

Nov. 29, 1960

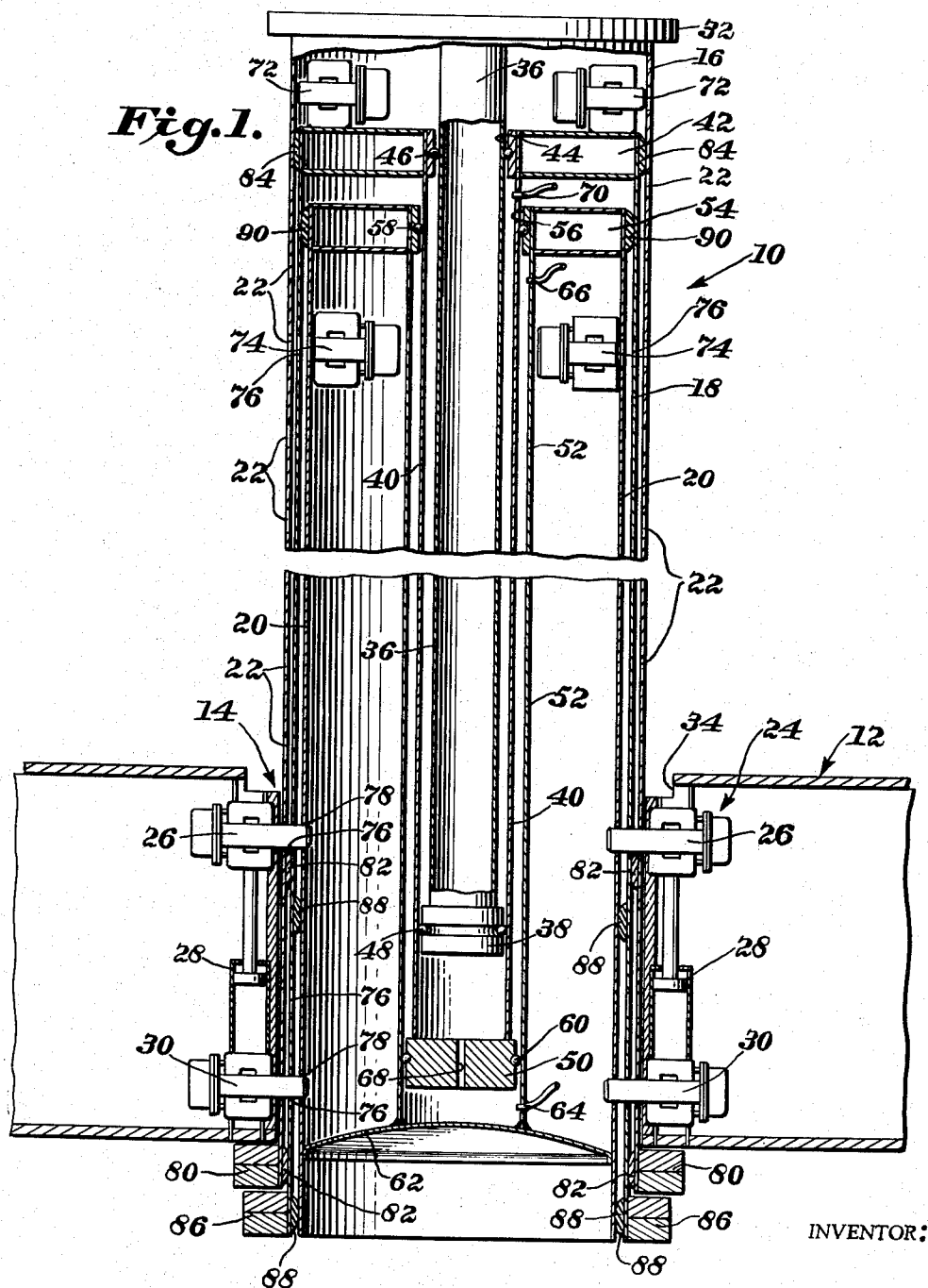
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2,961,837

