

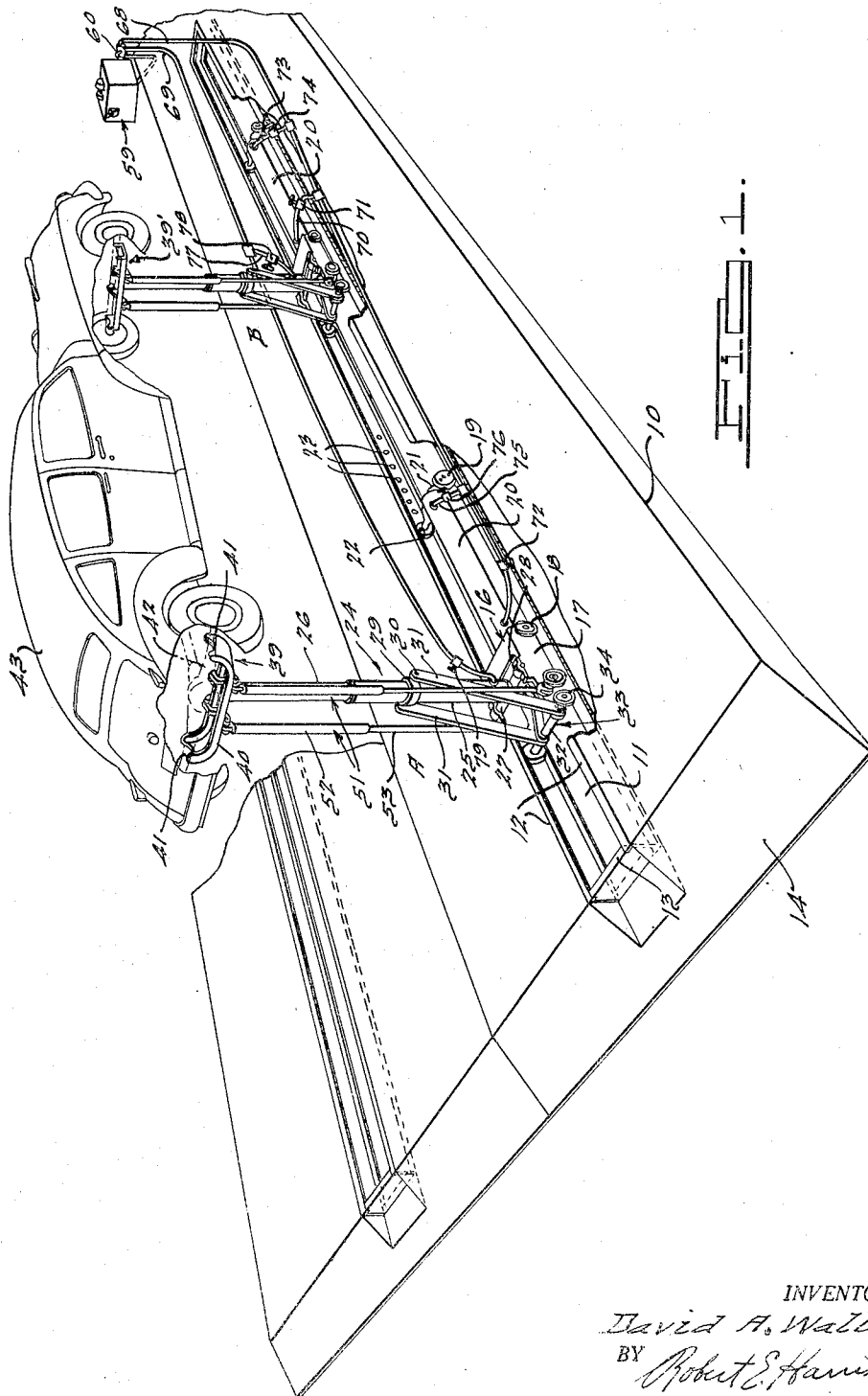
Nov. 27, 1951

D. A. WALLACE
HOISTING APPARATUS

2,576,907

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3 Sheets-Sheet 1



