Aug. 16, 1966 R. J. DORN 3,266,636

AUTOMATICALLY COUNTERBALANCED TRACTOR SIDE-BOOM CRANE

Filed June 30, 1965 3 Sheets-Sheet 1

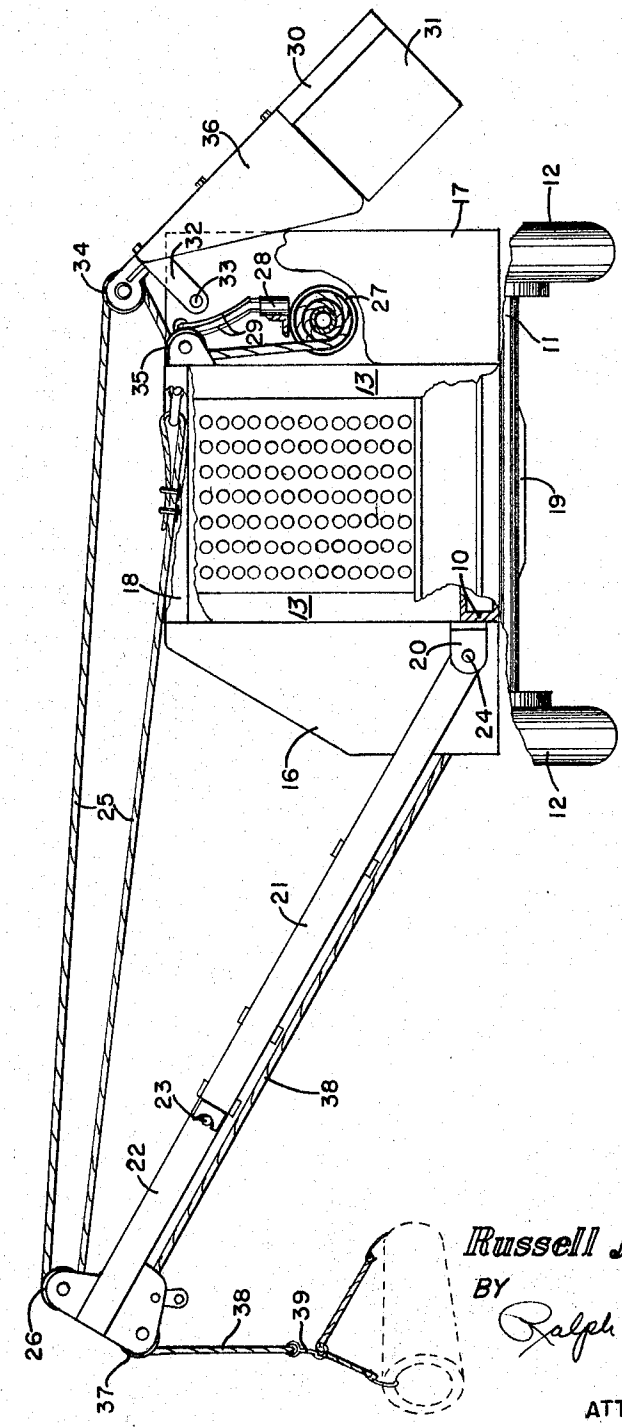


Fig. 1

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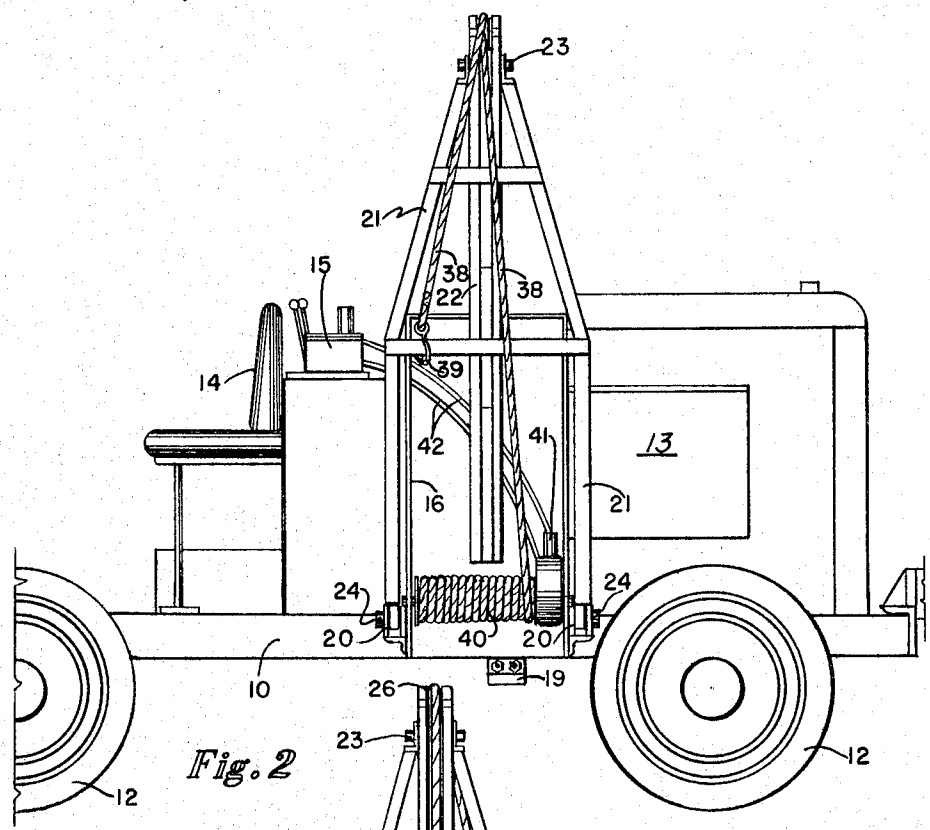


