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Ruff et al.

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[45] **Jan. 22, 1974**

[54] **MODULAR STRUCTURE TRANSPORTING APPARATUS**

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[52] **U.S. Cl.**..... **214/512,** 214/515, 280/43.17

[51] **Int. Cl.**..... **B60p 1/02**

[58] **Field of Search**. 214/38 B, 38 BA, 38 CC, 512, 214/515; 280/43.17, 43.23

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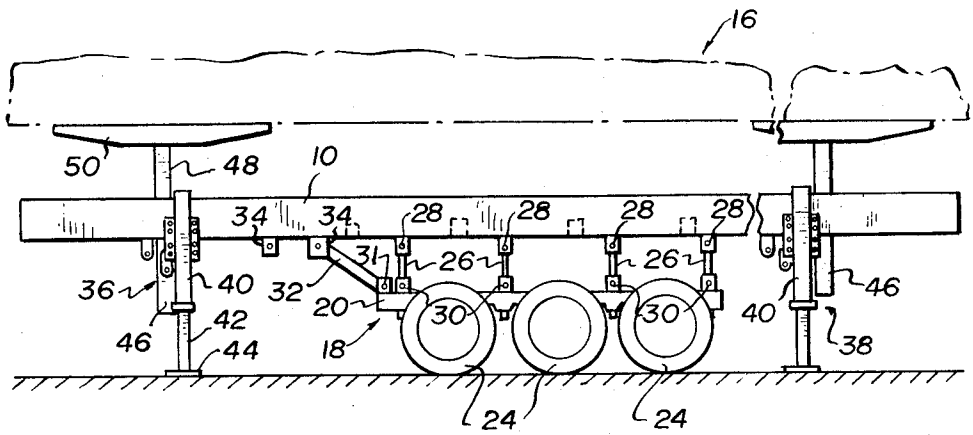
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[57] **ABSTRACT**

A trailer for transporting modular building structures from a point of assembly or storage to a point of permanent installation. The same includes an elongated frame having sufficient strength to receive and support a modular building structure and a wheeled carriage secured to the underside of the frame for vertical movement relative to the frame so that the height of the frame above the terrain over which it may travel may be varied. The frame also mounts a plurality of pairs of jacks with one jack on each pair adapted to engage the underlying terrain to raise or level the frame relative thereto and the other jack in the pair adapted to move an element upwardly to engage the underside of a modular building structure. Each pair of jacks is pivotally mounted of the frame for movement between the above operative position and traveling position and the arrangement is such that the weight of one jack generally counterbalances the other of the pair so that the same may be easily manipulated.