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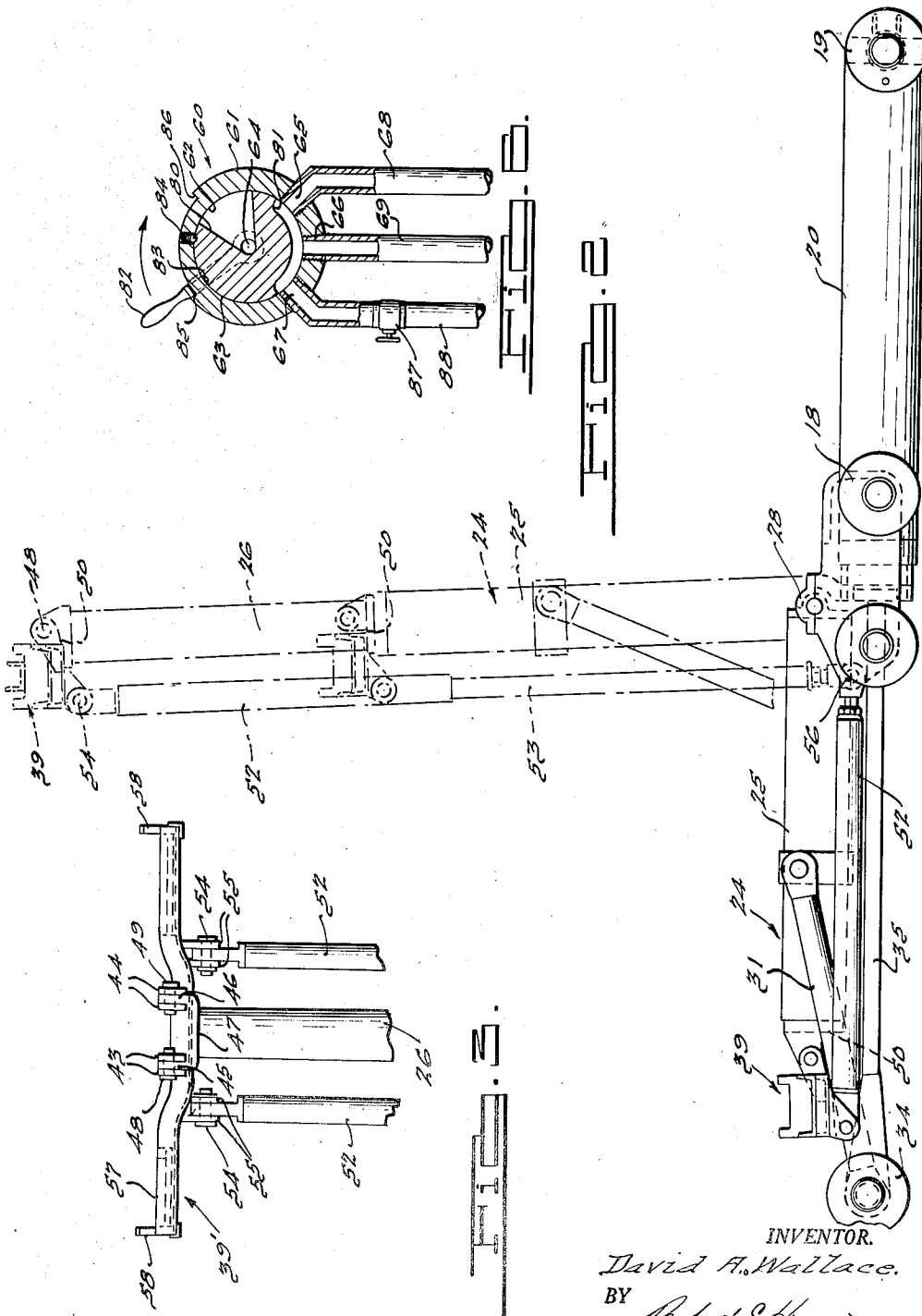
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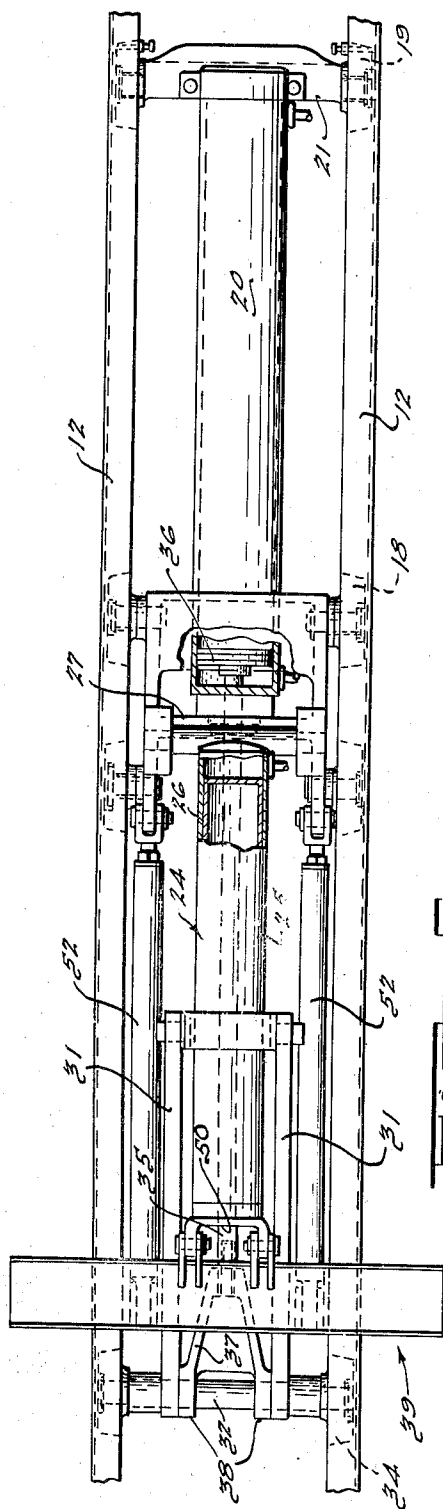


