

March 23, 1965

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3,174,722

LOAD LIFTING DEVICE

Filed Sept. 17, 1962

3 Sheets-Sheet 1

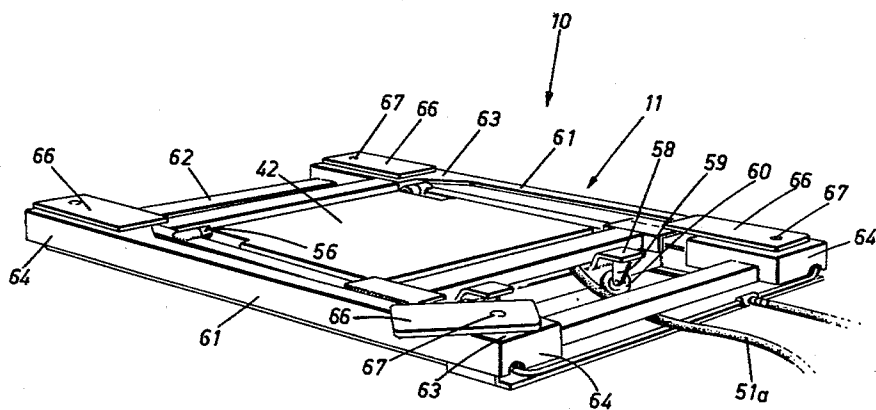
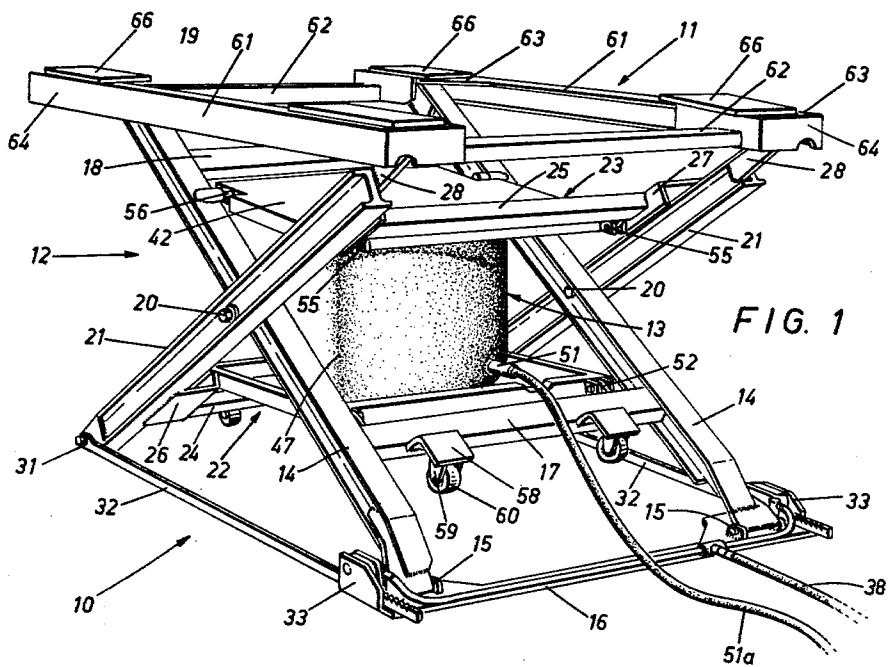


FIG. 3

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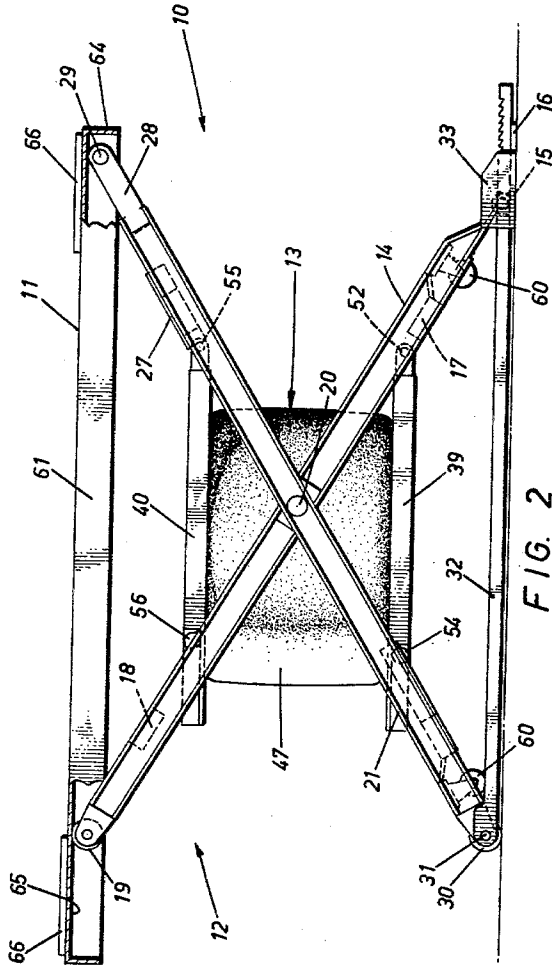