Fig. 2

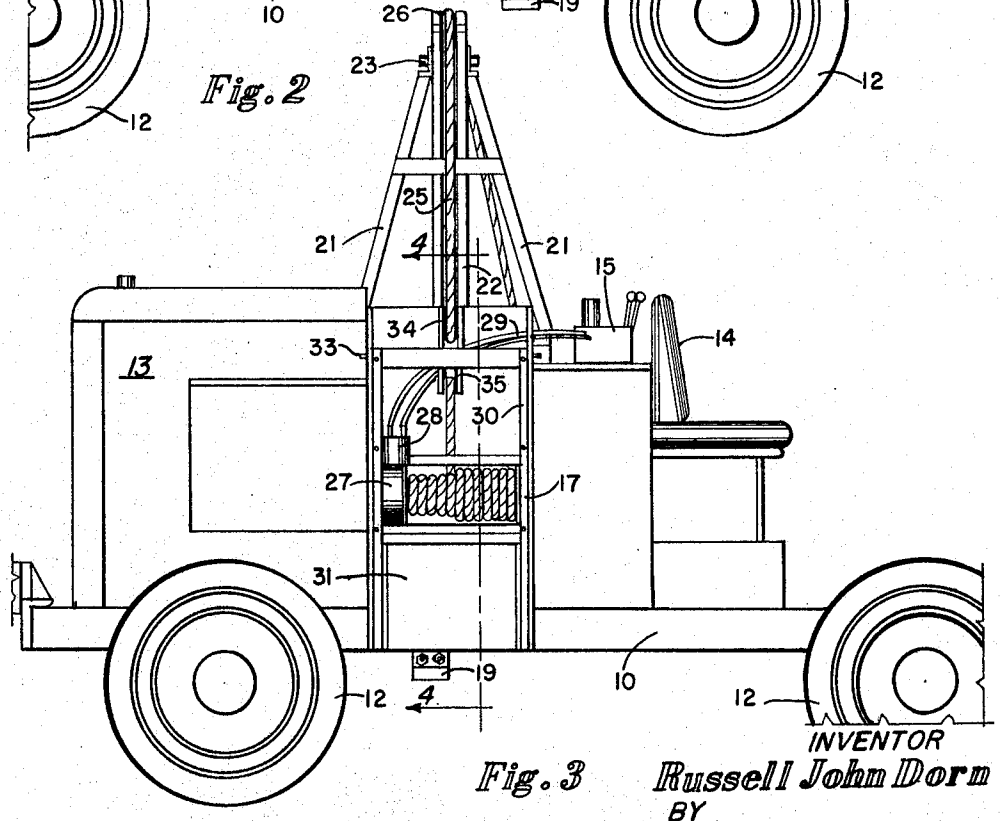


Fig. 3

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AUTOMATICALLY COUNTERBALANCED TRACTOR SIDE-BOOM CRANE

Filed June 30, 1965 3 Sheets-Sheet 3