FIG. 5.

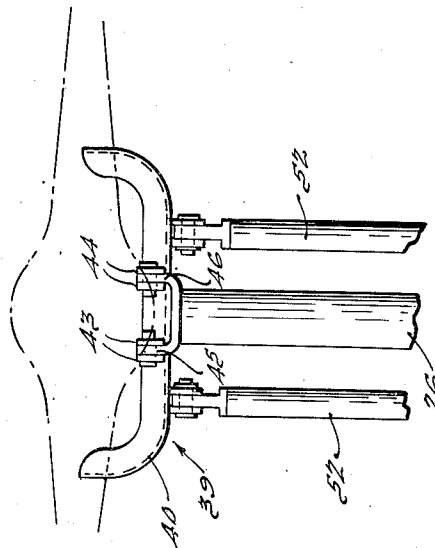


FIG. 4.

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HOISTING APPARATUS

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11 Claims. (Cl. 254—89)

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This invention relates to improved hoisting apparatus.

More particularly, the invention pertains to power actuated apparatus for hoisting vehicles.

One of the main objects of the invention is to provide hoisting apparatus of this character which can be conveniently installed in units of a desired number on the ground or higher floors of a building without requiring a pit in the ground floor or a chamber in the room below an upper floor for accommodation of any of the parts of the hoisting structure.

Another object of the invention is to provide hoisting apparatus which can be applied to an article from below it at a location in extremely close proximity to the level of the floor on which the apparatus is mounted.

Another object of the invention is to provide hoisting apparatus of this character which can be conveniently transferred from one location in a building to another.

Another object of the invention is to provide in hoisting apparatus of this kind, a boom member which, in lifting an object, may be rotated about an axis adjacent one end thereof from a horizontal position substantially parallel to the floor of a building to an approximately upright position and thereafter extend axially for increasing the elevation of the object, if desired.

A further object of the invention is to provide mechanism for rotating such a boom of hoisting apparatus of this character which includes linkage members that exert a toggle-like action upon the boom in rotating it about its pivoted end.

A still further object of the invention is to provide a pivoted seat member on the free end of the boom for receiving a portion of an object to be lifted, and mechanism articulated with the seat for maintaining it substantially horizontal, or at a predetermined relation to the horizontal, at all positions of the boom in its path of movement from horizontal to upright position.

Another object of the invention is to provide a pair of hoisting units of the foregoing character either one or both of which may be conveniently shifted relative to each other for adapting the hoisting apparatus to lift vehicles or other objects of diverse lengths.

Other objects of the invention are to provide fluid pressure operated mechanism for producing the rotative and extending actions of the boom of a hoisting unit of the foregoing character; to provide control apparatus for the fluid pressure operating mechanism by which the boom of a single unit or the booms of a plurality of units may be rotated to upright position and thereafter extended, and later contracted and subsequently rotated to horizontal position in the order recited.

An illustrative embodiment of the invention is shown in the accompanying drawing, in which Fig. 1 is a perspective view showing my im-

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proved hoisting apparatus employed for the purpose of hoisting a vehicle.

Fig. 2 is a side elevational view of a hoisting unit of the apparatus shown in Fig. 1, illustrating the boom structure of the unit in its lower and elevated positions.

Fig. 3 is a fragmentary elevational view of a supporting seat which is particularly adapted to receive the front end portion of the chassis of a vehicle.

Fig. 4 is a fragmentary elevational view of a supporting seat which is adapted to receive the rear axle housing of a vehicle.

