United States Patent

Bordes

[15] **3,680,321**

[45] **Aug. 1, 1972**

[54] **MOBILE OFFSHORE PLATFORM**

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[73] Assignee: **N.V. Industrieele Handelscombinatie Holland,** Rotterdam, Netherlands

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Dec. 4, 1969 Netherlands.....18255/69

[52] **U.S. Cl.**.....**61/46.5,** 115/9

[51] **Int. Cl.**.....**E02b 17/00,** E02f 9/04, B65b 21/50

[58] **Field of Search**.....61/46.5; 115/9; 37/73

[56] **References Cited**

UNITED STATES PATENTS

3,230,721	1/1966	De Long et al.	61/46.5
3,590,587	7/1971	Smulders	61/46.5

Primary Examiner—Jacob Shapiro

Attorney—Young & Thompson

[57] **ABSTRACT**

A mobile offshore platform has at least five columns mounted eccentrically in rotatable frames on the platform. Each column has a foot at its lower end in which the column is rotatably disposed. The platform can walk on the sea floor by lowering three feet, raising the remaining feet, rotating the frames of the lowered feet whereupon the platform advances with an arcuate movement while the column rotates in its emplaced foot, then lowering the raised feet, and so on.

6 Claims, 9 Drawing Figures

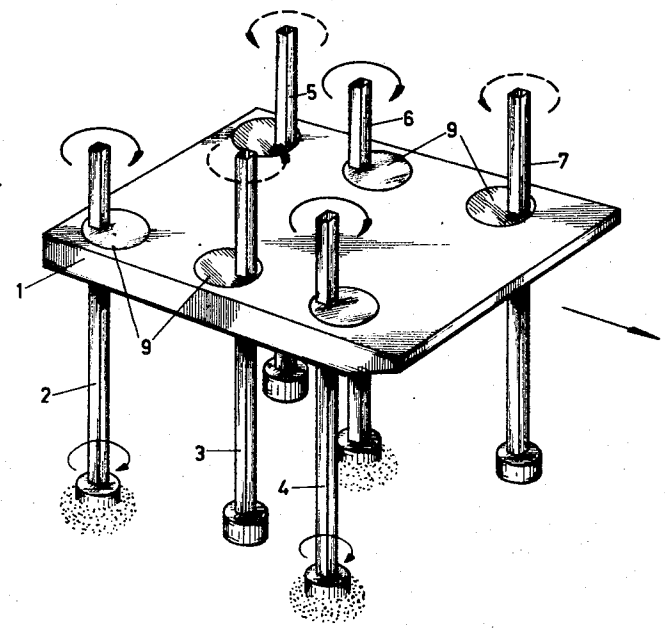

FIG. 1

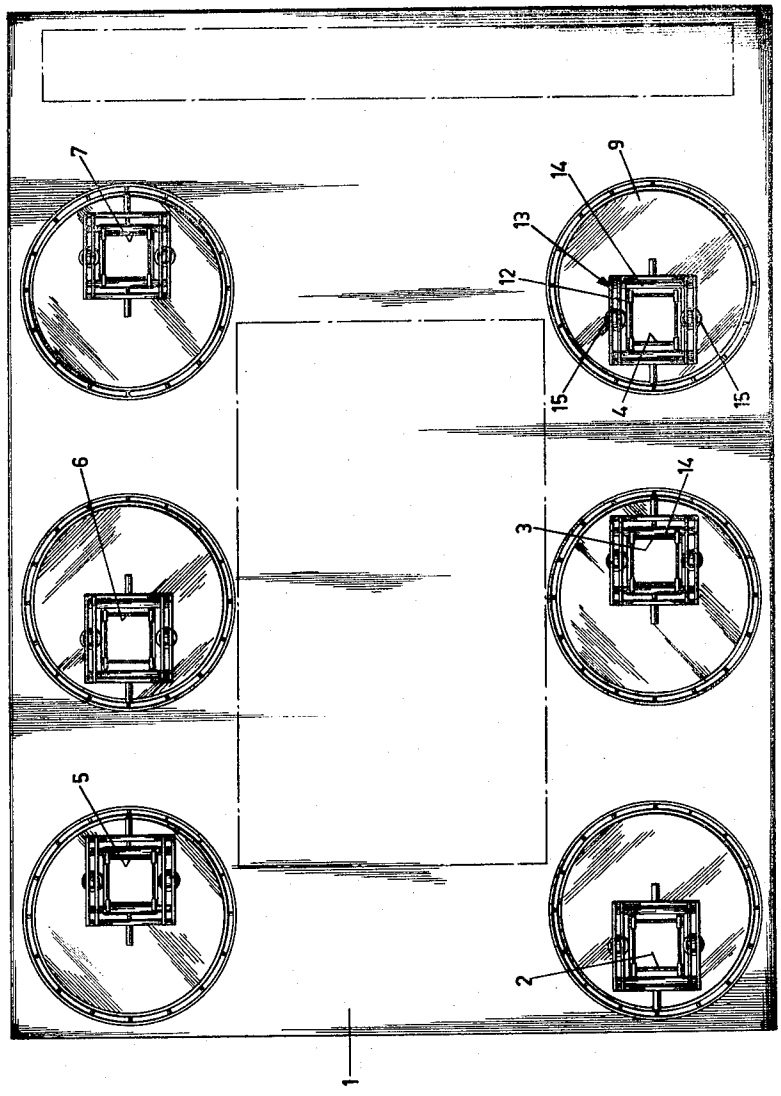

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FIG. 2

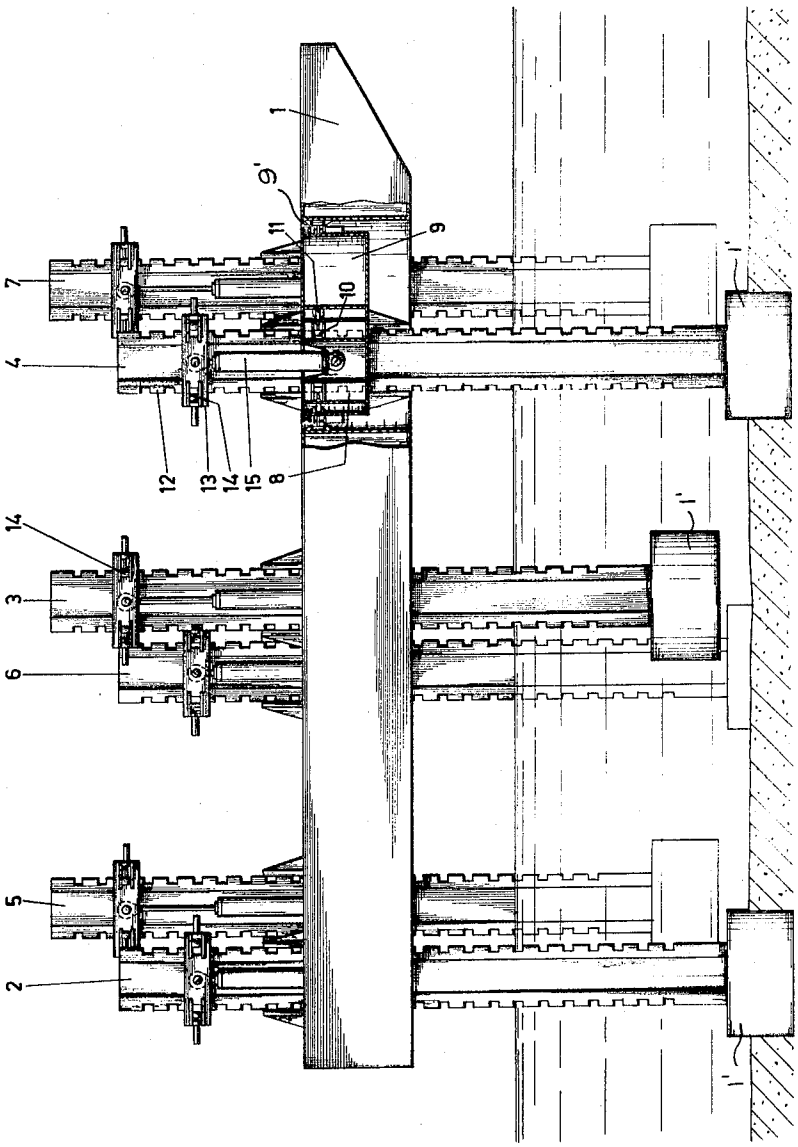

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Fig. 3

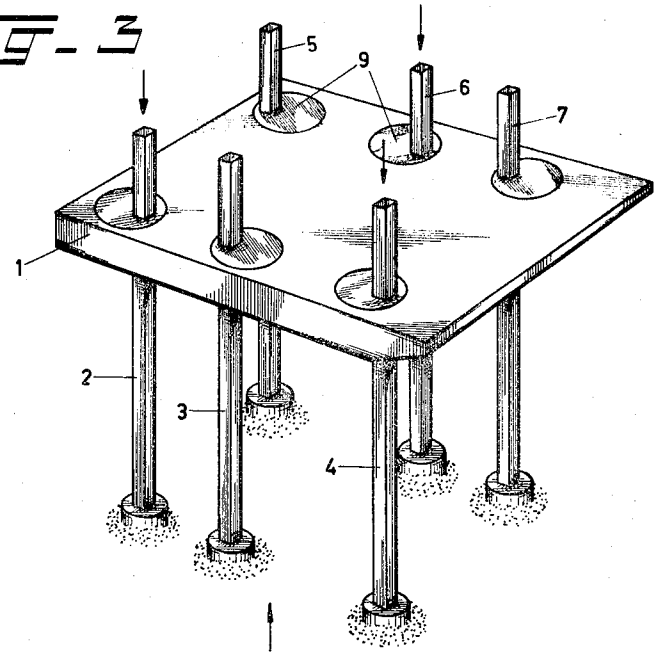

Fig. 4

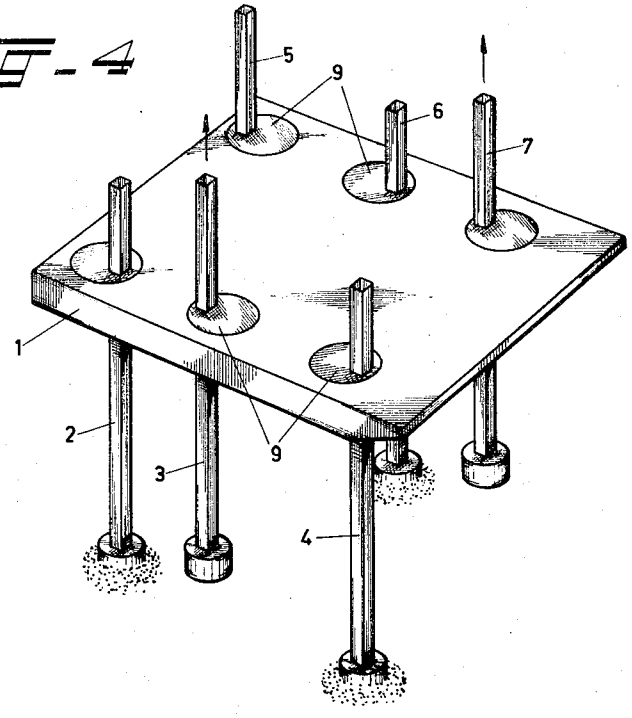

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Fig. 5

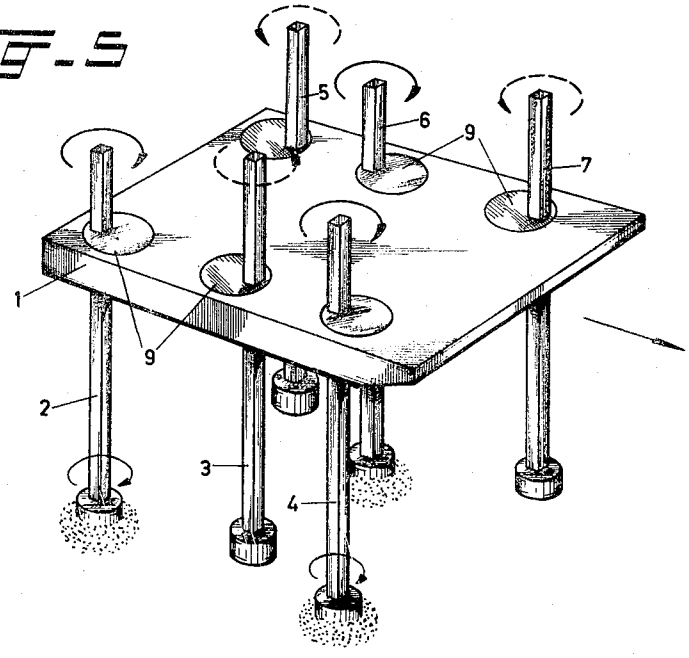

Fig. 6

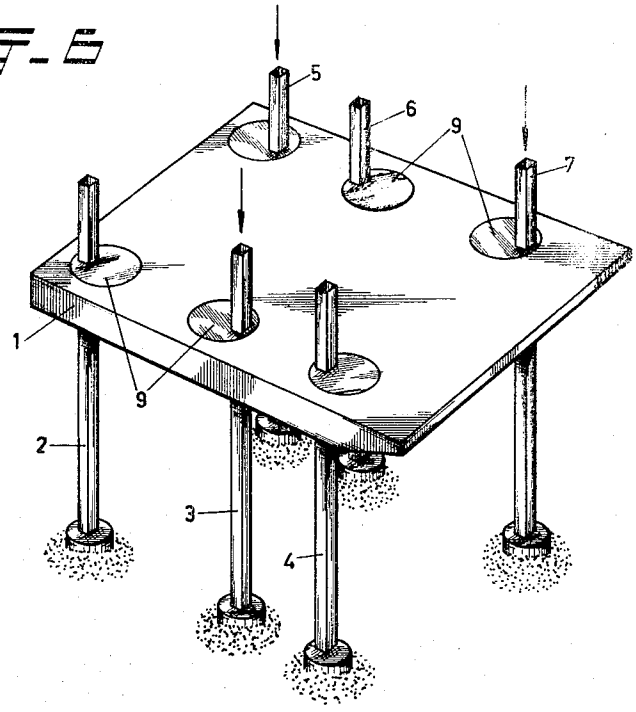

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Fig-7

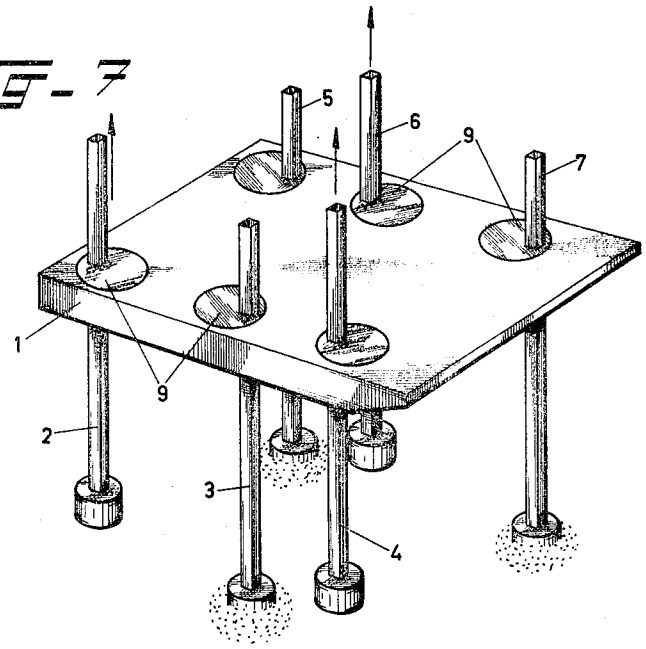


Fig-8

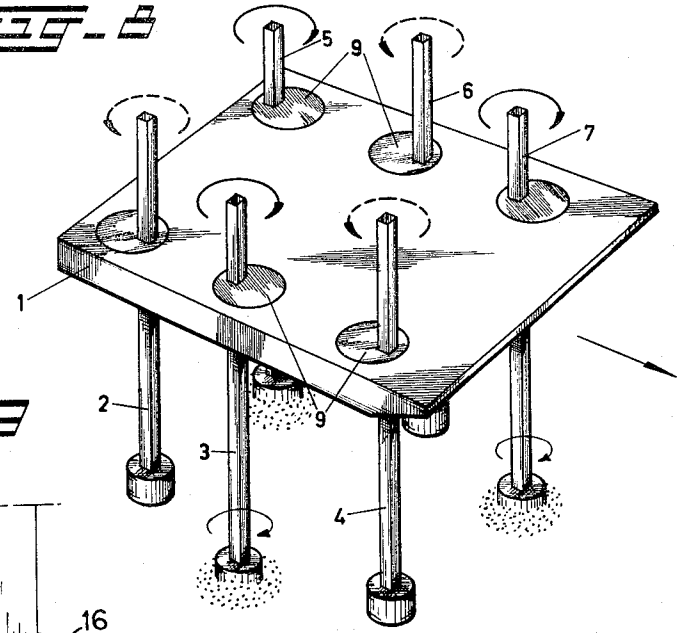
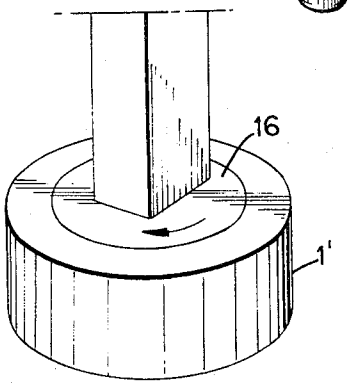


Fig-9



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MOBILE OFFSHORE PLATFORM

The present invention relates to mobile offshore platforms of the type comprising a buoyant platform and at least five columns located off center in frames, the frames being rotatably mounted in the pontoon body and the columns each being vertically movable relative to the frames. The present invention is an improvement on the invention of U.S. Pat. No. 3,590,587, owned in common herewith.