FIG. 2

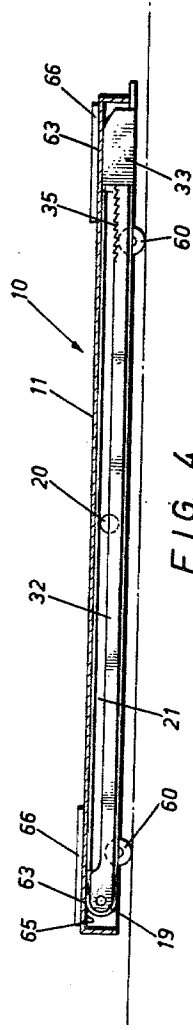


FIG. 4

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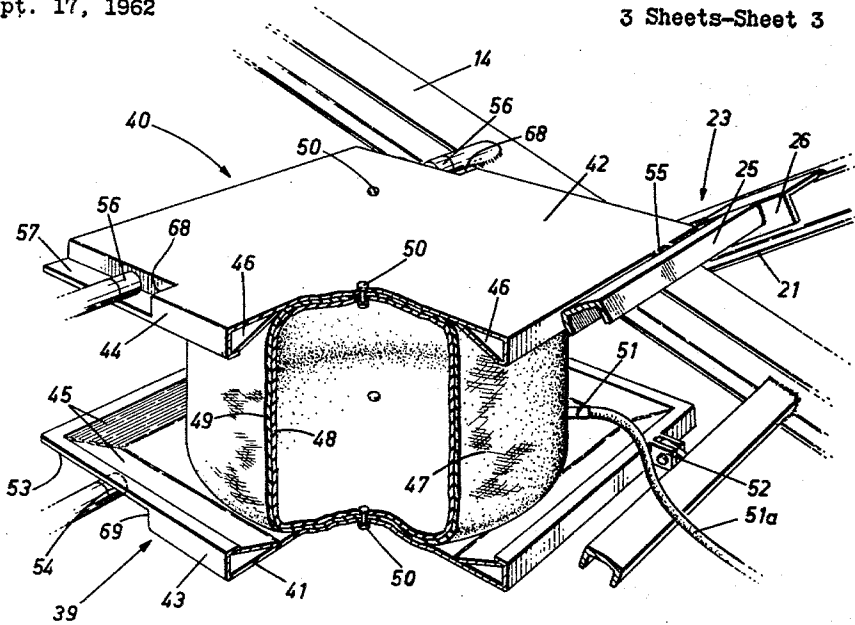


FIG. 5

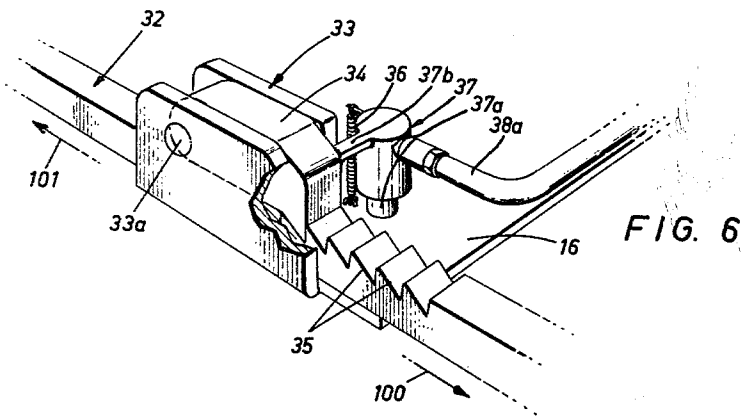


FIG. 6

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LOAD LIFTING DEVICE

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This invention relates to improvements in devices for lifting and supporting loads and particularly for lifting and supporting vehicles for inspection, repair, maintenance or for any other purpose.