Fig. 5 is a plan view, partly in section, of the hoisting unit shown in Fig. 2.

Fig. 6 is a sectional view diagrammatically illustrating a control valve of fluid pressure control mechanism with which the improved hoisting apparatus may be provided.

The improved hoisting apparatus shown in the drawing may be shiftably mounted on the floor of a building but is preferably provided with a platform 10 comprising concrete, wood or other suitable material having one or more longitudinally extending grooves 11, open at its upper surface. Spaced tracks 12 comprising channel bars having inwardly facing side flanges are disposed along the side walls of each groove 11. A removable end wall 13 is preferably provided at one extremity of the groove 11 for facilitating access to the end of the groove when desired. The platform 10 has an inclined ramp portion 14 at its left end, as viewed in Fig. 1, up which a vehicle or other object to be hoisted may be moved.

The apparatus shown in Fig. 1 includes a pair of substantially identical hoisting units A and B, the description of one of which will serve for both. While two hoisting units are preferably employed in hoisting a vehicle, only one may be employed for lifting the ends of a vehicle one at a time. Any desired number of hoisting units may be used as required by the nature of the object or load to be hoisted.

Each hoisting unit A and B comprises a base or carriage generally designated by the numeral 16 having a frame 17 on which are journaled two pairs of wheels 18. The carriage 16 includes another pair of wheels 19 which are spaced from the frame member 17 and rigidly connected thereto by a cylinder 20, hereinafter more fully described, and an axle member 21 on which the wheels 19 are journaled. The wheels 19 are provided with holes 22 which register with holes 23 in the flanges of the channel bars 12 for receiving pins (not shown) by which one or both of the hoisting units may be releasably fixed in a selected position longitudinally of the track.

A boom structure, generally designated by the numeral 24, is pivotally mounted at one end on the frame 17 of the carriage 16 for rotation about a substantially horizontal axis. The boom

structure includes a lower section 25 comprising a cylinder and a tubular upper section 26 which is axially shiftable mounted in telescoping relation in the lower section 25. The cylinder of which the lower boom section 25 consists has a closed end at its right extremity, as viewed in the drawings, and this end of the tube is rigidly fixed to a transverse shaft 27 which is journaled in bearings 28 mounted on the carriage frame 17. The cylinder included in the upper section 26 has a closed right end and the walls of the cylinders of the upper and lower boom sections 26 and 25, respectively, fit sufficiently close to form a substantially fluid tight seal therebetween in order that the cylinder 26 of the upper boom section will act as a piston within the cylinder of the lower boom section when fluid pressure is admitted, as hereinafter described, into the right end of the cylinder 25, as viewed in Fig. 6.

A ring 29 surrounds and is fixed to the lower boom section 25 and provided with trunnions 30 on which levers 31 are journaled adjacent their right ends as viewed in Fig. 5. The left ends of the levers 31 are journaled on an axle 32 of a wheel and axle assembly 33 having wheels 34 disposed between the side flanges of the channel bars 12 and movably supported by the latter. The wheel and axle assembly 34, together with the ends of the links 31 attached thereto, are adapted to be drawn toward and forced away from the carriage 16 by a piston rod 35 extending into the actuating cylinder 20 and having a piston 36 on its inner end. The outer end of the piston rod 35 is connected with the assembly 33 by a yoke 37 attached to the piston rod and having diverging arm portions 38 journaled on the axle 32. The links 31 serve as a toggle member in rotating the boom structure from its lower full line position to its elevated position shown in dotted lines in Fig. 2 under the action of the piston rod 35 as the latter is moved inwardly of the cylinder 20, from its extended position by the admission of fluid under pressure to the left end of cylinder 20, as hereinafter more fully described. These links 31 are preferably so predetermined in length as to hold the boom structure 24 from reaching a true vertical position in order to make certain that the load on the boom structure will bias it in a counter-clockwise direction as viewed in Fig. 2 and towards its lower position. The piston 36 and piston rod 35 may be urged leftwardly by the admission of fluid pressure to right end of the cylinder 20, as hereinafter described, for the purpose of lowering the boom structure 24 to its lowermost position after the load has been removed from the boom.

In order to reduce the torque required to rotate the boom structure 24 about its pivotal axis this rotation is produced while the upper section 26 of the boom is in contracted position within the lower boom section 25. The upper boom section 26 may be extended to bring the load to a desired elevation after the boom structure is in its substantially upright position by admitting fluid pressure to the lower end of the cylinder of the lower boom section 25.

