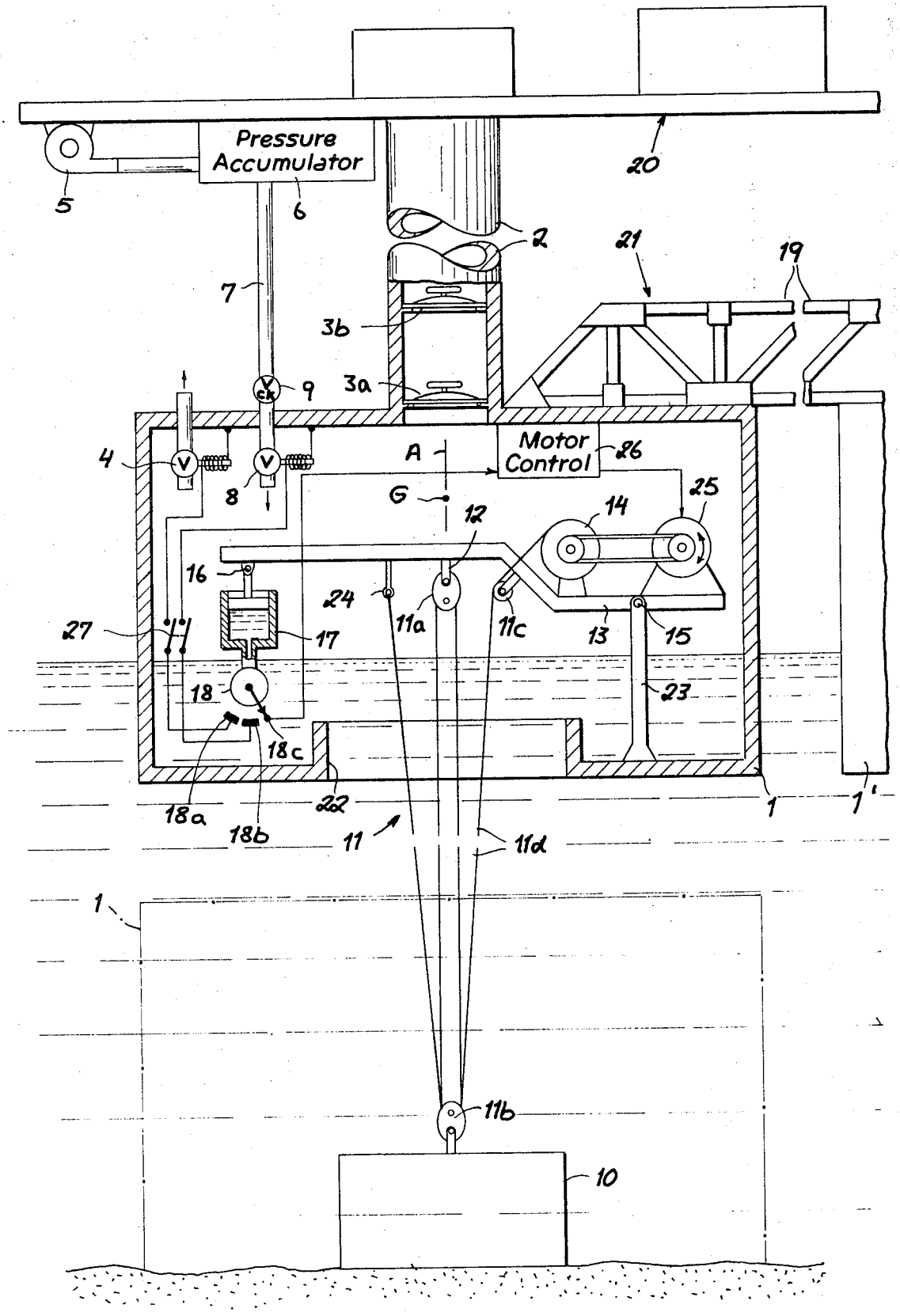
March 2, 1971 H. RAMME 3,566,608

SUPPORT FOR TRANSPORTABLE OFF-SHORE ISLAND

Filed Feb. 24, 1969



United States Patent Office 3,566,608 Patented Mar. 2, 1971

3,566,608

SUPPORT FOR TRANSPORTABLE OFF-SHORE ISLAND

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Filed Feb. 24, 1969, Ser. No. 801,472
Claims priority, application Germany, Feb. 22, 1968, P 17 08 547.1
Int. Cl. B63b *35/44, 43/06*
U.S. Cl. 61—46.5 3 Claims

ABSTRACT OF THE DISCLOSURE

A leg supporting a maritime platform comprises a buoyant base held submerged by a weight resting on the sea bottom, the weight being tied to the base by a hoisting cable whose tension controls a pair of valves for partly flooding or venting the base to reduce or increase its buoyancy in a manner compensating for changes in the load of the platform.

