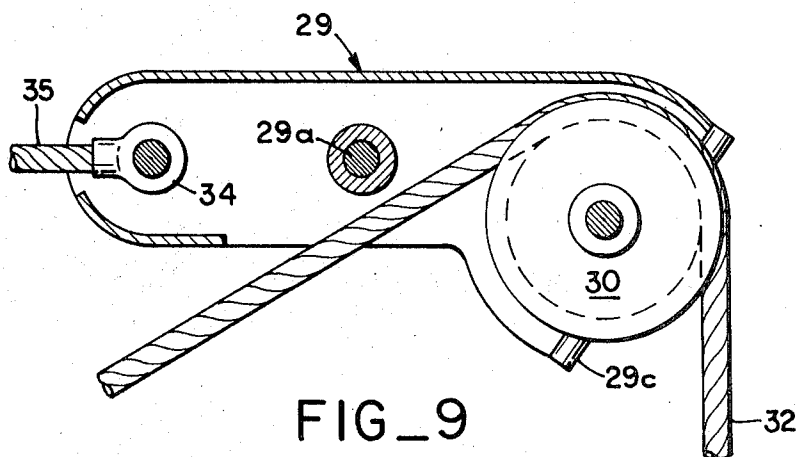


FIG. 9

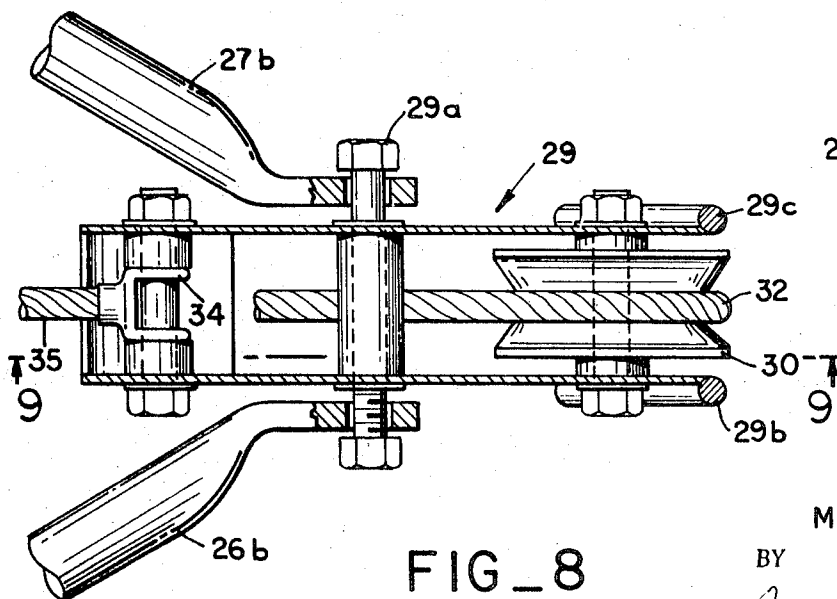


FIG. 8

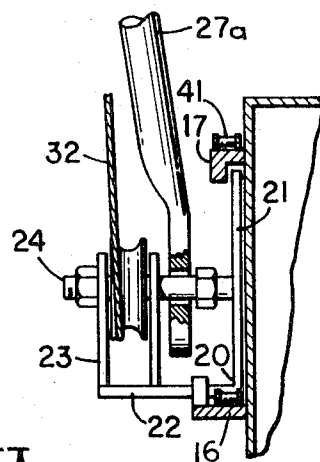
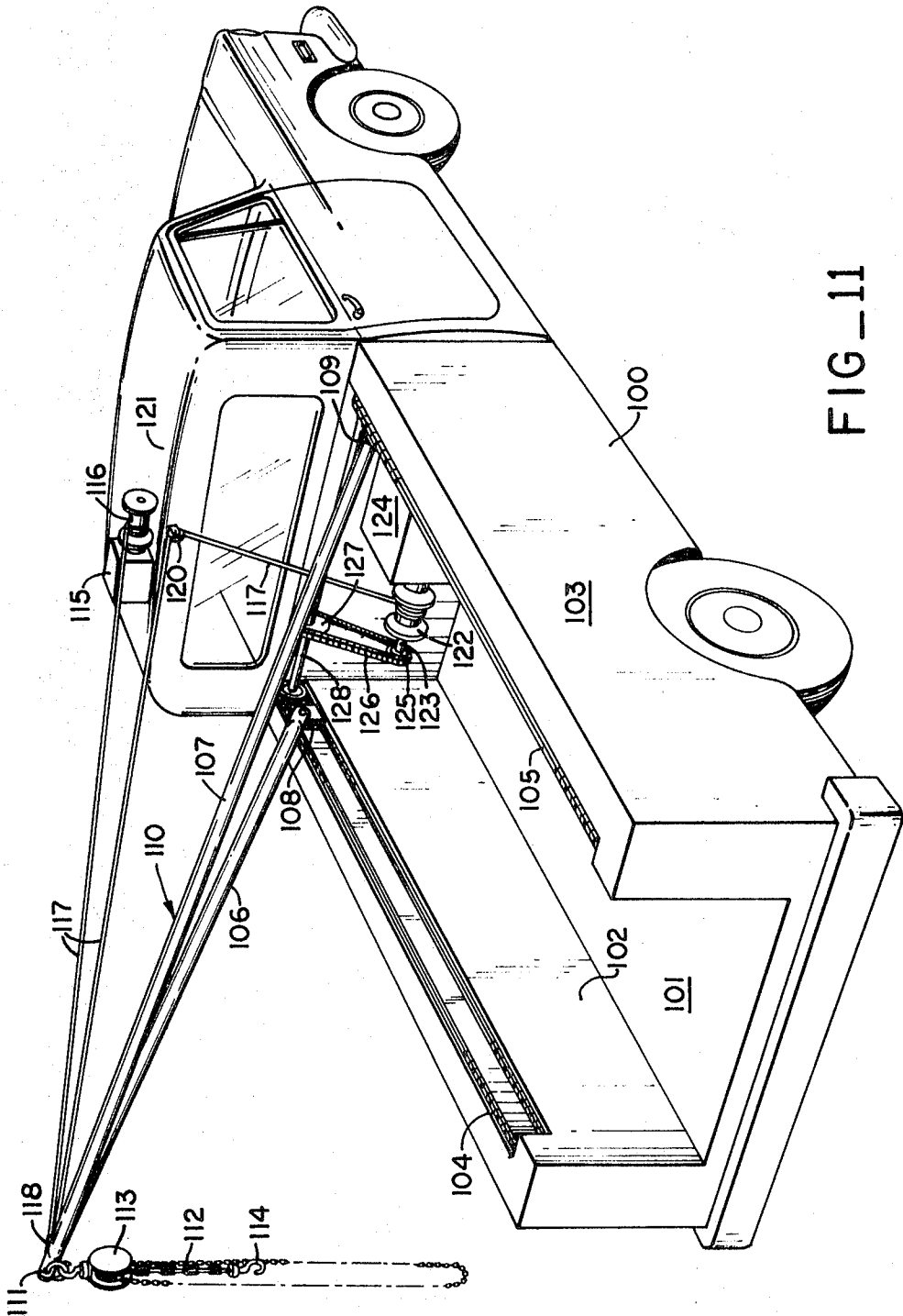


FIG. 7

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FIELD SERVICE VEHICLE

This invention relates to an improved field service vehicle.