3 Claims, 7 Drawing Figures



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SHEET 1 OF 3

FIG. 1

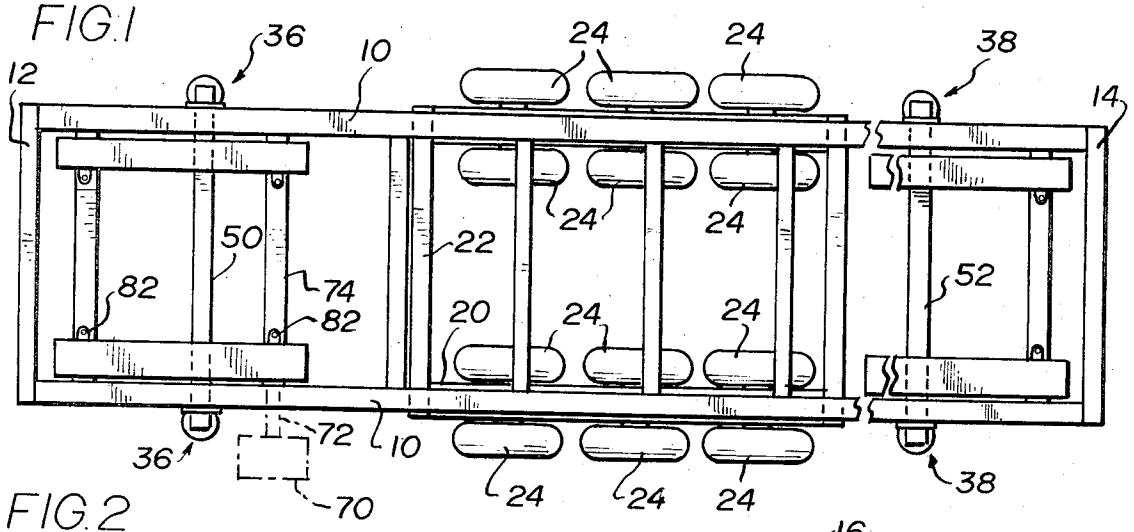
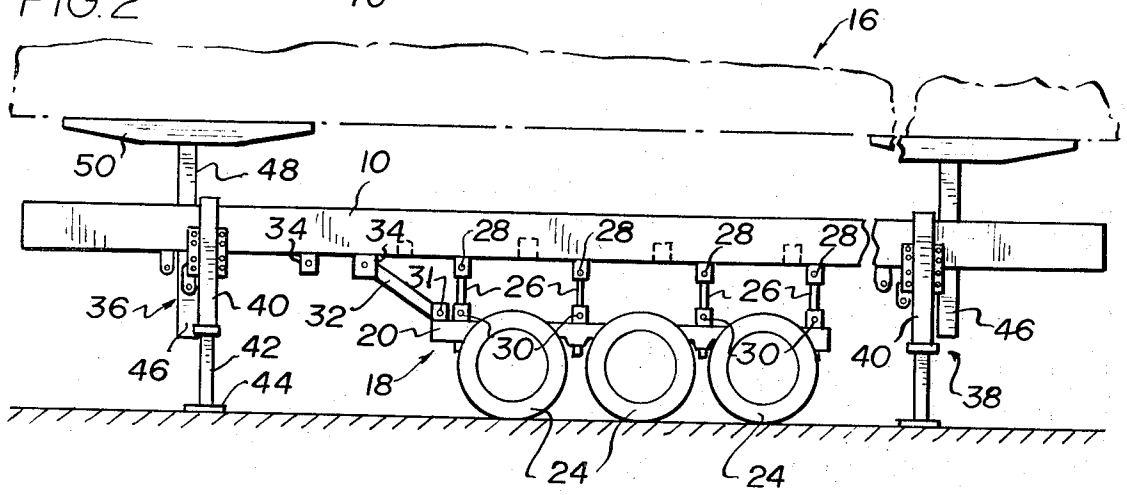