While hoisting units embodying the invention may be used for lifting diverse objects, the units A and B shown in the drawings are provided with load-receiving seats which are particularly adapted to receive portions of front and rear ends of a vehicle. The load-receiving seat 39 of the hoisting unit A comprises a channel member 40 having upturned end portions provided

with notches 41 for receiving the rear axle housing 42 of the vehicle 43. The channel member 39 is provided with spaced pairs of arms 43 and 44 between which are received side flanges 45 and 46, respectively, of a head structure 41 rigidly mounted on the upper boom section 26. The arms 43 and 44 are pivotally attached to the flanges 45 and 46 by pins 48 and 49, respectively, which extend through registering apertures in the associated flanges and arms. The head structure 41 is provided with an abutment surface 50 which is disposed substantially horizontally when the boom structure is in its substantially upright position and upon which the seat 39 rests while the boom structure is in the latter position.

The load-receiving seat 39 is maintained in substantially horizontal load-receiving and supporting position throughout the entire range of rotative movement of the boom structure 24 by parallelogram mechanism which comprises a pair of link members generally designated by the numeral 51. Each link member 51 comprises a pair of link sections 52 and 53. The upper section 52 of each link is pivotally attached at 54 to spaced arms 55 rigidly mounted on the load-receiving seat 39. The lower link sections 53 are pivotally attached at 56 to the frame structure 17 of the carriage 16, as shown in Figs. 1 and 2. The distance between the pivotal axis at 54 of the connection between each upper link section 52 and the load-receiving seat, and the distance between the pivotal axis at 56 of the connection between each lower link section 53 and the carriage frame 17 are substantially equal. Thus, during pivotal movement of the boom structure between its lower and upright positions, the links 51, which are in their contracted positions, serve to cooperate with the boom structure in providing a parallelogram control action which retains the load-receiving seat 39 in substantially the same position with respect to a horizontal plane throughout the entire range of pivotal movement of the boom structure 24. When the sections of the boom structure are extended, the links 51 also extend to accommodate upward movement of upper boom section 26. When this action takes place, the seat 39 is supported in load sustaining position by engagement with the abutment surface 50 on the head structure 41 provided on the upper boom section 26.

Since the hoisting units A and B are substantially identical, with the exception of the load-supporting seat structures thereof, the description of the unit A will serve for both. The corresponding parts of the units are designated by the same numerals. The seat of the unit B, which is shown in Fig. 3, is generally designated by the numeral 39' and includes a channel member 57 having notched end pieces 58 adapted to receive portions of the front end of a vehicle for supporting it as illustrated in Fig. 1.

The hoisting apparatus may be provided with any suitable fluid pressure supply system. In the drawings is illustrated a fluid pressure supply system which is particularly adapted for the application of the hoisting apparatus to the lifting of vehicles. This system includes a fluid pressure-creating unit diagrammatically illustrated in Fig. 1 and generally designated by the numeral 59. Inasmuch as any of a large number of commercially available fluid pressure-creating devices may be employed, a detailed description thereof is not herein set forth. The fluid pres-

sure-creating unit 59 supplies fluid under pressure to a manually controllable valve generally designated by the numeral 60, and shown somewhat in detail in Fig. 7. The valve 60 comprises a stationary casing 61 of generally cylindrical shape having a cylinder 62 in its interior in which is rotatably mounted a movable valve element 63. The casing 61 is provided with an inlet port 64 communicating with the central portion of the cylinder 62 through which fluid under pressure is supplied to the interior of the valve from the fluid pressure-creating unit 59. The valve casing 61 has two outlet ports 65 and 66 and an exhaust port 67. Conduits 68 and 69, preferably comprising flexible hose, communicate with outlet ports 65 and 66 and extend from the valve along the channel 11 so as to serve the cylinders 20 which rotate the boom structures of the hoisting units A and B and the cylinders 25, respectively, of the boom structures thereof by which the boom structures are extended. As shown in Fig. 1, the conduit 68 has a branch 70 leading to the left end of cylinder 20 of unit B, in which is included a shut-off valve 71. The left end of the conduit 68 is provided with a shut-off valve 72 and it communicates with left end of the cylinder 20 of unit A. A branch conduit 73 having a shut-off valve 74 leads from the conduit 68 and communicates with the right end of the cylinder 20 of a unit B. A branch conduit 75, having a shut-off valve 76 leads from the conduit 68 and communicates with the right end of the cylinder 20 of unit A. The conduit 69 has a branch 77, provided with a shut-off valve 78, communicating with the lower end of the cylinder 25 of unit B, as viewed in Fig. 1, which corresponds to the right end of the cylinder 25 when the boom structure is in the position shown in Fig. 6. The left end portion of the conduit 69 has a shut-off valve 79 and it communicates with the lower end of the cylinder 25 of hoisting unit A.