Large automotive vehicles such as large farm tractors, earthmoving vehicles, bulldozers, large trucks, and so on, at times have breakdowns, and it is often desirable to be able to give these vehicles field service. For example, if a large tractor has engine trouble and cannot be operated it is very expensive to load the entire tractor on a very large truck to take it many miles to the dealer for repair, when all that needs to be done is to replace or repair the engine. Hence, a field service vehicle may be called to go out and remove the engine, replace it with a service engine, and carry the damaged engine to the repair station. These engines and the other various parts of the vehicle that may need such replacement are often quite heavy and cannot be lifted by one or two men; they require a power winch. It is important, therefore, for the field service vehicle to have a boom and winch combination to enable lifting of such heavy articles onto or down from the field service vehicle.

Since a field service vehicle that is adequate for all purposes is a very heavy and very expensive truck, it has often been advisable for the dealer or repair service to maintain some auxiliary vehicles to answer most calls, reserving only the most difficult calls for the heavy truck. A relatively light pickup truck provided with a suitable boom should be able to take care of a large percentage of the jobs that would otherwise require the much larger and more expensive truck. With the right kind of light truck, even a large repair operation needs only one or two large trucks, supplemented by perhaps a dozen of the smaller pickup trucks.

Such pickup trucks, when fitted with booms, have heretofore been plagued by many problems and have had many disadvantages. Their boom has usually consumed such a large proportion of the bed of the truck that only a small area of the truck bed has been available for supporting the engine or other part that is picked up. Even then, the length of the boom poles has been restricted, for if the attempt were made to provide boom poles long enough for use on large machines, they would either extend beyond the legal length limit or, if raised to avoid that, extend beyond the limit of legal height for travel on highways. Furthermore, their boom has generally had to be mounted either directly over the rear axle or approximately there, and this arrangement has left only very little room to the rear of the boom in the truck bed to accept the load. When attempts were made to place the load forward of the rear axle, the boom had to swing over center, and this has created very serious problems, tending toward collapse of the boom on the truck cab. As a result, the danger of letting the boom pass over center and dropping poles has limited such pickup trucks to using only the relatively small area to the rear of the boom base, and to the rear of the rear axle, to transport the payload. Safety has remained a difficult factor, and the strain on the boom line has often been great.

In the present invention, the boom, instead of being a single pole supported on the bed of the truck, is preferably an A-frame structure, and the bases of the boom legs are supported on track-engaging means; these ride on a pair of tracks that extend horizontally, fore and aft along the sidewalls of the truck, preferably spaced some distance above the truck bed. This new structure accomplishes several things. It enables the use of longer boom poles, because the bases of the poles can be brought forward close to the rear of the cab, so that the boom point does not extend too far beyond the rear of the truck. For one thing, it enables substantially all of the truck bed to be used, since only a small proportion of the bed is consumed by the boom and hoist equipment, and that is the area taken up by the power system for the winch assembly, which can be located well to the front against the cab. Also, this new system enables fore and aft movement of the boom itself, so that the bases of its two legs can be moved from close to the cab of the truck to a point close to the tailgate, thereby giving much greater versatility in handling loads.

In providing for fore and aft movement of the boom, however, another problem is created. If the hoist cable is not com-

pensated for fore and aft movement of the boom, then when the boom moves towards the cab of the truck, the hook on the hoist cable tends to drop in elevation, and when the boom moves towards the rear of the truck, the hook tends to rise. A resultant change in elevation of the load would not be desirable. Moreover, the boom itself tends to be swung by this fore and aft movement, and this swinging also affects the elevation of the load. Hence, a very important feature of the present invention is a differential arrangement by which the travel of the boom is achieved without changing the angle of inclination of the boom and without changing the height of the load-engaging member of the hoist. By the use of this differential action, almost even parallelism is maintained while moving the base of the A-frame boom legs. This action facilitates the installation of repair units and their loading and unloading.

As stated, the fact that the base of the booms is high and at the sides of the truck creates a large carrying area heretofore unavailable in field service trucks having booms and winches. Also, by spreading the load along the sides of the truck bed, the need for reinforcement of the truck bed is greatly lessened and the load can be transmitted directly to the frame.

Remote control of either single or multiple operation option is achievable by this invention.