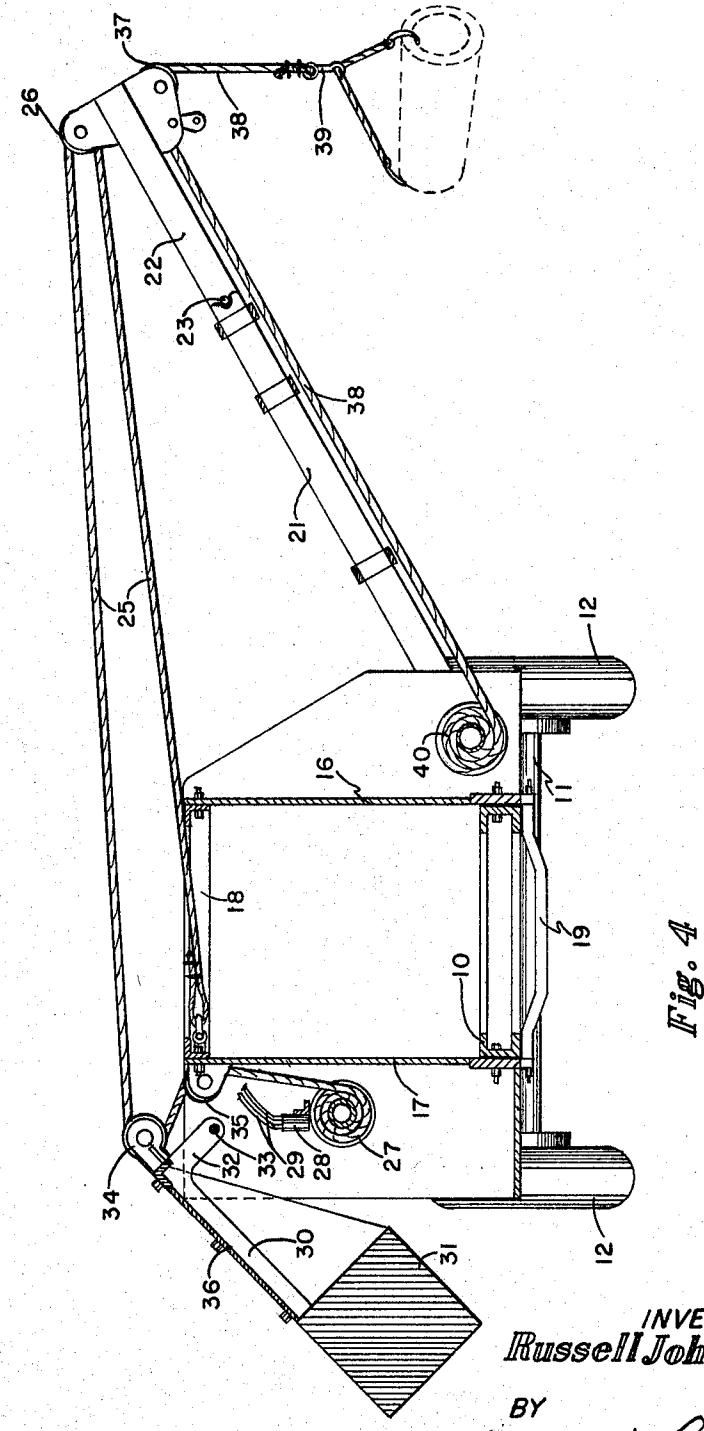


Fig. 4

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AUTOMATICALLY COUNTERBALANCED TRACTOR SIDE-BOOM CRANE

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8 Claims. (Cl. 212—8)