The principal object of this invention is to provide a lift or hoist of relatively light-weight construction, readily movable from one location to another and which does not require anchoring, but merely rests upon a supporting surface in the position selected to engage and lift the load.

Another important object is to provide a hoist which is collapsible into a compact form readily disposable beneath a vehicle, and for storage, the hoist being easily manipulated thereunder to place it in the zone appropriate for lifting and supporting the vehicle.

Still another object is to provide apparatus capable of developing power sufficient to raise quite heavy loads, quickly, over a determined range of adjustment; to provide apparatus which is safe; and further to provide apparatus which can be manufactured economically.

Still another object of this invention is to provide a lift or hoist which incorporates integral means upon which it can be moved over a support surface from one location to another.

The principal feature of this invention resides in providing a load-engaging platform formation which is supported from below upon extensible lever formations arranged in spaced parallel relation, operable contemporaneously by a displaceable fluid pressure operated mechanism to raise and lower the load-engaging platform formation, the latter mechanism being mounted upon and extending between the extensible lever formations only.

More particularly a very important feature resides in rigidly securing opposing like members of the extensible lever formations together to ensure uniform extension, and hence horizontally of the load-engaging platform.

Still another feature resides in employing a fluid-pressure-operated mechanism in the form of an inflatable member of predetermined configuration which inflatable member is constrained against ballooning under inflation and has the characteristic of being extensible substantially solely in a single direction, there being associated with the inflatable member, opposing platform formations secured to the aforementioned extensible lever formations and displaceable therewith and adapted to bear against the ends of the cylindrical inflatable member which, under inflation of the inflatable member, are forced apart to extend the extensible lever formations.

Another feature resides in providing casters mounted upon the lever formations which upon the collapse thereof depend below the extensible lever formations to bear upon the supporting surface, the mounting of the casters being so arranged that the weight of the descending load engaging platform formation and consequent compact disposition of the platform and lever formations moves the casters into contact with the supporting surface, with the platform and lever formations being urged upwardly of the casters and retained in that position by inter-engaging supports carried by the lever formations resulting in the weight of the apparatus being taken solely by the casters.

These and other objects and features will be found in the following specification to be read in conjunction with the sheets of drawings in which:

FIGURE 1 is a perspective view of a hoist, con-

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structed in accordance with the invention, in the extended position.

FIGURE 2 is a side elevational view of the apparatus of FIGURE 1.

FIGURE 3 is a perspective view of the apparatus of FIGURE 1 in the collapsed state.

FIGURE 4 is a vertical mid sectional view of the apparatus in the collapsed state taken along lines 4—4 of FIGURE 3.

FIGURE 5 is a perspective view of the fluid pressure-operated expansible cylinder of the apparatus of FIGURE 1, with the extensible support formation and load-engaging frame broken away and with a portion of the wall of the cylinder cut away.

FIGURE 6 is a perspective view of the safety mechanism employed with the apparatus of FIGURE 1.

Where understanding has not been impaired, in the following specification and drawings, the same numerals have been used to designate parts of like function but of opposite symmetry for purposes of clarity.

In FIGURES 1 and 2 the hoist 10 is illustrated in the extended load-supporting position. Hoist 10 consists of a load-engaging platform formation 11, uppermost, an extensible support formation 12, and a fluid-pressure-operated mechanism 13 for extending or elevating the support formation 12.

Support formation 12 comprises essentially a first pair of steel I-beam members 14 and a second pair of I-beam members 21, pivoted together on aligned pivots 20. The lower extremities of members 14 are hingedly connected as at 15 to a transversely extending base plate 16, and braced laterally adjacent to their lower ends by a channel member 17 and adjacent to their upper ends by a similar channel member 18.

Uppermost, as best seen in FIGURES 2 and 4, members 14 are provided with rollers 19 which are adapted to bear against a lower bearing surface of the load-engaging platform 11 as will be explained.

Members 21, likewise, are provided with lower brace members 22 and upper brace members 23, each of which consist of intermediate channel portions 24, 25, and outer channel portions 26, 27, respectively, channel portions 26 opening upwardly and channel portions 27 opening downwardly to receive the adjacent sections of members 14 when the hoist is collapsed into the form shown in FIGURES 3 and 4.