The invention enables automatic relocation and moving of the base of the boom legs and thereby eliminates the danger of having the boom go over center and dropping poles. The boom poles can be made longer for greater reach with a structure of this type. The boom movement enables the obtaining of better lifting positions from the standpoint of convenience, of safety, of loading ability, and ability to reach under overhead obstructions. The strain on the boom line is decreased by improving the relative position of the boom itself to the truck bed, when desired.

The invention also provides for a linear actuator on one boom leg to lengthen or shorten that leg to enable a substantial amount of side shift movement, when this is desirable.

Other objects and advantages of the invention will appear from the following description of a preferred form thereof.

In the drawings:

FIG. 1 is a view in perspective of a field service vehicle embodying the principles of the invention.

FIG. 2 is a top plan fragmentary view of the vehicle of FIG. 1.

The boom is shown in two different positions of travel, a forward position in solid lines, and a more rearward position in broken lines. The front of the truck is broken off to conserve space.

FIG. 3 is a view in section taken along the line 3—3 in FIG. 2 showing the same two alternative positions.

FIG. 4 is a view in end elevation of the power assembly for the boom and hoist of FIGS. 1—3.

FIG. 5 is a somewhat diagrammatic view in side elevation of the assembly of FIGS. 4 and 5.

FIG. 6 is a fragmentary view in section through one of the differentials and some of its adjacent parts.

FIG. 7 is a fragmentary view in section taken along the line 7—7 in FIG. 3.

FIG. 8 is an enlarged view, looking from the bottom of the upper end of the boom and the bracket and sheave thereon.

FIG. 9 is a view in section taken along the line 9—9 in FIG. 8.

FIG. 10 is a fragmentary top plan view of the boom illustrating its extensibility. Solid lines show the telescoped shorter size, and broken lines show the extended position.

FIG. 11 is a view in perspective of the rear of a truck having a modified, simplified embodiment of the invention.

The vehicle 10 may utilize a conventional type of pickup truck. Any size and weight may be used, of course, matching the size of the equipment to the truck. The truck 10 incorporates a bed 11 where a load may be carried, and the bed 11 is located between a pair of generally vertical sidewalls 12 and 13. Preferably high up on these walls 12 and 13, the present invention provides a pair of track means 14, 15, such as a base flanged rail 16 and an upper flanged rail 17 with an inset slot

(FIG. 7). To each of these track means 14, 15 is mounted a track-engaging means 18, 19, which may comprise an angle iron 20 with a vertical portion 21 and a horizontal portion 22. To this angle iron 20, a suitable bracket 23 is attached, and this bracket 23 supports a pivot pin or shaft 24 to which is attached one of the two legs 26 and 27 of an A-frame boom 25. Other types of booms 25 may be used, but the A-frame type is desirable, in that it gives a superior action with open space between its legs 26 and 27, especially since the legs 26 and 27 are elevated above the bed. At the top 28 of the boom 25 is a suitable sheave 30, supported there by a bracket 29.

Both of the legs 26 and 27 are preferably, but not necessarily, extensible by a telescope-type structure with outer sleeves 26a and 27a and telescoping portions 26b and 27b, (see FIG. 10). To make this feasible, the openings in the legs 26 and 27 for the shaft 24 are made oversize and the parts adjacent thereto are well spaced apart from the leg 26, 27 (FIG. 7). Also, the bracket 29 (see FIGS. 8 and 9) is held to the upper ends of the portions 26b and 27b by a bolt 29a, with very loose clearance. As a result, the legs 26 and 27 can be extended as shown in FIG. 10. The sleeve 30 (FIGS. 8 and 9) is supported in the bracket 29 with antifriction bearings and tighter clearances.