This invention relates to adjunctive equipment suited for operative association with self-powered, automotive vehicles, to supplement and extend the utility of the vehicle without impairment of its primary capabilities. More particularly, this invention relates to a jib crane organization adapted for use with a vehicle of conventional tractor type provided with a hydraulic, pressure-fluid system, and capable of applying the hydraulic power supply of the vehicle for hoisting functions.

The principal object of the invention is to provide a novel and improved crane unit that is arranged for assembly in operative attachment to a tractor without significant alteration of tractor elements and components.

Another object of this invention is to provide a novel and improved crane unit that is expedient of operative correlation with a tractor, in variable extension laterally therefrom.

A further object of the invention is to provide a novel and improved crane unit that is characterized by an advantageous and optionally-variable effective span directed laterally from its tractor mount.

Another object of the invention is to provide a crane unit of the above type having an enhanced and increased load-handling capacity relative to its tractor mount.

Still a further object of the invention is to provide a novel and improved crane unit of the foregoing character that effects in use automatic counterbalance of loads thereby engaged at a lateral separation from the tractor with tendency to careen the mount.

Still another object of the invention is to provide a novel and improved crane unit that is feasible of ready adaptation to use in side-mounted association with conventional tractors of diverse structural particularity.

A further object of the invention is to provide a novel and improved crane unit that is amenable to full operative control in side-mounted association with a tractor through simple connections served by the hydraulic system of the tractor.

A further object of the invention is to provide a novel and improved construction and intercorrelation of elements and features constituting a side-boom crane attachable to a tractor.

A further object of the invention is to provide a unitary side-boom crane attachment for a tractor that is expedient of economical production, facile of cooperative association with a tractor, functionally efficient over an extensive range of practical utility, responsive to convenient control in powered connection with the hydraulic pressure system of the tractor, and durably reliable in positive attainment of the ends for which designed.

With the foregoing and other objects in view, the invention resides in the form, construction, and operative combination of elements and features as hereinafter set forth, pointed out in the appended claims, and illustrated by the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of the improved crane as associated in one position of use with a tractor vehicle in accordance with the concept and principles of the invention, portions of the vehicle being broken away to reveal otherwise concealed relationships and a load engaged by the crane being represented by broken lines.

FIG. 2 is an elevational view of the arrangements according to FIG. 1 as seen from the left with the crane in non-use position.

FIG. 3 is an elevational view of the arrangements according to FIG. 1 as seen from the right with the crane in non-use position and with a housing member omitted for enhanced clarity of disclosure.

FIG. 4 is a section view taken transversely through and substantially in the plane of line 4—4 of FIG. 3, with the crane attachment positioned as in FIG. 1, extended portions of the latter being omitted to conserve space.

The economic merit and practical advantages of adapting tractor-type automotive vehicles for multiple specific uses have long been recognized, and it being abundantly manifest that the utility of tractors applied to facilitate many construction operations is much enhanced by the presence of a side-boom crane translatable with and powered by the tractor, the instant invention is directed to the provision of a unitary such facility suited for attachment to and use with conventional tractors of varying structural particularity.

Fragmentarily and diagrammatically illustrated, but to the extent requisite for understanding of the present invention, the tractor represented in the several views of the drawings is but exemplary of equivalent self-propelled vehicles supplied with hydraulic pressure systems having, as is conventional, a rigid main frame **10** supported for dirigible translation in generally-horizontal disposition by axles **11** and wheels **12**, a prime mover operatively carried by the frame, as within a housing **13**, an operator's station **14** on the frame, and a regulable supply of hydraulic pressure indicated by the control cluster **15** conveniently adjacent the station **14**, whereby to qualify in every essential respect for functional cooperation with the improved side-boom crane attachment.