Members 21 are each provided, adjacent to their upper ends, with a rigid plate 28 extending axially which is pivotally connected as at 29 to the load-engaging platform 11 as best seen in FIGURE 2.

Members 21 are provided at their lower ends with surface-engaging rollers 30 mounted on suitable pivots 31. Connected by each of the pivots 31 to the members 21 and located outwardly thereof is a pair of elongated rack members 32 which extend longitudinally of the hoist 10, the opposite ends thereof being located within a channel shaped guide formations 33, located at each end of base plate 16 and immediately adjacent the lower ends of the members 14.

Mounted on pivot 33a to extend between the walls of each of the channel-shaped guide formations 33 is a pawl 34, swingable to engage in teeth 35 of each rack 32, the teeth and pawl being configured such that upon extension of the members 14 and 21 upwardly, the pawl rides over the teeth 35, with the racks 32 moving in the direction of the arrow 100. As shown in FIGURE 6, the pawl 34 will positively engage the teeth 35 in sequence preventing withdrawal of the rack. As will be readily understood, this provides an automatic safety device to prevent collapse, should the fluid pressure-operated mechanism 13 fail.

An extension spring 36 is connected between the base

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plate 16 and a displaceable cylinder 37a of a fluid pressure-operated piston and cylinder device 37 which is mounted upon base plate 16. The displaceable cylinder 37a is fixedly connected by an arm 37b to pawl 34. Upon delivery of fluid under pressure by way of the hose connection 38a from a suitable source to the piston and cylinder device 37, the cylinder 37a is moved upwardly and hence the pawl 34 is released from the rack teeth 35, whereupon rack 32 is free to be displaced in channel 33 in the direction of arrow 101, to permit the descent of the support formation 12.

The hose connections 38a for each of the piston and cylinder devices 37 are connected to a common conduit 38b leading to a source of fluid under pressure.

Referring particularly to FIGURES 1, 2 and 5, the fluid pressure operated device 13 for extending the support formation 12 comprises a lower platform 39, an upper platform 40 and a cylindrical inflatable collapsible member 47. Each of the platforms 39, 40 consist of a main steel plate 41, 42 respectively, have integral flange formations 43, 44 and are reinforced with peripherally arranged plates 45, 46 disposed in angled relation to the main steel plates 41 and 42 and the flange formations 43, 44 respectively, and connected thereto as by welding, the foregoing arrangement defining a dish-shaped configuration for the reception of the ends of the member 47.

It is to be appreciated that the inflatable member 47 comprises in the preferred embodiment an inner cylindrically shaped vulcanized rubber casing 48 having an outer sheath or casing 49 of fabric which is flexible and substantially non-extensible to maintain the cylindrical configuration under inflation.

In one embodiment of the invention the inner vulcanized rubber casing 48 is constructed from material having $\frac{1}{8}$ inch thickness ($\frac{115}{1000}$ to $\frac{125}{1000}$ of an inch). The outer casing 49 comprises three layers of synthetic woven fabric known in association with the trademark "Terylene" 1100 denier with a tensile strength of approximately 700 lbs. per square inch.

Inflatable member 47 of the foregoing construction in one embodiment has a diameter of the order of 20 inches and an axial extent under inflation of the order of 16 inches which when fully inflated exerts a pressure of 65 to 70 lbs. per square inch, more or less, capable of lifting a load of 5000 lbs., which approximates the weight of a heavier vehicle, the average vehicle having a weight of 3500 lbs.

The end walls of the inflatable member 47 are secured to the underlying and overlying platforms 39 and 40 by suitable fasteners 50, the openings through the walls of member 47 and receiving the fasteners 50 being sealed in a suitable manner.

Inflatable member 47 is provided with an integral tubular portion 51 for passing fluid under pressure thereinto, and for the escape of fluid under pressure therefrom, the tubular portion 51 being connected to a hose 51a leading to a source of fluid pressure.

Lower platform 39 of mechanism 13 is connected by a pair of spaced hinge formations 52 to channel member 17 bracing the inner members 14, with platform 39 having recesses remote from the hinges 52 and on opposite sides to provide bearing surface formations 53, each of which is adapted to be engaged by a roller bearing 54, carried by and extending inwardly of channel portions 26 (FIGURE 1).