FIG. 2



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ATTORNEYS

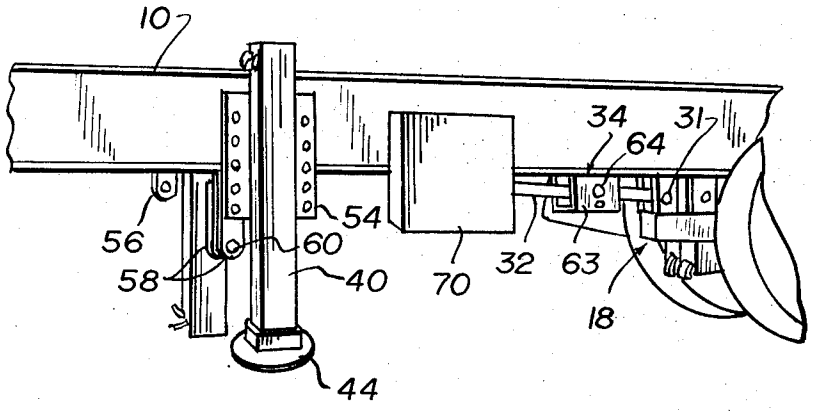


FIG.3

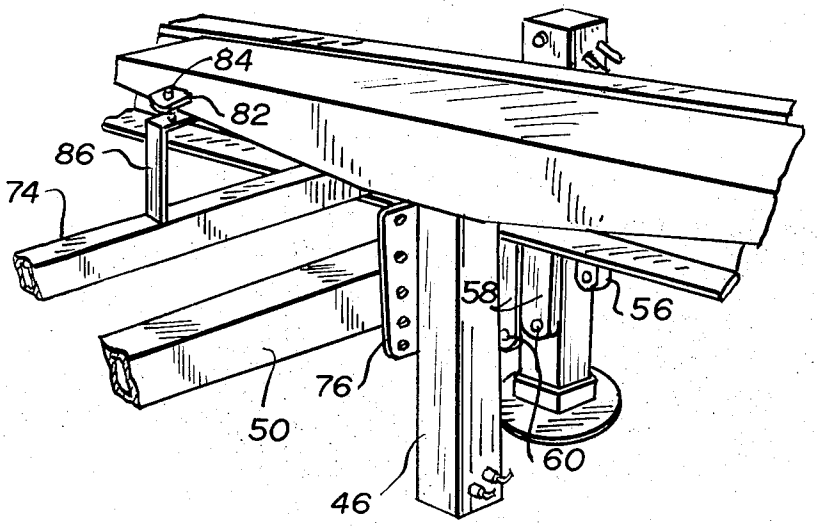


FIG.4

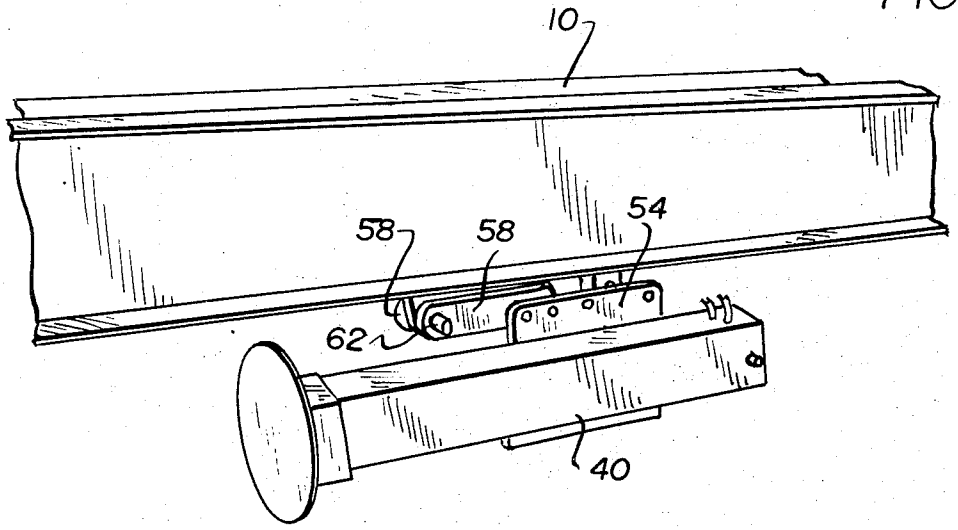


FIG.5

FIG. 6

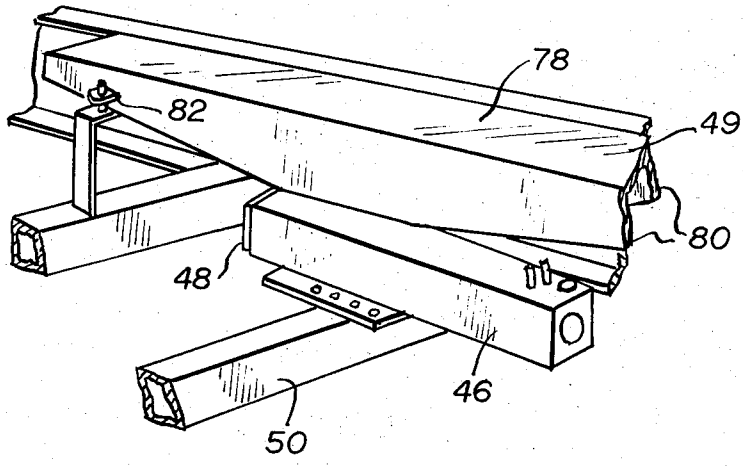
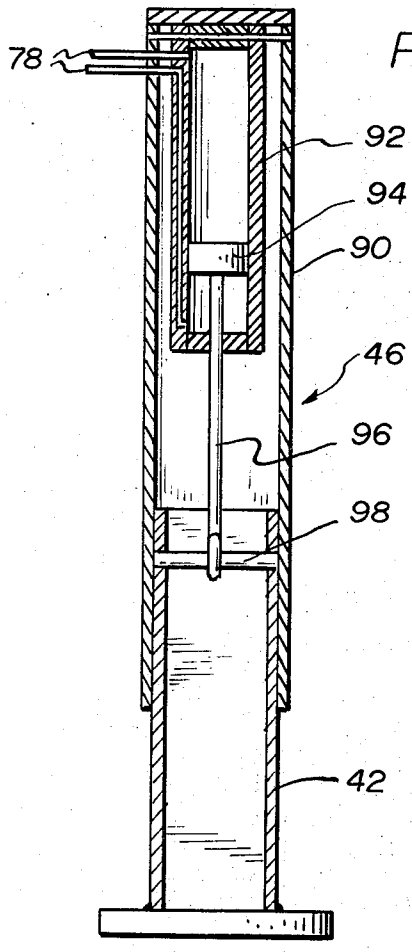