SUPPORTING LEG ASSEMBLY FOR MARINE PLATFORM

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3 Sheets-Sheet 1



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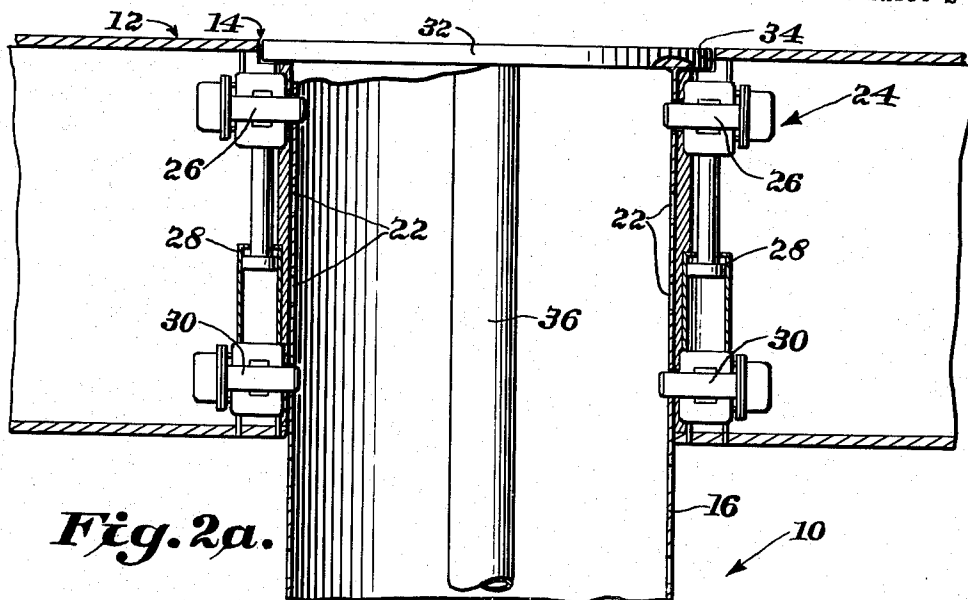
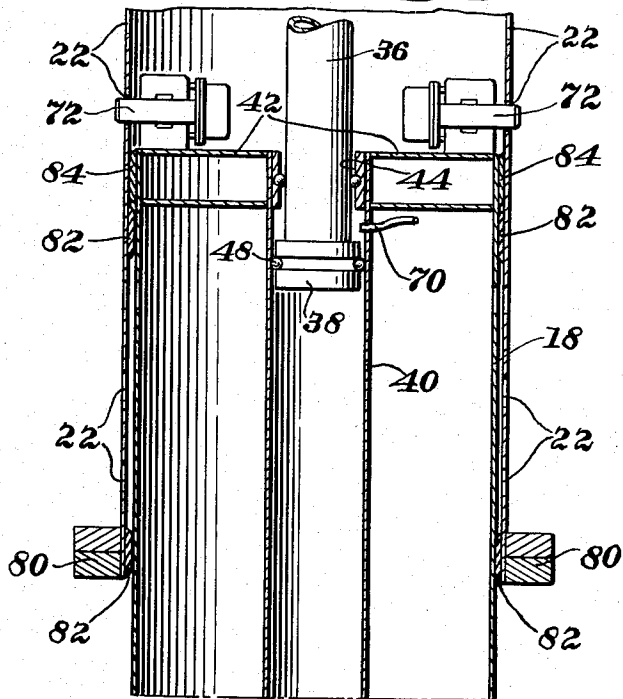


Fig. 2a.