The movable valve element 63 has a V shaped notch 80 to which fluid under pressure is supplied from the inlet 64 and it is provided with a peripheral recess 81 of sufficient length to connect both ports 65 and 66 with the exhaust 67 when the movable valve element is in the position shown in Fig. 7, at which time the notch 80 is out of registration with 65, 66 and 67 and both conduits 68 and 69 and the cylinders connected therewith are exhausted if the individually operable shut-off valves 71, 72, 74, 76, 78 and 79 are open.

The first step of clockwise rotation of the valve member 63 from the position shown in Fig. 6 brings the notch 80 into communication with only the port 65 and conduit 68. This movement of the valve member, which may be effected by manipulation of the handle, causes an indentation 83 in the periphery of the valve member 80 to move into registration with a spring-pressed detent 84 shiftably mounted in the wall of the valve casing 61 for the purpose of establishing the intermediate position of the valve member 63. The opposite limiting positions of the valve member 63 are established by engagement of the handle 82 with shoulders 85 and 86, respectively, on the outer periphery of the valve casing 61.

When the valve member 63 is in its intermediate position, fluid under pressure may be simultaneously supplied to only the left ends of the cylinders 20 of the hoisting units A and B if valves 72 and 71 are open and valves 76 and 74

are closed. The fluid pressure thus admitted to cylinders 20 of both units simultaneously rotates the boom structures 24 of both units from their substantially horizontal to their substantially upright positions. Further clockwise movement of the valve body 63 to its rightward limiting position brings the notch 80 into communication with each of the ports 66 and 65 at the same time and consequently fluid pressure is maintained in the conduit 68 and is introduced into the conduit 69. If at this time shut-off valves 79 and 78 are open, the upper sections 26 of the boom structures 24 of each unit are extended simultaneously to their outermost positions, thus lifting a vehicle to the position shown in Fig. 1. Either boom structure may be retained in its lower position while rotatively elevating the other by suitable manipulation of the shut-off valves associated therewith prior to opening of the main control valve 60. Likewise, either one of the upper sections of the boom structure may be extended while the other remains in contracted position by proper manipulation of the shut-off valves 77 and 79.

The vehicle may be lowered to floor level by first returning the valve member 63 to its intermediate position and retaining it in such position until the fluid pressure is exhausted from the cylinder 25 by flowing from the conduit 69 through the recess 81 to the exhaust port 67 which, in this position of the valve, connects only the latter conduit with the exhaust conduit 67. This operation permits the outer sections 26 of the boom structures of both units to shift to their retracted positions under the weight of the vehicle. When the outer boom sections 26 have been fully retracted, the valve member 63 is then returned to the position shown in Fig. 6 and fluid pressure is exhausted from the conduit 68 through the recess 81 and exhaust port 67. This action exhausts the fluid pressure from the cylinders 20, thus accommodating counter-clockwise rotation of the contracted boom structures 24 under the load of the vehicle toward their lower positions. If the weight of the vehicle is received by the platform 10 before the boom structures are returned to their lowermost positions, then the boom structures may be rotated further downwardly by closing the valves 71 and 72 and opening valves 73 and 76 and thereafter moving the valve member 63 to its intermediate position so as to supply fluid pressure only to the right ends of the cylinders 20, thus forcing the pistons of the latter to their extreme left hand positions.

It is believed to be obvious that the hoisting units may be operated individually by suitable setting of the appropriate shut-off valves. The various shut-off valves may also be employed to retain fluid under pressure in the cylinders of the apparatus without relying upon a continued supply of fluid pressure through the valve 60. The rate of lowering movement of hoists may also be adjustably predetermined by manipulation of a valve 87 in an exhaust conduit 88 leading from the exhaust port 67.

By virtue of the design and construction of the foregoing hoisting apparatus, it may be employed on any floor of a building without requiring accommodation of any portion of the apparatus in the space below the floor on which it is mounted. The torque required to rotate the boom structure 24 of the apparatus is held to a reasonably low value by rotating it while in a contracted position and thereafter extending it while in a substantially upright position. A

pair of hoisting units of the kind described may be readily positioned for receiving vehicles or other objects of various dimensions. Several tracks may be provided in a floor or platform as shown in Fig. 1 and the hoisting units may be shifted from one to the other, as required. The control valve 60 may be relied upon to simultaneously rotate both or either hoisting unit to an upright position and to thereafter extend both or either of the boom structures. This valve mechanism also serves to first effect contraction of the boom structures and to thereafter rotate them to their lower positions.