Distinctively significant and primary to the concept and practice of the invention is the arrangement devised for relating the crane boom and its complements in operative association with the tractor by means interconnectible in laterally-embracing attachment to the tractor with but minor and immaterial modification of the tractor elements. Naturally variable in detail for coaction with tractors of different makes and sizes, the mount for the crane is comprised for assembly on the tractor as an inverted U-shaped yoke having wide, deep channel legs **16** and **17** secured at their lower ends to upstand in spaced, registered opposition vertically from the opposite side, or longitudinal, members of the tractor frame **10** and a rigid, rectangular, open plate **18** fixedly conjoining the upper ends of said legs laterally of, above, and parallel to the said tractor frame **10**.

Factors of applied load, stress, and the like, may commend reinforcement of the frame **10** members whereto the legs **16** and **17** are attached, which, while not always requisite and not specifically illustrated, is inherent in the contemplation of the invention and well within ordinary skill of the related art. Save for such contingency, the said legs are attached to the main tractor frame **10** without modification thereof other than the addition of the few bolt holes necessary to adequately secure the legs to the frame members. Contingent upon the nature and organization of the tractor frame **10** to which the improvement is applied, it may be desirable to couple the lower ends of the legs **16** and **17** with a stiff brace **19** fixed to span therebetween transversely of and beneath said frame, as shown, whereby to rigidify and consolidate the yoke mount in its attachment to the tractor.

Generally similar as channels rectangular in transverse section, the legs **16** and **17** are affixed to the frame **10** with their base portions spacedly parallel to outstand as U-shaped struts opening laterally and outwardly from the frame. One of the legs, designated **16**, designed to ful-

crum the crane boom is furnished with paired, apertured ears **20** exteriorly fixed adjacent the lower side corners of the leg where attached to the frame **10** in an arrangement to align the apertures of said ears as an axis of articulation spacedly paralleling the member of the said frame supporting said leg.

The crane boom is formed as a longitudinally-telescopic assembly characterized by a wide, rigidly-braced, forked base portion having counterpart arms **21** convergent to a terminal throat, and a straight, stiff girder **22** reciprocable through said throat longitudinally of and partially within the associated base portion, whereby the effective length of the boom may be adjusted at option as the girder is shifted in guided relation with the base portion and determined by a pin **23** entered through a selected one of a series of holes through the girder for such engagement with the notched ends of the arms **21** as inhibits shift of the girder inwardly of the associated base portion. Parallel in a separation suited for their engagement between the paired ears **20** at the opposite sides of the leg **16**, the spaced arms **21** at the forked end of the boom base portion are formed as eyes apertured to register in transverse alignment with the openings through said ears, whereby insertion of pins **24** through each pair of said ears and the end of the arm **21** received therebetween serves to hingedly connect the crane boom to the leg **16**, and therethrough to the tractor, for articulation on an axis parallel to the plane of the main frame **10** and consequent adjustment through a vertical arc at one side of the tractor in length-adjustable extension therefrom.

Regulation and adjustment of the so-mounted crane boom through its range of oscillation relative to the tractor to determine therewithin any desired angular attitude and consequent outward reach of the boom relative to the tractor is established through a flexible line **25** passed from attachment at one end to the plate **18** about a sheave **26** freely revoluble in a fixed mounting at and above the outer end of the girder **22** to operative connection at its other end with a winch **27** revolubly carried by the leg **17** with the winch axis spanning parallel to the main frame **10** between the complementary flanges of the leg. In any expedient conventional organization, the winch **27** is reversibly driven by an associated hydraulic motor **28** served by line **29** communicating with the hydraulic pressure system of the tractor in a usual manner through and for flow control by elements of the cluster **15**, whereby, as is manifest, selective actuation of the winch is made conveniently available to the tractor operator at the station **14**.