To enable movement to one side (See FIGS. 2 and 3), the bracket 29 may be provided with rolled edges 29b and 29c to form a guard that prevents binding or losing of the cable 32. Preferably, one leg 26 is provided with an extra telescoping sleeve 31, enabling the total length of the leg 26 to be lengthened or shortened separately from any alteration in the length of the leg 27. An electrical linear actuator or a hydraulic cylinder 38 may be used to perform this lengthening; this typically enables the bracket 29 to be shifted approximately 10° to one side, though the amount may be somewhat greater if desired. The loose fit of the bracket 29 on its bolt 29a helps again in accomplishing this shift. The shift may be used for several purposes, including equalization of the load on the boom legs 26 and 27 when the truck is not level.

A hoist cable 32 (See FIGS. 1-3) passes over the sheave 30 and ends in a hook 33 or other suitable fixture. The bracket 29 (FIGS. 8 and 9) also supports a clevis 34 to which a boom cable 35 is secured, the boom cable 35 passing (FIGS. 1-3) to a sheave 36 on the cab 37 and being used for raising and lowering the boom 25.

The fore and aft movement of the boom 25 along the track means 14 and 15 may be controlled in various ways. In the embodiment shown a pair of chains 40 and 41 (FIG. 2) is employed; each chain 40 or 41 passes over front sprockets 42 and rear sprockets 43 (FIG. 3) and has ends 44 and 45 attached to opposite ends of the track-engaging means 18 or 19, so as to complete a continuous loop. Thus, rotation of the drive sprockets 42, preferably near the cab 37 of the truck 10, results in movement of the boom 25 fore or aft, depending on the direction of rotation of the sprockets 42.

The sprockets 42 may be secured to a shaft 46 (FIG. 4), and the shaft 46 may be driven by a chain 47 engaging a sprocket 48 on the shaft 46 and driven from a sprocket 49 mounted on a shaft 50. The shaft 50 may be driven by a travel motor 51 having a drive shaft 52 with a pinion gear 53 thereon engaging a gear 54 secured to the shaft 50. The shaft 52 also carries a sprocket 55 that drives a chain 56.

As shown in FIG. 4, the hoist cable 32 is normally driven by a hoist motor 60 which is connected through a drive shaft 57 and a differential 70 to a shaft 61, to which is secured a pinion gear 62, which engages a gear 63 on a winch 64, on which the cable 32 may be wound or unwound. Similarly, the boom cable 35 is ordinarily wound around and driven by a winch 65 and turned by a boom motor 66 that is connected thereto, through a drive shaft 58, a differential 80, a shaft 67 and pinion gears 68 and 69.

However, in this invention, it is important that fore and aft movement of the boom 25 results in no substantial change in the height of the load which may be suspended from the hook 33 (or other load-engaging means at the extremity of the hoist

cable 32). It is also important that the boom 25 not swing during travel. Yet, if the hoist cable 32 and boom cable 35 are left as so far described, the boom 25 will swing and the hook 33 will rise or fall at any fore and aft movement of the boom 25. For this purpose, the invention provides a novel differential and transmission arrangement.

The differential 70 (FIG. 6) has a gear 71 secured to the drive shaft 57 and a gear 72 secured to the shaft 61. The gears 71 and 72 are connected by gears 73 and 74, which are supported by shafts 75 and 76 that are secured to the differential housing 77. The housing 77, which is freely rotatable relative to the shafts 57 and 61, has a hub 78 to which is secured a sprocket 79 that is driven by the chain 56. Thus, when the travel motor 51 is stationary, the chain 56 holds the housing 77 against rotation, and the hoist motor 60 can drive the shaft 61 through the differential 70. However, when the hoist motor 60 is stationary, it holds the gear 71 stationary, and the travel motor 51 acts through the chain 56 to turn the housing 77 and thereby rotate the shaft 61.

Similarly, the differential 80 (FIG. 4) has a gear 81 secured to the drive shaft 58 and a gear 82 secured to the shaft 67, and the gears 81 and 82 are connected by gears 83 and 84, that are supported by shafts 85 and 86 secured to a housing 87. The housing 87 has a hub 88 that is secured to a sprocket 89 engaging the chain 56, so that the relationship to the travel motor 51 is the same as for the differential 70.