The load-receiving seat structures 39 of the boom structures are maintained in a proper load supporting position throughout the entire range of rotative movement of the boom structures and when the latter are in their substantially upright positions, the load supporting seats are positively held in horizontal positions by engagement with the abutment surfaces 50 on the upper ends of the sections 26. An effective toggle-like action involving relatively low frictional resistance is utilized for rotating the boom structures.

Although but one specific embodiment of the invention is herein shown and described, it will be understood that various changes in the sequence of operations, steps and materials employed may be made without departing from the spirit of the invention.

I claim:

1. Hoisting apparatus including a base structure, a boom member pivotally mounted adjacent one of its end portions on said base structure, elevating mechanism for rotating said boom member from a horizontal to a substantially upright position including a toggle element pivoted at one end to said boom member and having means shiftably mounting its opposite end for movement toward and away from said base structure, power actuating means connected with said toggle element for moving the shiftable end of the latter toward and away from said base structure to elevate and lower said boom member, respectively, a seat shiftably mounted on the free end of said boom member for receiving an object to be elevated, and means for shifting said seat relative to said boom member during rotative movement of the latter about its pivotal axis to maintain said seat in a fixed relationship to a horizontal plane throughout all positions of rotative movement of said boom member, said means including an extensible and contractible element for accommodating extension and contraction of said boom member.

2. Hoisting apparatus including a base structure, a boom member pivotally mounted adjacent one of its end portions on said base structure, elevating mechanism for rotating said boom member from a horizontal to a substantially upright position including a toggle element pivoted at one end to said boom member and having means shiftably mounting its opposite end for movement toward and away from said base structure, power actuating means connected with said toggle element for moving the shiftable end of the latter toward and away from said base structure to elevate and lower said boom member respectively, a seat pivotally mounted on the free end portion of said boom member for receiving an object to be elevated, said seat and boom member having registering abutment surfaces spaced from the pivotal axis of said seat and engageable for maintaining the latter in a

substantially horizontal load supporting position when said boom member is in its upright position, and parallelogram mechanism for maintaining said seat in said position during rotative movement of said boom member from its horizontal to its upright position.

3. Hoisting apparatus including a base structure, a boom member pivotally mounted adjacent one of its end portions on said base structure, mechanism for rotating said boom member about its pivotal axis, a seat shiftably mounted on the free end of said boom member, means for shifting said seat relative to said boom member during rotative movement of the latter about its pivotal axis to maintain said seat in a fixed load supporting relationship with respect to a horizontal plane throughout the range of rotative movement of said boom member and registering abutment surfaces on said seat and boom member engageable with each other for maintaining said seat in a substantially horizontal load supporting position when said boom member is in its upright position.

4. Hoisting apparatus including a base structure, a boom member pivotally mounted adjacent one of its end portions on said base structure, mechanism for rotating said boom member about its pivotal axis, a seat pivotally mounted on the free end portion of said boom member for receiving an object to be elevated, said seat and boom member having registering abutment surfaces spaced from the pivotal axis of said seat and engageable for maintaining the latter in a substantially horizontal load supporting position when said boom member is in its upright position, and parallelogram mechanism for maintaining said seat in said position during rotative movement of said boom member from its horizontal to its upright position.

5. Hoisting apparatus including a base structure, a boom member pivotally mounted adjacent one of its end portions on said base structure for movement about a substantially horizontal axis, said boom member comprising an axially extensible and retractable section, means for extending and retracting said section of said boom member, mechanism for rotating said boom member about its axis between substantially horizontal and substantially upright positions, a load-carrying seat pivotally mounted on the outer end portion of said section of said boom member, means connected between said base structure and seat for pivotally moving said seat relative to said boom member in timed relation to relative movement of said boom member to maintain said seat in a fixed load-supporting relationship with respect to a horizontal plane throughout the range of pivotal movement of said boom member, said last mentioned means including an axially extensible and contractable link for accommodating extension and retraction of said section of said boom member when the latter is in upright position, and registering abutment surfaces on said section of said boom member and said seat respectively, spaced from the pivotal axis of said seat and engageable for maintaining said seat in a load-supporting position when said boom is in its upright position.