Since forces imposed upon and by the crane boom tending to careen the tractor are reflected as tensions in the line **25**, the variable such tensions are ingeniously utilized automatically to effect counterbalancing reaction to such forces. In furtherance of this application of the variable tension forces, a stirrup **30** is fixed in embracing relation with and at one side of a massive weight **31** receivable between the flanges of the leg **17**, and extends from said weight to terminate in angularly-related, end-apertured links **32**, spacedly overhanging the weight in a parallel separation receivable within the flanges of the leg **17**, whereto and wherebetween said stirrup is engaged, as on a shaft **33**, through the end apertures of the links **32** parallel to the main frame **10**. So mounted, the stirrup rocks laterally of the tractor with the weight **31** depending from an axis above the winch **27** in a disposition such as to normally bias the weight to reception within the lower portion of the leg **17** beneath said winch.

At the end of the stirrup **30** remote from the weight **31** a sheave **34** is bracket-mounted to rotate in spaced, coplanar relation with the sheave **26** in extension to clearing relation with the plate **18** and elements of the tractor and a complementary, coplanar sheave **35** is bracket-mounted at the conjunction of the leg **17** and plate **18** to rotate in inward, subjacent proximity to said sheave **34**, over and about which sheaves the line **25** is led prior to its connection to the winch **27** to pass from the sheave **26** first over and about the sheave **34** and then oppositely over and about the sheave **35** in its approach to the winch **27**, thus to confine the sheave **34** rockable with the stirrup **30** and weight **31** in a bight of the line **25** subject to the variable tensions of crane operation in such manner as to effect lateral rocking and angular extension of the weight relative to the tractor in reflection of the tensions manifest in the line **25**. The portion of the stirrup **30** open above the weight **31** may be housed in a boot **36** adapted to close exteriorly over contiguous components of the leg **17** as a protective cover for the winch **27** and its adjuncts.

Supplementary to the hoisting functions inherent in the altitudinally-adjustable organization of the crane boom as just set forth is the provision of separate, independently-powered means effective for the altitudinal translation of loads relative to the outer end of the crane boom in any and all operative dispositions of the latter. Obviously susceptible of variation in detail, the supplementary means just mentioned expediently may be constituted, as shown, as a sheave **37** freely rotatable coplanarly-subjacent the sheave **26** at the outer end of the girder **22**, a line **38** coacting with said sheave to establish a free fall terminating in a hook **39**, or equivalent connector, and a run subjacently paralleling the crane boom, and a winch **40** operatively accommodated between the flanges at the lower end of the leg **16** with its axis parallel to the plane of the main frame **10** in reversibly-driven association with its individual hydraulic motor **41** served through lines **42** communicating with the hydraulic system of the tractor under independent flow control at the cluster **15**, whereby, as is fully apparent, to qualify the winch **40** and associated line **38** for independent actuation by and at the option of the tractor operator for reciprocable manipulation of loads attached to the line in dependence from the outer end of the crane boom.

Functionally and structurally characterized as disclosed, the improvement of the invention is a practical facility expedient of association with a tractor having an hydraulic pressure system to therewith operate as hereinbefore discussed to advantageously extend the utility and enhance the capability of the tractor through consequent availability of a side-boom crane distinctively qualified as to potential and performance.

Since changes, variations, and modifications in the form, construction, and arrangement of the elements and features shown and described may be had without departing from the spirit of the invention, it should be understood that the scope of this invention is limited solely by the scope of the appended claims, rather than by any details of the illustrative showing and foregoing description.