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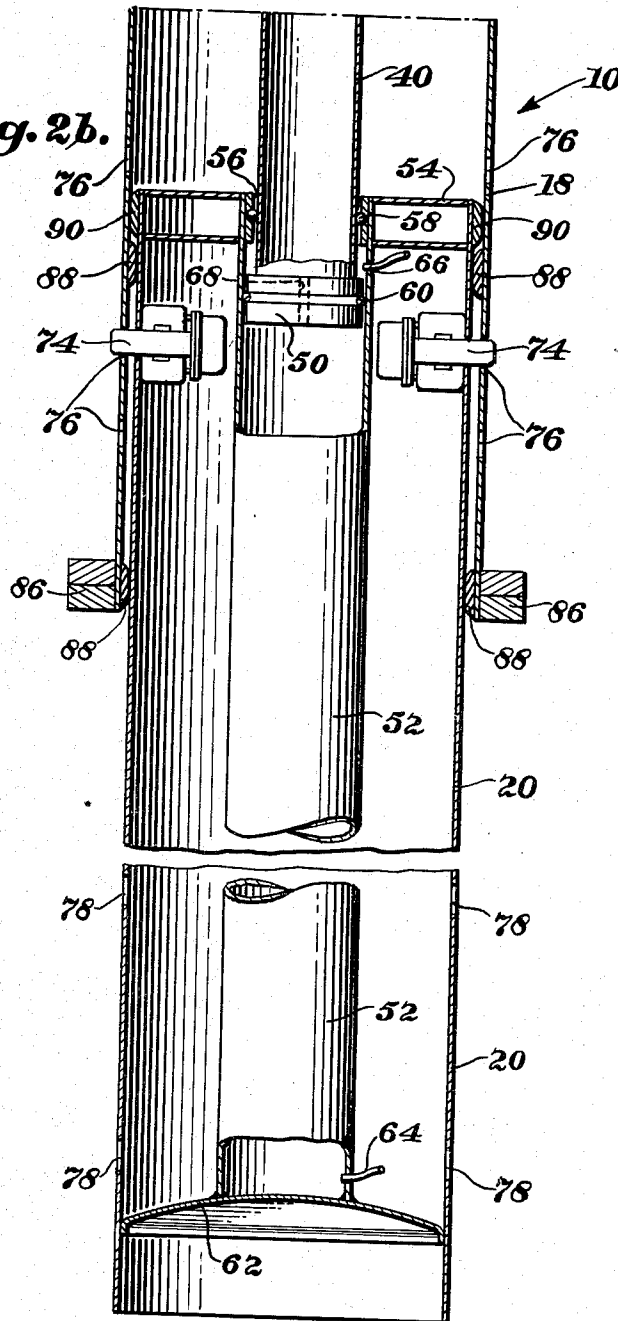
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Fig. 2b.



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SUPPORTING LEG ASSEMBLY FOR MARINE PLATFORM

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7 Claims. (Cl. 61—46.5)

This invention relates to convertible marine platforms and, more particularly, to supporting leg assemblies for such platforms having jacking mechanisms for relatively manipulating the supporting leg assemblies and platform, so that the latter can be converted from a floating platform to an elevated platform supported by the marine bottom above the water level and vice versa.

The present invention is particularly useful in the marine installation system, such as disclosed in the Pointer application, Serial No. 283,567, filed April 22, 1952 now Patent No. 2,775,869. In general, this system embodies the utilization of a floating platform which may be transported to any suitable marine site, as by tugs or the like, and which is provided with a series of elongated supporting legs which are utilized when the floating barge has been transported to the marine site to support the floating barge from the marine bottom in an elevated position above the water level. The system, disclosed in the aforesaid Pointer application, illustrates the use of tubular one-piece supporting legs which are initially moved through the platform guide means by means of pneumatically-operated jacking mechanisms until the lower ends thereof are embedded in the marine bottom. Subsequently, the jacking mechanisms are operable to raise the platform on the supporting legs to a suitable height above the water level. With the platform thus supported, the same may be utilized for a variety of purposes. For example, permanent docks and piers have been constructed utilizing this system and it is also valuable in off-shore drilling operations where the platform is to be used temporarily. In the latter case, after operations have been completed, the jacking mechanisms are operable to permit the platform to be lowered on the supporting legs until the same is again floating on the surface of the water and then to subsequently raise the supporting legs clear of the marine bottom and to a transporting position on the platform.

In most installations, it is of importance to provide an elevated platform which has a substantially unobstructed upper deck surface. Due to the uncertainty and the unevenness of the marine bottom, it is usually the case when dealing with one-piece supporting legs that the upper ends thereof will project above the upper deck surface of the platform when the latter has reached its operative elevated position. In permanent installations, the supporting legs can be welded or otherwise permanently secured to the platform and the upper ends cut off, but this is not practical in temporary installations. Moreover, this procedure is time consuming and costly.