The differentials 70 and 80 can be of various structures other than that shown in the drawings. Planetary assemblies may, of course, be used, as may other types of differentials. In this differential, the gear ratios are so chosen that the relative change in height and angle of the hoist and boom is insignificant—e.g., about 8 inches of boom rise during 8 feet of travel, when the boom 25 is at about 45°.

Thus, the invention enables the operator to control several major factors. He may do this through a remote control device having a button for travel, a button for hoist, and a button for boom. The hoist motor 60 and boom motor 66 can, if pressed simultaneously with a travel motor 51, override it and raise or lower the boom 25 or raise or lower the hoist mechanism 33 while the boom 25 is traveling. This, however, is done only if there is a reason for doing it, and is ordinarily not done. All three of these motors 51, 60 and 66 are made reversible, so that there are two directions of movement for each. The overriding action just spoken of can therefore go in either direction, no matter which direction the boom 25 is being moved by the travel motor 51.

In operation then, the driver may drive the field service vehicle to the location, then may use the travel motor 51 to move the boom 25 to a desired location, employ the boom motor 66 to set the boom 25 at a desired angle, and operate the hoist motor 60 to set the hoist hook 33 at a desired height. Then he can move the hoist cable 32, while keeping the boom 25 stationary or can move the boom 25 while keeping the hoist cable 32 stationary, to raise the part to be lifted. He can also do both simultaneously and can thereby lift the load onto the truck or lift the load from the truck to a desired location.

When the travel motor 51 runs, it rotates the shaft 52, so that the pinion gear 53 drives the pinion gear 54 and rotates the shaft 50. The sprocket 49 on the shaft 50 transmits this drive to the shaft 46 through the chain 47 and the sprocket 48. The shaft 46 drives the sprockets 42 which drive the chains 40 and 41 and thereby the boom 25 is moved. During this time, the shaft 52 is also driving the chain 56 through its sprocket 55. The chain 56 drives the sprockets 79 and 89, which, in turn drive the differential housings 77 and 87. The differential housing 77 moves the gears 73 and 74 about the then stationary gear 71 and therefore drives the gear 72 and therefore the shaft 61; the shaft 61 drives the winch 64 through the pinion gears 62 and 63, and therefore lets out or takes up the cable 32. Similarly, the differential housing 87 moves the gears 83 and 84 about the then stationary gear 81, driving the gear 82 and the shaft 67; the shaft 67 drives the winch 65 through the pinion gears 68 and 69 and therefore lets out or takes up the

cable 35. Thus, the travel motor 51 not only moves the boom 25 fore and aft of the truck 10, it also moves the cables 32 and 35 to keep the hook 33 substantially at a constant level and to keep the boom 25 at a substantially constant angle of inclination.

The gears 71 and 81 are stationary only when their respective motors 60 and 66 are not in use, and if the motors 60 and 66 are operated, the boom 25 and hook 33 will rise or fall, as desired.

FIG. 11 shows a modified form of the invention which is less expensive but also less versatile. In this instance there is a truck 100 with a truck bed 101 and sidewalls 102 and 103. Each sidewall has tack means 104, 105, and a boom pole 106, 107 is pivoted to an assembly 108, 109 that rides in the track means 104, 105. The boom poles 106 and 107 unite to form a boom 110 and meet at the upper end 111 thereof. In this instance there is no hoist cable but a chain 112 is supported on a block 113 which is carried by the upper end 111 of the boom 110 and has a hook 114 or other fixture. This hoist is preferably hand regulated and operated; a small auxiliary motor may be used if desired, of course.