Likewise, the upper platform 40 is supported by spaced hinge formations 55 from channel portions 25 of brace members 21, while remote from the hinges 55 at opposite sides of the upper platform 40 recesses are provided to define bearing surfaces 57 which are adapted to be engaged by roller bearings 56 carried by and extending inwardly of the I-beam members 14.

As best seen in FIGURES 2 and 4, L-shaped flanges 58 are secured in spaced relation by welding to the lower transverse channel member 17 and the channel portion 24

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of the lower transverse brace 22 of the support formation 12. Flanges 58 carry pivotal depending lugs 59 between which wheels or casters 60 are mounted and upon which the apparatus is adapted to be supported for transport.

Load engaging platform formation 11 consists essentially of longitudinally extending angle members 61 at each side and transversely extending channel members 62 at each end, the angle members 61 having at each end a plate 63 of extended area, which plate is provided with a depending flange or apron 64 therearound. As seen in FIGURES 2 and 4, the lower surfaces of plates 63 as at A constitute bearing surface formations against which rollers 19 carried by the members 14 bear with the extension of the members 14, 21 upwardly to engage and lift the load supported upon the platform formation 11. The depending flange or apron 64 houses both the roller 19 and the pivot connection 29 at the opposite end, and as well serves as a stop or locating means for the rollers 19.

Mounted flatwise upon the upper surface of the plate 63 are extension plates 66 supported for swinging movement about a vertical central pivot 67 to accommodate the frame of a vehicle, so that adequate support will be given.

It is to be observed from FIGURE 4 that the wheels or casters 60, with the apparatus in a collapsed state depend below the framework, the casters 60 being offset from the axis of pivot 20 of the members 14 and 21 such that upon the descent of the support formation and the load-engaging frame the members 14 and 21 are located above the supporting surface. Furthermore, it is seen that the inner members 14 and outer members 21 are maintained in coplanar relation by reason of the channel portions 26, 27, serving as a stop against further descent.

It is now convenient to describe the operation of the device. Firstly, the apparatus as shown in FIGURE 3 in the collapsed state will be placed beneath the load to be hoisted, and by reason of the casters 60 can be rolled thereunder, if possible, and manipulated so that the proper zone will be engaged.

Controlling the application of pressure fluid to the inflatable member 47 will be a three-way valve mechanism, one position for directing pressure fluid to the member 47 from a suitable source, a second position which is neutral, and a third position to connect the inflatable member to the atmosphere to permit the member 47 to be emptied, so that the apparatus can be collapsed.

In the case of the preferred embodiment, when vehicles up to 5000 lbs. are to be lifted, it is necessary to develop approximately 65 to 75 lbs. pressure per square inch in the member 47, having the specifications 20 inches in diameter and an axial extent of the order of 16 inches. Normally, a source of fluid pressure, for example compressed air, at 150 lbs. per square inch would be used.

Compressed air is then directed through the conduit 51a in tubular portion 51 to the inflatable member 47. From the collapsed position to the extended position the rack 32 can be displaced in the direction of the arrow 100 with the pawl 34 riding over and engaging in the teeth 35. As inflation proceeds, because the inflatable member 47 is extensible substantially solely in the vertical direction, the platform formations 39 and 40 are forced apart, the lower platform 39 swinging on the hinges 52 and urged downwardly by the expansion of the member 47 to maintain its bearing surfaces 54 against roller bearings 55 at each side, and likewise the upper platform formation 40 swinging about its hinges 55 to maintain the bearing surfaces 57 against the roller bearings 56.

In this manner the extension of the inflatable member 47 is continuously transmitted to the members 14 and 21 causing them to swing about their common pivots 20, which results in the upward displacement of the load-engaging platform 11.

As will be readily appreciated from the drawings, the

members 14 swing about the lower pivots 15 carried by the base plate 16, and because of the upward displacement of the members 21 swinging on the pivots 20, the lower end of the members 21 are displaced towards the base plate 16 and roll upon the rollers 30. This is accompanied by displacement of the racks 32 through the channel formation 33 and the consequent engagement of the teeth 35 by pawl 34 to maintain the extended position.

Likewise, with the displacement upwardly of the members 14, rollers 19 are displaced to the right as seen in FIGURE 2 and bear against the under surfaces as at A of the plates 63.

It will be appreciated that the overlying platform formations 39 and 40 are maintained in substantial vertical registration by the reason of the hinged connections and roller bearing surface formations. Therefore the inflatable member 47 experiences no appreciable distortion throughout the range of extended positions.