Consequently, in a later application, Serial No. 584,962, filed May 15, 1956, by George E. Suderow, which is a continuation of application, Serial No. 502,313, filed April 19, 1955 and now abandoned, it was proposed to construct the supporting legs of telescopic sections so as to insure that there would be no obstructing upper supporting leg ends extending above the platform when the same is elevated to its operative position. Moreover,

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this sectional construction renders the legs easier to handle and affords more flexibility in operation.

Briefly, the telescopic supporting leg assembly disclosed in the above-mentioned Suderow application includes a plurality of telescoping sections having jacking mechanisms between adjacent sections with the outer section mounted for vertical movement with respect to the platform by a jacking mechanism carried by the platform. The jacking mechanisms disclosed are of the pin type embodying horizontally slidable pins engageable in a series of longitudinally spaced apertures formed in the supporting leg sections. While this type of jacking mechanism provides a positive mechanical restraint against movement of the sections, the numerous manipulations required in the normal operation thereof, renders the same somewhat time consuming.

Accordingly, it is an object of the present invention to provide a telescopic supporting leg assembly having improved means for selectively effecting or restraining relative longitudinal movement between the sections thereof which is continuous in operation and hence fast in operation.

A still further object of the present invention is the provision of a supporting leg assembly of the type described which is simple in construction, easy to operate, and economical to manufacture and maintain.

These and other objects will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings wherein an illustrative embodiment is shown.

In the drawings:

Figure 1 is a vertical sectional view showing a floating barge or platform having a telescopic supporting leg assembly, embodying the principles of the present invention applied thereto and illustrating the same in a collapsed transport position;

Figure 2a is a view similar to Figure 1 illustrating the upper portion of the assembly in its extended operative position; and

Figure 2b is a view similar to Figure 2a showing the lower portion of the assembly.

Referring now more particularly to the drawings, there is shown a telescopic supporting leg assembly, generally indicated at 10, which embodies the principles of the present invention. As was briefly noted above, the assembly of the present invention is particularly adapted to be utilized in the marine construction system disclosed in the aforesaid Pointer application, although it will be understood that the same may be readily used for other purposes. As shown, the assembly 10 is mounted on a floating barge or platform, indicated at 12. It will be understood that, in accordance with the Pointer system, the floating platform 12 may be provided with a series of telescopic supporting leg assemblies 10 which may be cooperatively operated so as to effect the various movements essential to the marine construction. In the drawings, only a portion of the floating platform is illustrated showing a single guide means 14 in the form of a vertical opening arranged to receive the single assembly 10.

The assembly 10 comprises a plurality of telescopically arranged sections of any suitable number. As shown, there is provided an outer tubular section 16, an intermediate tubular section 18, and an inner tubular section 20. The outer section is provided with a series of vertically spaced apertures 22 formed in the tubular wall of the section in diametrically opposed relation therein. A jacking mechanism, generally indicated at 24, is mounted adjacent the opening 14 so as to engage the openings 22 of the outer section for selectively effecting

or restraining vertical movement of the same with respect to the platform 12. The jacking mechanism 24 may be of any suitable construction, but preferably embodies a structure, such as set forth in copending application, Serial No. 523,323, filed July 20, 1955, by George E. Suderow. Briefly, the jacking mechanism includes an upper section rigidly secured to the platform and having a pair of opposed fluid-operated bolts or pins 26 mounted thereon for horizontal reciprocation into and out of registering apertures 22 in the outer section. A pair of fluid-pressure-operated ram units 28 extends downwardly from the upper section and carry a lower section having a second pair of fluid-pressure-operated bolts or pins 30, also mounted for horizontal reciprocation into and out of registering apertures 22 in the outer section. By selectively engaging one pair of the fluid-pressure-operated pins in the outer section and then actuating the ram units 28, relative vertical movement between the outer section 16 and the platform can be readily accomplished. A more detailed description of the operation of the jacking mechanism 24 can be had with reference to the above-mentioned Suderow application.