FIG. 7



MODULAR STRUCTURE TRANSPORTING APPARATUS

BACKGROUND OF THE INVENTION

The rapid escalation in the costs of conventional, on-the-site construction or residential structures has resulated in a vast upsurge in the popularity of alternative building procedures. One alternate to on-the-site construction is the use of so-called "modular homes" wherein a structure is fabricated in modules at a factory for the purpose of employing assembly line techniques. The virtually fully constructed modules are then shipped from the factory, or an intermediate storage area, to the site at which they are to be permanently located whereat they are located on a previously constructed foundation and joined together.

The size of the modules varies according to the total structure purchased by a buyer but generally is limited only by applicable state laws governing the size of objects that may be moved on public roadways. It is not unusual for a module to have a base dimension of ten by sixty feet and in some cases, where applicable laws permit, the width of the module may be as much as twelve feet.

In order to maintain the most significant advantage of modular structures, namely, lower cost, it is necessary that the cost of transporting a fully constructed module from the factory or a point of storage to the site whereat it is to be permanently installed must be as low as possible, particularly in terms of minimizing the cost of labor in loading a module onto a transporting device or removing the same from the transporting device onto a foundation.

Moreover, it is necessary that any such transporting apparatus be capable of easily moving over extremely varied terrain not normally of the type over which a vehicle would move such as that often found in the immediate proximity of the foundation on which the module is to be located. Thus, there is a real need for suitable modular building structure transporting apparatus which may be easily loaded and unloaded with a minimum of labor and which can be easily moved across extremely rough terrain.

SUMMARY OF THE INVENTION

The principal object of the invention is to provide a new and improved modular building structure transporting apparatus that can be loaded and unloaded with a minimum of manual labor and which is designed for easy movement to the immediate proximity of a foundation whereat the module is to be permanently located.

The exemplary embodiment achieves the foregoing object by means of a construction including an elongated frame of sufficient strength to receive and support a modular building structure. Below the frame is a carriage having a plurality of wheels and the carriage is movably secured to the frame. In particular, the arrangement is such that the vertical distance between the carriage and the frame may be varied so that the frame may be elevated if desired as, for example, to clear abrupt changes in terrain.

The frame, at spaced locations, mounts pairs of jacks. Each pair of jacks is pivotally secured to the frame so that the pair turns as a whole with the result that one of the jacks may have a ground engaging element directed downwardly to elevate the frame while the other may direct an elongated module engaging member upwardly to engage the underside of the structure as, for example, to lift the same off of a temporary storage foundation for subsequent seating on the frame prior to transporting the structure to the point of installation. The two jacks in each pair are arranged about their pivot so as to substantially counterbalance the justdescribed position and a position approximately 90° thereto which they are to occupy when the frame is being transported.

Other objects and advantages of the invention will become apparent from the following specification taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a modular building structure transporting apparatus made according to the invention;

FIG. 2 is a side elevation of the transporting apparatus;

FIG. 3 is a fragmentary perspective of the apparatus frame and an associated ground engaging jack;

FIG. 4 is a fragmentary perspective of the apparatus frame and a structure engaging jack;

FIG. 5 is a fragmentary perspective view of the frame and the ground engaging jack in a transport position;

FIG. 6 is a fragmentary perspective of the structure engaging jack in a transport position; and