In the device of that earlier application, the columns in the rotatable frames are movable horizontally relative to the frames. Thus the platform is movable over the sea bottom without the necessity of bringing the platform down to the water level before each horizontal displacement. During each displacement, the platform rests on three columns while the other columns are lifted from the sea bottom and the frames of the lifted columns are rotated so that the columns move from an eccentric rear position to an eccentric forward position in which position the columns are lowered again. When all the columns have been moved in this manner and all the frames have been rotated so that the desired direction of movement is ensured, the pontoon will then be moved as a whole relative to the columns, the frames and columns moving horizontally relative to each other.

However, the need to move the rotatable frames and the columns horizontally relative to each other makes it necessary to use structure and mechanism which it is preferred to avoid.

Accordingly, it is an object of the present invention to provide a device as described above, in which it is no longer necessary to make the frames and columns horizontally movable relative to each other.

Another object of the present invention is the provision of such a device which will be relatively simple and inexpensive to manufacture, easy to operate, maintain and repair, and rugged and durable in use.

Other objects and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a top plan view of a mobile offshore platform according to the present invention;

FIG. 2 is a side elevational view of the platform of FIG. 1, with parts broken away;

FIGS. 3–8 are somewhat schematic views showing the sequence of movement of the platform according to the present invention; and

FIG. 9 is an enlarged fragmentary perspective view of the lower end of a column.

Referring now to the drawings in greater detail, there is shown a mobile offshore platform according to the present invention, comprising a buoyant platform or pontoon 1 having six supporting columns 2 – 7. Each column is mounted for rotation at its lower end in and relative to a foot 1′ and for vertical movement in and relative to a rectangular frame 8 which in turn is carried eccentrically by a rotatable circular frame 9 mounted for rotation about its vertical axis on and relative to pontoon 1 under the influence of power means 9′.

Each frame 8 carries locking devices 10 operated by means of cylinders 11, these locks engaging selectively along the length of a toothed rack carried by each column. A second frame 13 guided on each column has

locks 14 operated by means of cylinders, the frames 13 being connected to frames 8 by means of cylinders 15 located on either side of each column. By operation of the assemblies 10–15, the pontoon 1 and the columns 2–7 may be moved vertically relative to each other. Further details of the construction and operation of this raising and lowering mechanism are given for example in U.S. Pat. No. 3,343,372, to which reference is made for a more complete disclosure.

Turning now to FIGS. 3–8, the sequence of operation can be followed. FIG. 3 shows the platform in its operative position, resting on all six columns. Notice that with respect to movement of the platform toward the lower right, as indicated by the arrows in FIGS. 5 and 8, the columns 2, 4 and 6 are in the forward position while the columns 3, 5 and 7 are in a rear position.