A best shown in Figures 1 and 2a, the upper end of the outer section is provided with a disc-like head member 32 which is arranged to seat within a recess 34 formed in the upper portion of the platform adjacent the opening 14 so as to insure that the upper horizontal surface of the outer section 16 will be in flush relationship with the upper horizontal deck surface of the platform, when the latter is in its operative position. Extending downwardly from the central portion of the head member 32 substantially throughout the entire length of the outer section 16 is a piston rod 36 which, as shown, may be of hollow construction. The lower end of the piston rod 36 has an enlarged piston 38 formed thereon which is slidably mounted within a cylinder 40 rigidly mounted within the central interior of the intermediate section 18. As best shown in Figures 1 and 2a, the upper end of the cylinder 40 is mounted within the intermediate section by means of a rigid head member 42 having a central opening 44 formed therein for receiving the piston rod 46 of the outer section. An O-ring 46 may be provided in the head member 42 adjacent the opening 44 so as to engage the exterior surface of the piston rod 36 and to provide a pressure-tight seal therewith. In a like manner, the piston 38 may be provided with an O-ring 48 which engages the interior surface of the cylinder 40 to provide a pressure-tight seal therewith.

The lower end of the cylinder 40, which also serves as a piston rod, has a piston 50 rigidly secured thereto and slidably mounted within a cylinder 52 mounted within the central interior of the inner section 20 and extending substantially throughout the entire length thereof. The upper end of the cylinder 52 is secured to the inner member 20 by head member 54 having a central opening 56 formed therein for receiving the cylinder 40. As before, the head member 54 may be provided with an O-ring 58 in the opening 56 for engaging the exterior surface of the cylinder 40 and providing a pressure-tight seal therewith. The exterior surface of the piston 50 may also include an O-ring 60 arranged to engage the interior surface of the cylinder 52 so as to form a pressure-tight seal therewith. The lower end of the cylinder 52 is closed by an end closure member 62 extending throughout the bottom of the inner section 20.

The lower end of the cylinder 52 is provided with a port 64 through which pressurized fluid may be selectively introduced and exhausted while the upper end thereof is provided with a port 66 through which the pressurized fluid may be selectively introduced and exhausted in cooperation with port 64. Pressurized fluid is introduced and exhausted from the lower end of the cylinder 40 through an axial port 68 formed in the piston

50, while a port 70 communicates with the upper end thereof for the introduction and exhaust of the pressurized fluid.

The means for selectively introducing or exhausting a pressurized fluid through the ports is not shown in the drawings but may be of conventional construction and preferably is of the pneumatic type. The fluid pressure means is mounted on the platform and air lines extend downwardly therefrom through apertures (not shown) in the sections to the various ports, as well as to the fluid pressure operated pins 72 and 74. These air lines may be contained on reels (not shown) mounted on the platform which permit the lines to pay out or retract in accordance with the movement of the corresponding section, as desired. Of course, in the usual way, suitable valves are operatively connected with the lines so that air under pressure may be either introduced or exhausted through any port or the port closed off from air passage in either direction.

In order to positively retain any two adjacent sections together by a mechanical locking action, there is provided a pair of fluid pressure-operated pins or bolts 72 suitably mounted in fixed relation above the head member 42 of the intermediate section for horizontal reciprocation into and out of the apertures 22 formed in the outer section 16. The inner section 20 is provided with a pair of similar fluid pressure-operated pins or bolts 74. The bolts 74 are preferably mounted on the inner section between its tubular wall and the cylinder 52 therewithin and below the upper head member 54 thereof. The pins 74 are also reciprocably mounted for horizontal movement into and out of upper and lower apertures 76 formed in diametrically opposed relation in the intermediate section. The lower portion of the inner section may also be provided with spaced apertures 78 on opposite sides of the section for receiving the pins 26 and 30 of the jacking mechanism 24.

The lower end of the outer section 16 preferably is provided with a reinforcing ring 80 rigidly mounted on the exterior surface thereof. The interior surface of the outer section has plate-like rings 82 rigidly secured thereto in a position adjacent the ring 80 and in a position spaced thereabove. The upper ring 82 serves, in addition to reinforcing the section, to cooperate with an upper plate-like ring 84 rigidly secured to the exterior surface of the upper end of the intermediate section adjacent the head member 42 for limiting relative extensible movement between the two sections. The intermediate section also includes a reinforcing ring 86 rigidly secured to the exterior surface of the lower end thereof and has upper and lower plate-like rings 88 rigidly secured to the interior surface thereof in positions similar to the rings 82. A plate-like ring 90 is rigidly secured to the exterior surface of the upper end of the inner section 20 and cooperates with the upper ring 88 in the same manner as cooperating rings 82 and 84.