FIG. 7 illustrates, in section, one form of a jack that may be used.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An exemplary embodiment of a modular building structure transporting apparatus is illustrated in FIGS. 1 and 2 and is seen to include a pair of elongated, side members **10** which preferably are in the form of I-beams and connected at their ends by a front cross member **12** and a rear cross member **14.** The cross members **12** and **14** may again be formed of I-beams and any suitable form of drawbar structure (not shown) may be associated with the front cross member or the forward ends of the side members **10** as desired so that the frame may be attached to a tractor to be drawn thereby. The members **10, 12** and **14** define a frame of sufficient strength to receive and support a modular building structure which is fragmentarily illustrated in FIG. **2** in dotted lines and generally designated **16.**

The frame thus defined is superposed over a carriage, generally designated **18** and formed of side members **20** and cross members **22.** The carriage **18** mounts, in any suitable fashion, a plurality of wheels **24** on which the frame may move over the underlying terrain.

As best seen in FIG. **2,** the carriage **18** is connected to the frame by means of a plurality of arms **26** each of which has one end pivotally connected as at **28** to an associated one of the side members **10** and its other end pivotally connected as at **30** to the carriage **18.**

The forward end of the carriage **20** includes pivots **31** to which two retaining tongues **32** are connected. The ends of the tongues **32** remote from the pivots **31** may be received within and selectively secured to either one of two securing means **34** depending from the side members **10** to be described in greater detail hereinafter. The purpose of the foregoing construction is as follows. As illustrated in FIG. **2,** the tongue **32** is releas-

ably secured to the rightmost one of the securing means **34** and in order for such to be permitted, it will be appreciated that the carriage **18** has been swung relatively counterclockwise about the pivot points **28** and will be held in such a position by the tongues **32.** This results in the arm **26** extending substantially vertically to provide a maximum spacing between the carriage **18** and the frame defined by the members **10, 12** and **14.** In such a mode, the frame will be at its maximum height above the underlying terrain so that abrupt changes in such terrain may be easily cleared. However, for normal transportation across a paved road, as a highway or the like, the tongues **32** may be secured to the leftmost one of the securing means **34** which will result from the the carriage **18** moving clockwise relatively about the pivots **28** so that a minimum spacing between the frame and the carriage **18** exists so as to lower th center of gravity of the transporting apparatus as well as any object transported thereon to as low a level as possible. As will be seen, no particular means are provided for changing the spacing between the carriage **18** and the frame as structure used for other purposes is used to perform this function as well.

The frame **10** also mounts, at spaced locations, a plurality of pairs of jacks. With reference to FIG. **1,** each of the side members **10** mounts a forward jack pair, generally designated **36,** and a rearwardly located jack pair, generally designated **38.** Each of the jack pairs **36** and **38** is substantially identical and thus, only one will be described.

With reference to FIG. **2,** a jack pair is seen to include a first jack **40** having an extensible element **42** terminating in a ground engaging foot or pad **44.** When the jack **40** is energized, as by the application of hydraulic fluid under pressure, the same is operative to raise the frame relative to the underlying terrain.

Each jack pair also includes a second jack **46** having an extensible element **48** which may engage an elongated channel member **49** near the midpoint of the latter so as to raise the same into abutment with the undersurface of the modular building structure **16** to lift the same above the frame, or for other purposes as will be seen.

It will be appreciated that through the use of the jacks **40** the height of the frame above the underlying terrain may be regulated and thus, the jacks **40** may be employed in conjunction with the force of gravity to serve as a means for elevating the frame relative to the carriage **18.** For example, if the frame is in its lowermost position relative to the carriage **18,** the tongue **32** may be released from the leftmost securing means **34** and the jacks **40** energized to elevate the frame. Gravity will cause the carriage **18** to remain in the same position and when the frame has been elevated sufficiently so that the tongue **32** can be aligned with the rightmost securing means **34,** a connection may be established to maintain the frame in its highest position relative to the carriage **18.**

Each of the jack pairs **36** and **38** is, as mentioned previously, pivotally secured to the frame. More particularly, a rectangular cross bar **50** is employed for mounting the jack pairs **36** while the rectangular cross bar **52** is employed for the same purpose with respect to the jack pairs **38.** By any suitable form of a pivot defining a pivot axis substantially along one corner of the tubular cross bars **50** and **52,** the latter is pivotally secured to both of the side members **10** for limited rotation through about 90°. The jacks **40** and **46** are mounted on the cross members **50** and **52** as follows. The jacks **40** are mounted on the ends of the cross members outboard of the side members **10** while the jacks **46** are mounted on one side of the cross members and just inboard of the side members **10.** Preferably, the jacks are mounted in such a way as to counterbalance each other about the pivot point for the jack pairs as well as the cross members so that the same may be easily manually swung through the 90° of movement mentioned previously.