The height of the boom is governed by a boom hoist arrangement having a motor 115, a drum 116 acting as a winch, and a cable 117. The cable passes over a pulley 118, which is secured pivotally to the boom 110 and then has a rear pass to a sheave 120 adjacent or on the truck cab 121. The cable 117 passes over this sheave 120 and ends on a drum 122, which is itself supported by a shaft 123 driven by a travel motor 124. The same shaft 123 may carry a sprocket 125 which drives a chain 126, which in turn drives a sprocket 127 secured to a shaft 128 which actuates the movement fore and aft of the boom 110, as by a mechanism substantially like that shown in FIGS. 1-10.

In this instance the boom hoist 116 is used to raise and lower the boom 110 and set the angle of the boom 110 independently of the travel motor 124. However, when the travel motor 124 is operated and the boom hoist motor 115 is not operating, fore and aft movement of the boom 110 acts to take up or let out the boom cable 117 so that when the boom 110 has moved toward the cab 121, the cable 117 is taken up by an amount substantially serving to keep the upper end 111 of the boom 110 at a constant level, and of course this means that the boom 110 stays at the same angle. For this purpose, the winch or drum is made of such a size relative to the sprocket and chain ratios to achieve this purpose. Similarly, when the boom 110 moves aft, the boom cable 117 is let out. This device obviously is not as versatile as that of FIGS. 1-10, but, being much less expensive, it has a place where such operations are not as large scale. It is of course apparent that the modifications may be incorporated into this system, such as some of the refinements of the system already described earlier.

While pickup trucks are preferred for many uses, a flat bed truck may be used for some uses, and in this instance, the tracks 14 and 15 are, of course on or in the bed, rather than in sidewalls. Even in other types of trucks, the tracks 14 and 15 may be on or in the bed or low down on sidewalls, when these are present.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. A field service truck having a cab and bed to the rear of said cab comprising:

track means supported by said truck at each side of said bed,

boom means having hoist means supported at its upper end, boom support means pivotally mounted to the lower ends of said boom means and mounted on said track means for movement fore and aft therealong, said boom support

means being free from transverse members in the vicinity of its lower end so that said bed is kept free from obstruction thereby and is capable of carrying a load that is unaffected by and does not affect the fore and aft movement of said boom support means, said boom means being able to swing up and down on the boom support means, due to the pivotal mounting,

a boom winch supported by said bed in a stationary position adjacent said cab and having cable means connected to the upper end of said boom means for raising and lowering said upper end,

a boom motor supported by said bed in a stationary position adjacent said cab and operatively connected to said boom winch for operating it, and

a travel motor supported by said bed in a stationary position adjacent said cab and operatively connected to said boom support means for moving them fore and aft on said track means.

2. The field service truck of claim 1 having boom-retaining means connecting said travel motor to said boom winch at a ratio such that fore-and-aft movement of said boom means retains the upper end of said boom means at substantially the same height, so long as said boom motor is not simultaneously operated.

3. The truck of claim 2 wherein said boom-retaining means comprises a drum and a shaft on which said drum is supported, said shaft being driven by said travel motor, said boom cable passing from said boom winch to said drum via said upper end of said boom means.

4. The truck of claim 2 wherein said boom-retaining means comprises differential means between said boom winch and said boom motor and between said boom winch and said travel motor.

5. The truck of claim 1 wherein said boom means comprises at least one telescopic leg for extension and retraction.

6. The truck of claim 1 wherein said track means are supported above said bed, so as not to interfere unduly with the holding capacity of said bed.

7. A field service truck having a bed to the rear of its cab, comprising

a pair of tracks supported at each side of said bed, a boom comprising two converging beams with a hoist pulley at their upper meeting ends,

boom support means pivotally mounted to the lower end of each said beam and free of transverse members therebetween and mounted on the tracks for movement fore and aft therealong, said boom being able to swing up and down on the boom support means, due to the pivotal mounting, said boom being movable fore and aft of said bed without interfering with a load on said bed and without being interfered with by such a load,

a stationary boom winch secured to said bed near said cab and having cable means connected to the upper end of said boom for raising and lowering said upper end,

a stationary boom motor secured to said bed near said cab and operatively connected to said boom winch for operating it, and

a stationary hoist winch secured to said bed near said cab and having cable means connected over said hoist pulley and having a hoist fixture thereon that is raised and lowered by said hoist winch,

a stationary hoist motor secured to said bed near said cab and operatively connected to said hoist winch for operating it, and

a stationary travel motor secured to said bed near said cab and operatively connected to said boom support means for moving them fore and aft on said tracks.