In utilizing the present invention in the system of the aforesaid Pointer application, it will be understood that a series of telescopic supporting leg assemblies will be utilized on a platform and cooperatively moved as described in that application. More specifically, each such leg assembly may be provided with a jacking mechanism 24 and the simultaneous cooperative operation of a plurality of such jacking mechanisms is disclosed in detail in the aforesaid Suderow application, Serial No. 523,323.

With the above in mind, operation of a single assembly of the present invention will now be described. Preferably, the telescopic supporting leg assembly 10 is transported to a suitable marine site in its retracted position, as illustrated in Figure 1. It will be noted that the pins 26 and 30 of the jacking mechanism 24 extend through registering apertures 22, 76 and 78 formed in the respective sections 16, 18 and 20. To accomplish this engagement, the pins are provided with an adjustable actuating means (not shown) which is capable of extending the

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pins past their normal operating extension so that they can enter the apertures 76 and 78. In this manner, all of the sections are positively locked against vertical movement and the entire assembly is maintained in an upwardly extending position with respect to the platform. Alternatively, the pins 26 and 30 may be utilized merely to lock the outer section to the platform with the pins 72 and 74 utilized to lock the inner and intermediate sections together and to the outer section.

The present arrangement provides for independent relative movement between any two adjacent sections and the outer section with respect to the platform. Relative movement between the inner section and the intermediate section is obtained by cooperatively introducing pressurized fluid through lower port 64 and exhausting pressurized fluid through the port 66 or vice versa. It will also be noted that by actuating the pins 74 radially outwardly into engagement with the registering apertures 76 formed in the intermediate section, relative movement in either direction between the inner section and the intermediate section is positively prevented by a mechanical locking action. Relative movement between the intermediate section and the outer section is obtained by introducing pressurized fluid through the port 64 with port 66 closed and allowing the pressurized fluid to exhaust through the port 70 or vice versa. It will be understood that the pressurized fluid introduced through port 64 will enter the lower portion of the cylinder 40 through the axial port 68 formed in the piston 50. Again it will be noted that by actuating the pins 72 radially outwardly into engagement with registering openings 22 in the outer section, relative movement in either direction between the inner section and outer section is positively prevented by a mechanical locking action. Relative vertical movement between the outer section and the platform is achieved by the operation of the jacking mechanism 24 which has been briefly discussed above and which is disclosed in detail in the aforesaid Suderow application, Serial No. 523,323. It will be understood that the pins 26 and 30 also serve to prevent relative vertical movement between the outer section and platform by a mechanical locking action.

From the above, it is apparent that the individual sections of the assembly 10 may be expanded from the transport position, illustrated in Figure 1, to an operative position, such as illustrated in Figures 2a and 2b, by suitably supplying or exhausting pressurized fluid through the ports 64, 66 and 70 and by the operation of the pins 72 and 74. Likewise, the outer section may be lowered with respect to the platform from the transport position shown in Figure 1 to a flush operative position, as shown in Figure 2a, by the operation of the jacking mechanism 24. The precise order in which the mechanisms are operated to effect the movement of the assembly from the transport position to the operative position may be varied. It will be understood, however, that since the distance from the water level to the marine bottom may vary, the total expansion of the sections need not be accomplished to elevate the platform to a desired operative height above the water level. Consequently, in order to achieve this operating height with the outer section in flush relation with respect to the upper deck surface of the platform, suitable manipulation of the sections of the assembly must be made. With the assembly in operative position the pins 72 and 74 are actuated so as to positively lock the sections against relative vertical movement. In this regard it will be noted that the series of apertures 22 in the outer section makes it possible to lock the intermediate section thereto by the pins 72 in a plurality of vertical positions. This range of adjustment serves to accommodate differences in the amount of extension of the assembly in operation. Of course, additional apertures 76 may be provided in the intermediate section where a wider range of adjustment is desired.