6. Vehicle hoisting apparatus including spaced tracks, a pair of hoisting units shiftably mounted on said tracks each including a carriage having wheel members confined on said tracks, a boom structure pivotally mounted adjacent one of its ends on each of said carriages respectively, mechanism for rotating the boom structure of

each unit from a relatively horizontal position to a substantially upright position, said mechanism of each unit comprising a lever member pivotally attached at one end to said boom structure and shiftably and pivotally connected at its 5 opposite end to said tracks and comprising an actuating unit for shifting the last mentioned end of said lever member toward said carriage for elevating said boom structure, a seat element on the free end of the boom structure of each 10 unit for respectively receiving a portion of the front and rear ends of a vehicle, and means for releasably fixing the carriage of one of said hoisting units to said tracks.

7. Vehicle hoisting apparatus accommodatable substantially entirely within the space above a level of a floor including a pair of hoisting units each comprising a shiftable floor supported carriage, an extensible and retractable boom structure having a lower section pivotally mounted on said carriage for rotative movement about a substantially horizontal axis and an upper section axially shiftable mounted on said lower boom section and having fluid pressure actuating mechanism for extending said boom sections from a contracted relationship, mechanism for 20 rotating said boom structure from its lower position adjacent said floor level to its elevated position including a toggle member pivotally attached at one end to said lower boom section and having means on its opposite end for shiftably supporting it upon said floor and including fluid pressure actuating means for shifting the last mentioned end of said toggle member toward said carriage for rotating said boom structure from its lower position to its elevated position, a seat element on the upper section of the boom structure of each hoisting unit for respectively receiving a portion of the front and rear ends of a vehicle, and a fluid pressure supply system for the fluid pressure actuating means of said boom structure rotating and extending mechanisms including control apparatus having a shiftable valve member and ports controlled thereby, said ports being so constructed and arranged as to simultaneously first supply fluid pressure to the boom rotating mechanism of each hoisting unit and to thereafter simultaneously supply fluid pressure to the boom extending mechanism of each hoisting unit in response to shifting of said valve member in a single direction.

8. Hoisting apparatus including a base structure, a boom member, means shiftable mounting said boom member on said base structure for movement from a generally horizontal position to an upright position, mechanism for shifting said boom member from its generally horizontal position to its upright position, a seat pivotally mounted on the upper end of said boom member for receiving an object to be elevated, said seat and boom member having registering abutment surfaces spaced from the pivotal axis of said seat and engageable for maintaining the latter in a substantially horizontal load supporting position when said boom member is in its upright position, and parallelogram mechanism for maintaining said seat in said position during rotative movement of said boom member from its generally horizontal to its upright position.

9. Hoisting apparatus including a base structure, a boom member comprising relatively axially extensible and contractable sections, means shiftable mounting said boom member on said base structure for movement from a generally 75

horizontal position to an upright position, mechanism for shifting said boom member from its generally horizontal position to its upright position, apparatus for axially extending said boom member, a seat pivotally mounted on the upper end of said boom member for receiving an object to be elevated, said seat and boom member having registering abutment surfaces spaced from the pivotal axis of said seat and engageable for maintaining the latter in a substantially horizontal load supporting position when said boom member is in its upright position, and parallelogram mechanism for maintaining said seat in said position during relative movement of said boom member for its generally horizontal position to its upright position including a link element comprising extensible and contractable sections for accommodating extension and contraction of said boom member.

10. Vehicle hoisting apparatus including spaced tracks, a pair of hoisting units shiftable mounted on said tracks each including a carriage having track engaging members confined on said tracks, a boom structure pivotally mounted adjacent one of its ends on each of said carriages respectively, mechanism for rotating the boom structure of each unit from a relatively horizontal position to a substantially upright position, said mechanism of each unit comprising a lever system pivotally connected at one end to said boom structure and shiftably and pivotally connected at its opposite end to said tracks and comprising an actuating unit for producing relative shifting movement between the last mentioned end of said lever system and said carriage for elevating said boom structure, a seat on the free end of the boom structure of each unit for respectively receiving a portion of the front and rear ends of a vehicle, and means for releasably fixing one of said hoisting units to said tracks.

11. Hoisting apparatus comprising a base structure, a boom member having a load receiving seat on one end, a carriage pivotally supporting the other end of said boom member and shiftable mounted on said base structure, link means pivotally connected at one end to an intermediate portion of said boom member, a second carriage on said base structure, means pivotally connecting the other end of said link means to said second carriage, and mechanism for shifting said boom member from a generally horizontal to a generally vertical position comprising a cylinder fixed to one of said carriages and a piston member fixed to the other carriage and slidably engaged in said cylinder and including means communicating with said cylinder for supplying a fluid medium to said cylinder to urge one of said carriages toward the other.

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