8. The field service truck of claim 7 having differential means connecting said travel motor to said boom winch and said hoist winch, connecting said boom motor to said boom winch, and connecting said hoist motor to said hoist winch, at ratios such that fore-and-aft movement of said boom retains the upper end of said boom at substantially the same height

and retains the hoist fixture at substantially the same height, so long as said hoist motor and boom motor are not simultaneously operated.

9. The field service truck of claim 8 having means for intentionally operating said hoist motor while said travel motor is operating.

10. The field service truck of claim 8 having means for intentionally operating said boom motor while said travel motor is operating.

11. The field service truck of claim 7 having means for extending both of said boom legs simultaneously.

12. The field service truck of claim 7 having means for extending one leg of said boom a limited amount.

13. The field service truck of claim 7 wherein said truck bed has sidewalls and said tracks are supported above said bed by said sidewalls, so as not to interfere unduly with the holding capacity of said bed.

14. A field service vehicle having a cab and a bed to the rear of said cab, comprising:

a boom comprising two converging beams meeting at an upper end with a hoist pulley at the upper ends of said boom,

boom support means pivotally mounted to the lower end of each said beam, said boom being able to swing relatively to the boom support means and being free of transverse members so that said bed is left free for carrying a load, guide means at each side of said bed for guiding said boom support means fore and aft of said vehicle,

first stationary power means secured to said bed near said cab and operatively connected to said boom for swinging the upper end of said boom relative to its lower ends cable means connected over said hoist pulley and having a hoist fixture thereon,

second stationary power means secured to said bed near said cab and connected to said cable means for raising and lowering said fixture, and

third stationary power means secured to said bed near said cab and operatively connected to said boom support means for moving them fore and aft along said guide means.

15. The vehicle of claim 14 having first differential means operatively connecting both said first power means and said third power means by different paths to said boom at a ratio such that during fore-and-aft movement of said boom the upper end thereof is maintained at substantially the same

height and second differential means operatively connecting both said second power means and said third power means by different paths to said cable means at a ratio such that during fore-and-aft movement of said boom the hoist fixture is maintained at substantially the same height.

16. The vehicle of claim 14 wherein said vehicle has sidewalls on each side of said bed and said guide means are in said sidewalls.

17. A field service vehicle having a bed with sidewalls, comprising:

a pair of guide means supported by said sidewalls, one at each side of said bed, and located above said bed so as not to interfere with the holding capacity of said bed, an A-frame boom comprising two converging beams and a hoist pulley at its upper end,

boom support means pivotally mounted to the lower end of each said beam and mounted to said guide means for movement fore and aft therealong,

a chain having its ends secured to opposite ends of each said boom support means, for moving said boom fore and aft, a boom winch having cable means connected to the upper end of said boom for raising and lowering said upper end, a boom motor operatively connected to said boom winch for operating it,

a hoist winch having cable means connected over said hoist pulley and having a hoist fixture thereon that is raised and lowered by said hoist winch,

a hoist motor operatively connected to said hoist winch for operating it,

a travel motor operatively connected to said chains for moving said boom support means fore and aft on said guide means,

a first differential connecting said travel motor and said boom motor by different paths to said boom winch at a ratio such that during fore-and-aft movement of said boom, the upper end of said boom is maintained at substantially the same height, and

a second differential connecting said travel motor and said hoist motor by different paths to said hoist winch at a ratio such that during fore-and-aft movement of said boom, the hoist fixture is maintained at substantially the same height,

provided neither said hoist motor nor said boom motor is simultaneously operated.

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