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When operations have been completed at a marine site and it is desired to transport the platform to any marine site for operations therein, the above procedure is merely reversed so as to move the supporting leg assembly from its extended operative position as shown in Figures 2a and 2b to its transport position as shown in Figure 1.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

I claim:

1. A forcefully extensible and contractible support comprising: inner, intermediate and outer telescoping sections; means fixed in one of said sections defining a first longitudinally extending cylinder, means fixed on another of said sections defining a first piston slidable in said first cylinder and a second cylinder fixed to said first piston, means fixed on the other of said sections providing a second piston slidable in said second cylinder, means for selectively introducing, retaining or releasing a pressurized fluid into, in or from said first and second cylinders on either side of the respective pistons slidable therein so as to selectively effect or restrain relative longitudinal movement in either direction between the section, defining said first piston and said second cylinder, and either of the other two sections, and means for positively locking each of said telescoping sections selectively in either their fully extended or fully retracted positions with respect to the sections adjacent thereto and at least to adjacent sections in any one of a plurality of positions therebetween.

2. A forcefully extensible and contractible support comprising: inner, intermediate and outer tubular telescoping sections; a first cylinder rigidly mounted within said inner section; a first piston slidably mounted within said first cylinder; a second cylinder disposed within said intermediate section having one end rigidly secured to said first piston and its opposite end rigidly secured to said intermediate section; a second piston slidably mounted within said second cylinder; a piston rod disposed within said outer section having one end rigidly secured to said second piston and its opposite end rigidly secured to said outer section, and means for selectively introducing into, retaining in, or releasing from said first and second cylinders on either side of the respective pistons slidable therein a pressurized fluid so as to selectively effect or restrain relative longitudinal movement in either direction between any two adjacent sections.

3. A support as defined in claim 2 wherein said last-mentioned means includes first ports extending through said first cylinder adjacent the ends thereof on opposite sides of said first piston, a second axial port formed in said first piston communicating the portion of said first cylinder below said first piston with the portion of said second cylinder below said second piston, and a third port extending through the upper end of said second cylinder above said second piston.

4. In apparatus of the type described, the combination comprising: a platform, a telescopic supporting leg, including an outer section and at least one inner section; guide means on said platform mounting said outer section for substantially vertical movement in either direction relative to said platform; fluid pressure-actuated holding means carried by one end of one of said sections and releasably engageable with the other of said sections for positively restraining relative longitudinal movement between said sections in either direction in any one of a plurality of positions between fully retracted and fully extended positions with respect to each other; a pair of vertically spaced and relatively vertically movable

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holding means carried by said platform and releasably engageable with said outer section for restraining relative vertical movement in either direction between said outer section and said platform; and power-actuated means operable upon release of one of said pairs of holding means to effect relative vertical movement between said platform and said outer section in either direction and upon release of said first-mentioned holding means to effect relative longitudinal movement of said sections between said fully retracted and extended positions in either direction, said power-actuated means including a cylinder rigidly mounted on one of said sections and extending longitudinally therein substantially throughout its length, a piston slidably mounted within said cylinder, and an elongated piston rod fixed at one end to said piston and at its other end to the other of said sections.

5. The combination as defined in claim 4 wherein said first-mentioned holding means comprises a horizontally disposed pin movable into and out of engagement with a section.

6. The combination as defined in claim 5 wherein said outer section includes upper and lower apertures for receiving a pin.

7. In apparatus of the type described, the combination comprising: a platform; a longitudinally extending telescopic supporting leg including an outer section, an intermediate section and an inner section; guide means on said platform mounting said outer section for substantially vertical movement in either direction relative to said platform; and power-operated means for selectively effecting or restraining relative vertical movement in

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either direction between said platform and said outer section independent of the remaining sections and for selectively effecting or restraining relative vertical movement in either direction between any two adjacent sections independent of the remaining section and said platform, said power-operated means including a first cylinder rigidly mounted within said inner section, a first piston slidably mounted within said first cylinder, a second cylinder disposed within said intermediate section having one end rigidly secured to said first piston and its opposite end rigidly secured to said intermediate section, a second piston slidably mounted within said second cylinder, and a piston rod disposed within said outer section having one end rigidly secured to said second piston and its opposite end rigidly secured to said outer section.

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