In the drawings it is seen that roller bearings 55 and 56 have limit positions with respect to their bearing surface formations which is dictated by the upstanding wall formations 68 and 69 respectively. This, however, is variable.

When it is desired to lower the hoist, firstly the pawls 34 are released from the teeth 35 of racks 32 by transmitting fluid-under-pressure to piston and cylinder mechanisms 37 which lifts the pawls 34, permitting the racks 32 to be withdrawn from the channel formations 33.

Then the three-way valve mechanism is operated to connect the inflatable member 47 to the atmosphere to permit the inflatable member 47 to be emptied of pressure fluid, the weight of the load assisting in its escape.

Upon the collapse of the support formation 12 it will be seen in FIGURE 3 that the channel portions 27 embrace the adjacent portions of the inner members 14, and likewise the channel portions 26 are adapted to embrace the portions of the inner members 14 so that a planarity of the components may be achieved, and casters 60 rest upon the supporting surface.

Furthermore, it is to be appreciated that the dish-shaped configuration of the overlying platforms 39 and 40, against which the ends of the inflatable member 47 bear, serve as a receptacle for the collapsed inflatable member 47, assisting in achieving the planarity desired.

As shown in FIGURES 1 and 3 particularly, the depending flange or apron 64 of the load-engaging frame 11 is provided with openings 70 therethrough to accommodate the air hose sections 38a leading to the piston and cylinder devices 37, to achieve the horizontal registration and desired planarity.

What I claim is:

1. In a load lifting apparatus including a load-engaging frame and a ground-engaging frame and two pairs of hinged levers connected between said frames one pair on each side thereof, a first one of each of said pairs of levers being corresponding and a second one of each of said pairs of levers being corresponding, the improvement comprising: a first platform hingedly connected between said corresponding first levers and movably connected to said corresponding second levers; a second platform hingedly connected to said second corresponding levers in a spaced apart relationship from said first platform connections thereto and movably connected to said first corresponding levers in a spaced apart relationship from said first platform connection

thereto, and fluid inflatable means constrained to expand substantially vertically secured between said first and second platforms.

2. A load lifting apparatus including a load-engaging frame and a ground-engaging frame and means for raising said load-engaging frame relative to said ground-engaging frame said means comprising: a first lever and a second lever on each side and extending between corresponding sides of said frames, said levers being pivotally connected one to the other intermediate their ends; said first levers each being pivotally connected at a lower end to said ground-engaging frame and at an upper end to said load-engaging frame, said second levers being movably connected at an upper end to said load-engaging platform and movably connected at a lower end to said ground-engaging frame; a first platform movably connected between said second lever members, and pivotally connected between said first lever members, and a second platform secured between said lever members in a spaced apart relationship from said first platform; said second platform being pivotally connected to said first lever members and movably connected to said second lever members, and an inflatable bag constrained to extend substantially in a vertical direction secured between said first and second platform members.

3. Apparatus as claimed in claim 1 wherein said inflatable means comprises a casing having a generally cylindrical configuration.

4. Apparatus according to claim 3 wherein said cylindrical casing is defined by an axially extending and end walls of flexible extensible material, and inflatable over a predetermined range of pressures, and means associated with said axially extending and end walls constraining same against extension over said predetermined range of pressures.

5. Apparatus as claimed in claim 1 wherein said connections of first and second platforms to said levers are spaced inward of the ends thereof.

6. Apparatus as claimed in claim 1 wherein said load-engaging frame comprises a pair of side members and a pair of transverse members extending between and rigidly secured to opposed ends of said side members to define an area exceeding the area of said ground-engaging frame.

7. Apparatus as claimed in claim 1 including lock means for securing said load-engaging platform in a fixed elevation relative to said ground-engaging platform.

8. Apparatus as claimed in claim 1 including wheel means mounted in a fixed relationship to said first corresponding levers and wheel means mounted in a fixed relationship to said second corresponding levers.

9. Apparatus as claimed in claim 8 wherein said first lever members include wheel means mounted adjacent a ground-engaging end thereof.

References Cited by the Examiner

UNITED STATES PATENTS

1,859,830	5/32	Kummel	254—122
2,001,744	5/35	Patterson.	
2,495,092	1/50	Cox et al.	254—93
2,609,177	9/52	Hughes.	
2,610,824	9/52	Grier	254—122
2,843,418	7/58	Gray	254—122 X

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