Turning now to FIG. **3,** it may be seen that the jack **40** is secured to a mounting plate **54** which in turn is secured to an associated one of the pivotal cross members **50** and **52,** in this case the cross member **50.** Depending from the underside of the side member **10** is an eye **56** while rigidly secured to the back side of the mounting plate **54** is a pair of spaced links **58** each including an aperture **60** near their extremity. As, can be ascertained from FIG. **5,** when the jack **40** is pivoted 90° from the position shown in FIG. **3** in a clockwise direction, the apertures **60** and the links **56** aligned with the eyelet **56** to receive a retaining pin **62.** In this way, the jacks may be held in a transport position whereat they cannot come into engagement with the ground. A similar connection (not shown) is employed to hold the jacks in their operative position.

FIG. **3** additionally shows, in greater detail, the nature of the securing means **34.** Each side member **10** mounts the two securing means **34** and each is in the form of a channel member **63** having its legs secured to the underside of the I-beams forming the side members **10.** Aligned apertures **64** (only one of which is shown) in the legs of the channel member **63** are adapted to receive a retaining pin similar to the retaining pin **62** used in conjunction with the jacks.

The tongue **32** is apertured at its free end to receive the retaining pin and further is located to extend between the legs of the channel member **63** and slide therein so that the locking of the carriage **18** relative to the terrain in either of the two positions may be accomplished easily and without requiring the manual manipulation of the tongue **32** which, by reason of its function, must be rather strong which requires it to have substantial weight.

FiGS. **1** and **3** also illustrate a control panel **70** for the various jacks. In the interests of clarity, the showing of hydraulic lines have been omitted from the drawings, it being recognized that the provision of suitable hydraulic control circuits for the jacks is well within the skill of the ordinary artisan. The control panel **70** is preferably mounted on one end of a rectangular tubular member shown in dotted lines at **72** in FIG. **1.** The same is adapted to be telescopingly received within a cross member **74** affixed between the side members **10** and by means of flexible hydraulic conduits, the control panel may be moved from a position in substantial abutment with the side member **10** to an extended position substantially spaced therefrom so that the hydraulic elements may be operated easily when a modular structure substantially overhangs the sides of the side member **10.** That is, by extending the control panel from the side member **10,** it is not necessary for an operator to crawl under a rather wide modular building structure on the apparatus in order to operate the various jacks.

Turning now to FIGS. 4 and 6, the nature of the second jack 46 will be described. Each jack 46 is secured to a mounting plate 76 which is in turn secured to the corresponding one of the cross members 50 and 52 as described previously. As can be ascertained from FIG. 6, the elongated, modular structure engaging member 49 is separate from the extensible element 48 of the jack 46 and is in the form of a channel member having an elongated base 78 which may engage the underside of the structure and flanked by two downwardly extending legs 80. The arrangement is such that when the cross member 50 or 52 is pivoted as mentioned previously, the jacks 56 will pivot to a position whereat its direction of elongation is transverse to the plane of the base 78 so that when actuated, the extensible element 48 will engage the underside of the base 78 to elevate the entire member 49. The operative position is illustrated in FIG. 4 while the transport position is illustrated in FIG. 6.

To insure positive location of the elongated member 49 at all times, as seen in FIGS. 1, 4 and 6, the innermost one of the legs 80 is provided with horizontally extending eyelets 82 near its opposite ends. A vertically projecting pin 84 is mounted on a bracket 86 extending upwardly from a cross member such as the cross member 74 to the web of the I-beam forming the side member 10 so as to define a bed for the elongated member 49. Initially, the elongated members 49 are located such that corresponding ones of the pins 84 impale the eyelets 82 with the underside of the legs 80 resting upon the brackets 86. The weight of the members 49 will normally be sufficient to retain the same in this position and when the jack 46 is pivoted to the position illustrated in FIG. 4, its direction of lift will be vertical and upon descent, the pins 84 will again enter the eyelets 82 to maintain the just-described relation.