I claim as my invention:

1. A side-boom crane for a tractor having a main frame dirigibly supported and powered for translation in a generally-horizontal attitude and an hydraulic pressure system, comprising a rigid yoke assembly laterally and upwardly spanning the tractor in fixed attachment at its lower ends to opposite sides of said frame, a boom end-hinged to one side of said yoke for vertical oscillation in a plane transverse of the tractor, winch means carried at the side of said yoke remote from the boom in powered relation with the hydraulic system of the tractor selectively actuable to angularly adjust said boom through its range of oscillation, counterweight means pivotally mounted to said yoke at the same side of said yoke as winch means, a first sheave means on said counterweight means, a second sheave means mounted on said yoke inwardly of said counterweight pivot, and cable means connected to said boom passing over said first sheave means, thence over said second sheave means to said winch means, whereby loads applied laterally of the tractor by said boom are automatically counterbalanced.

2. The organization according to claim **1**, wherein said yoke is constituted as a pair of counterpart, channel-form legs correspondingly end-affixed to the frame in registered

opposition to open laterally and outwardly of the frame in vertical extension thereabove and a plate parallel to the plane of said frame fixedly conjoining the upper ends of said legs.

3. The organization according to claim 1, wherein said yoke includes counterpart, channel-form legs correspondingly end-affixed to the frame in registered opposition to open laterally and outwardly of the frame in vertical extension thereabove, said boom is formed with a base portion forked to exteriorly embrace one of said channel-form legs adjacent its connection to the frame, and the forked extremities of the boom are pinned to the leg thereby embraced to articulate on an axis parallel to the plane of the frame adjacent the leg and frame conjunction.

4. The organization according to claim 1, wherein said boom is constituted as a base portion forked at one end to hingedly connect with the yoke and convergent at its other end to a longitudinally-directed, restricted throat, a girder reciprocable through said throat in guided relation with said base portion, and means for securing said girder in adjusted extension from said base portion and against retraction therewithin.

5. The organization according to claim 1, wherein said yoke includes counterpart, channel-form legs correspondingly end-affixed to the frame in registered opposition to open laterally and outwardly of the frame in vertical extension thereabove, the boom is embracingly hinged to one of said legs adjacent its conjunction with the frame, said winch means is operatively mounted with its axis parallel to the hinge axis of the boom within the channel of the leg remote from that engaged by the boom, said boom mounts at the outer end thereof, a sheave coplanar with the longitudinal axis of the boom, and said cable connects from end-attachment to said yoke about said boom sheave and said first and second sheaves to said winch.

6. The organization according to claim 1, wherein said yoke includes counterpart, channel-form legs correspondingly end-affixed to the frame in registered opposition to open laterally and outwardly of the frame in vertical extension thereabove, the boom is embracingly hinged to one of said legs adjacent its conjunction with the frame, said winch means is operatively mounted with its axis parallel to the hinge axis of the boom within the channel of the leg remote from that engaged by the boom and said cable connects about a sheave at the outer end of

the boom and about said first and second sheaves between said winch and end attachment to said yoke, and the counterweight means is pivoted to swing laterally of the tractor in the leg remote from the boom on an axis parallel to and above that of said winch, said first sheave embraced by said cable is mounted on said counterweight above and outwardly of the tractor from the hinge axis of the counterweight, and said second sheave engaged by said cable is mounted within said leg inwardly of the tractor from and below the sheave on the counterweight, whereby tensions manifest in the cable occasion proportional displacements of the counterweight relative to and laterally of the tractor.

7. The organization according to claim 1, wherein independent means are carried at the same side of the yoke as the boom in powered relation with the hydraulic system of the tractor selectively actuable as a hoist effective at the outer end of the boom.

8. The organization according to claim 7, wherein said yoke includes counterpart, channel-form legs correspondingly end-affixed to the frame in registered opposition to open laterally and outwardly of the frame in vertical extension thereabove, the boom is embracingly hinged to one of said legs adjacent its conjunction with the frame, and the independent means selectively actuable as a hoist effective at the outer end of the boom is a winch hydraulically powered for selective control operatively mounted with its axis parallel to the hinge axis of the boom within the channel of the leg engaged by the boom, a sheave coplanar with the longitudinal axis of the boom freely rotatable at the outer end thereof, and a flexible line connecting over said sheave between a free fall terminating in a connector and said winch.

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