Columns 2, 4 and 6 may be forced downward, as indicated by the arrows in FIG. 3, and columns 3, 5 and 7 raised so that their feet 1′ are raised above the sea floor, as seen in FIG. 4. Then all the frames 9 are rotated, in the directions of their arrows as seen in FIG. 5, that is, columns 2, 4 and 6 clockwise as viewed from above and columns 3, 5 and 7 counterclockwise. During this rotation, the columns 2, 4 and 6 of course do not advance horizontally, because their feet 1′ are sunk in the sea bed, but rotate about their vertical axes relative to their stationary feet. The pontoon 1 thus undergoes an increment of forward motion along a semicircular path having a sagittal length twice the eccentricity of each column in its frame 9; while the columns 3, 5 and 7, which are simultaneously or sequentially undergoing the same advance relative to the pontoon 1, undergo a total forward movement equal to four times the eccentricity of the columns in the frames 9.

The columns 3, 5 and 7 are then lowered, as indicated in FIG. 6, and the columns 2, 4 and 6 are raised, as indicated in FIG. 7, which transfers the load to columns 3, 5 and 7. The frames 9 are then rotated in the direction of the arrows shown in FIG. 8, which may be the same as the direction shown in FIG. 5 or may be the opposite as indicated in FIG. 8, and the cycle is repeated. It will thus be recognized that, for each rotation of the frames 9, the pontoon advances twice the eccentricity of the columns and the frames 9; but for each complete cycle, the pontoon advances by four times that eccentricity. In FIG. 9, it will be noted that the lower end 16 of the column is rotatable relative to foot 1′, so that the column can rotate while the foot remains stationary on the sea floor.

The foregoing discussion of the operation is based on rotation of frames 9 through an angle of 180°, thereby to advance pontoon 1 along a path whose average direction is rectilinear and parallel to the longitudinal edges of the pontoon as shown in the illustrated embodiment. Of course, by varying the size and direction of the increment of rotation of the frames 9, the pontoon can be moved in any selected direction or in various directions. Thus, for example, a rotation of the frames 9 by 90°, followed by resumption of 180° rotations, would change the direction of movement of the pontoon to a right angle in one direction; while rotation through 270° would change it to a right angle in the opposite direction.

It is of course also possible to swing the pontoon somewhat by rotating different frames 9 different increments within the limits imposed by the natural play or flexibility of the structure.

From a consideration of the foregoing disclosure, therefore, it will be evident that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with a preferred embodiment, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

What is claimed is:

1. A mobile offshore platform comprising a pontoon and at least five vertical columns, means mounting the columns for vertical movement parallel to their length relative to the pontoon, means for rotating at least three of the columns relative to the pontoon about vertical axes eccentric to the columns, said at least three of the columns having lower portions rotatable relative to upper portions of the columns about upright axes.

2. A mobile offshore platform as claimed in claim 1, each column being mounted in a frame which is connected to the pontoon, each said frame being rotatable about its vertical axis relative to the pontoon, the column being fixed in the frame against horizontal movement of the column relative to the frame.

3. A mobile offshore platform as claimed in claim 1, said last-named lower portion comprising a foot carried by the lower end of at least some of said columns and rotatable relative to the column.

4. A mobile offshore platform as claimed in claim 1, there being six said columns arranged off center of said platform.

5. A method of moving over a body of water a floating platform which is comprised by a buoyant pontoon and at least five vertical columns, comprising supporting the pontoon on the columns above the level at which the pontoon is buoyant in the body of water, raising a plurality of said columns relative to the pontoon out of supporting relationship with the pontoon while maintaining the pontoon supported above said level on at least three columns, rotating said raised columns about a vertical axis eccentric to the raised columns to advance the raised columns horizontally, lowering the horizontally advanced plurality of columns again into supporting relationship to the pontoon, and while said plurality of columns are raised, rotating said at least three supporting columns about their vertical axes while swinging the pontoon about said axes to advance the pontoon horizontally.

6. A method as claimed in claim 5, said horizontal advance of said pontoon being performed by rotating said pontoon and said at least three columns relative to each other about a plurality of upright axes eccentric to said at least three columns.

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