Turning now to FIG. 7, one form of a jack construction is illustrated. Preferably, the jacks are of the type used on aircraft landing gear wherein casing members take the entire load other than that exerted as a pure compressive force. In particular, one of the jacks 46 is illustrated and such a construction is typical for the jacks 40 as well. The jack 46 includes a rectangular, elongated body 90 telescopingly receiving the extensible element 42 as illustrated. Within the body 90 is a hydraulic cylinder 92 including a piston 94. A piston rod 96 is secured to the piston 94 and connected to a cross pin 98 rigidly secured internally within the extensible element 42. The cylinder 92 is secured in any suitable manner to the uppermost end of the body 90 and suitable porting 98 may be provided. It will be appreciated that twisting or bending forces during use of the jack will all be taken up within the body 90 and the extensible member 42 and will not be transmitted to the cylinder 92, the piston 94 or the piston rod 96.

From the foregoing description, it will be appreciated that the apparatus may be used in a number of ways. For example, it is fairly typical to support a completed module at the factory in a storage area on concrete blocks or the like. Thus, the apparatus may be moved under the module and either of the jacks 40 and 46, or both, may be actuated to raise the module off of the blocks. Thereafter, the blocks may be removed and the jacks deactuated to lower the module onto the frame 10 at which time it is ready for transport. In some instances, depending upon the nature of a foundation, the module may be lowered onto a foundation in substantially the same manner.

And, as mentioned previously, the jacks 40 may be used to set the relative height of the frame 10 in conjunction with the carriage 18 and the movable connection of the latter to the frame so that extremely abrupt changes in terrain will not result in the frame bottoming out with a load upon it. In addition, the jacks may be selectively operable to level a module in any of a variety of instances where such may be necessary. And it will be appreciated that the device is easy to use, particularly in view of counterbalancing arrangement of the jacks in each pair as well as the extensible nature of the control panel 70.

We claim:

1. Modular building structure transporting apparatus comprising: means defining an elongated frame of sufficient strength to receive and support a modular building structure; a plurality of wheels carried by said frame; a plurality of first jacks located at spaced locations about the periphery of the frame and including ground engaging elements so that, when operated, the same can level the frame over varied terrain and raise the frame relative to the underlying terrain; a plurality of second jacks mounted on said frame at a plurality of spaced locations thereon and including modular building structure engaging means movable upwardly from the frame when said second jacks are operated to engage the undersurface of a modular building structure, said first and second jacks being paired; means pivotally mounting each pair of jacks to said frame for movement between a first, operative position and a second, inoperative traveling position, including a pivotally mounted member connected to each jack of a pair intermediate the ends of each jack to have the pair of jacks effectively counterbalance each other about the povotal mounting whereby each pair of jacks may be easily pivoted between said first and second positions.

2. The modular building structure transporting apparatus of claim 1 wherein said modular building structure engaging means include elongated members separable from the second jacks and nestably received by said frame and said second jacks are positioned beneath said elongated members and movable between a traveling position remote from the elongated members and a position wherein the second jacks may engage the enlongated members to move the same upwardly into engagement with the undersurface of a modular building structure.

3. Modular building structure transporting apparatus comprising: means defining an elongated frame of sufficient strength to receive and support a modular building structure; a wheeled carriage below said frame, said carriage being movably connected to said frame whereby the vertical position of the wheels with respect to the frame may be varied; means for holding said carriage in a desired position relative to said frame; a plurality of first jack means located at spaced locations about the periphery of said frame, said jack means including ground engaging elements so that said jack means, when operated, can level said frame over varied terrain and raise said frame relative to the underlying terrain; and a plurality of second jack means mounted on said frame at a plurality of spaced locations thereon, said second jack means including modular building structure engaging means movable upwardly from said frame means when said second jack means are oper-

ated to engage the undersurface of a modular building structure, said modular building structure engaging means including elongated members nestably received by said frame and said second jack means are pivotally secured to said frame beneath said elongated members and movable between a traveling position and a position wherein the jack means may engage the elongated member to move the same upwardly into engagement with the undersurface of a modular building structure.

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