My present invention relates to a transportable offshore island wherein a load-carrying structure, such as a steel platform, is mounted on several (usually three) legs rising from the bottom of the sea or some other body of water in which the island is to be stationed, e.g., for well-drilling purposes.

The stationing of such structures on legs directly resting on the sea bottom entails the risk that the legs would gradually sink into the relatively soft ground. It has therefore already been proposed to mount these legs on a buoyant base held submerged by weighted anchors which are tied to the structure by cables sloping in different directions and are equipped with grappling hooks or the like to resist peripheral and centripetal forces resulting from the torque of the drilling operation and the buoyancy of the base. The weight of these anchors must be considerable in order to ensure that the island will not be cast adrift upon a major reduction in load or in response to severe buffeting by winds and waves.

The placement and relocation of these anchors, accordingly, is a difficult and time-consuming maneuver.

The general object of my present invention is to provide a support for a maritime platform, or other structure rising from a body of water, in which the aforedescribed difficulties are avoided and which therefore can be anchored and refloated with a minimum of effort.

Another object is to provide means in such system for maintaining the buoyancy of a submerged support within a predetermined, relatively narrow range independent of loading conditions, thus enabling the support to be held down by a relatively small weight.

A related object of my invention is to provide support means for such a structure whose lifting force under water is substantially constant and low enough to be overcome by a weight or weights so small as to be carried by the support means upon a floating of the latter.

I realize the aforestated objects by the provision of sensing means responsive to the tension of a cable or other tie means linking the submerged base with its anchoring weight or weights, this tension being a measure of the buoyancy of the base as modified by the load carried on the supported structure, in combination with control means such as a set of valves for varying this buoyancy in a manner compensating for changes in load.

In a preferred embodiment, the base includes a framework rigid with a plurality of generally pontoon-shaped floats, three such floats being normally sufficient to carry a platform equipped with a well-drilling rig. Each float has a bottom opening or well through which a cable from a hoist anchored therein extends substantially vertically to engage a weight which, during the stationing of the platform, is lowered through that opening onto the ocean floor; a subsequent tensioning of that cable by the hoist drive, after a reduction of the buoyancy of the float by additional loading and/or by partial flooding, then draws the base under water oncoming to rest on the ocean floor, the float will receive the weight in its bottom well. Upon submersion the tension sensor associated with the hoist is made operative to maintain an approximately constant buoyancy in the submerged float.

With the center of gravity of the float substantially coinciding with a vertical axis passing midway through the bottom opening thereof, and with a platform-supporting leg rising from the float substantially in line with that axis, the position of the submerged base will generally be stable against both lateral and rotary stresses. Naturally, conventional grappling hooks of negligible weight could be used in addition, if necessary, to secure the structure against horizontal motion in any direction.

An advantageous arrangement for sensing the tension of the hoisting cable, and therefore the magnitude of the lifting force exerted by the float, involves the anchoring of the hoist to a mobile member, preferably a generally horizontal lever arm, the buoyancy-control means including a pressure gauge coupled directly or indirectly to that arm. The restoring force needed to counteract the tensioning of the hoisting cable may be supplied at least in part by the reaction of this pressure gauge, supplemented if necessary by springs and/or counterweights.

The above and other features of my invention will become more clearly apparent from the following detailed description of a preferred embodiment illustrated, partly diagrammatically and with portions broken away, in an elevational sectional view constituting the sole figure of the accompanying drawing.

The system shown in the drawing comprises a platform **20** supported by a base **21** which includes several structurally identical floats **1**, **1'** (only two shown), a framework **19** rigidly interconnecting these floats, and a set of legs **2** (only one shown) rising from the center of each float to the underside of the platform, e.g., at a respective corner of its triangular outline. The leg **2** is a tubular column which, in a manner well known per se, may permit a crew member to descend from the platform **20** to the interior of the float by way of an air lock represented by a pair of hatches **3***a*, **3***b*.

The axis A of column **2** passes through the center of gravity G of float **1** and also through the center of a bottom opening or well **22** which may be of circular, square or other polygonal configuration. A heavy block **10**, fitting with some clearance inside the well **22**, is connected with the float **1** by a hoist **11** including an upper roller **11***a*, a lower roller **11***b* and a deflecting roller **11***c*. Roller **11***a* is mounted by a strap **12** on a lever **13** having a fulcrum **15** on a post **23**; the cable **11***d* of the hoist has its fixed end secured to the lever **13** at **24** and has its opposite end wound about a reel **14** driven by a reversible motor **25**. The reel **14** and the motor **25** are both shown supported on the lever **13** in the vicinity of its fulcrum while the opposite, free end **16** of the lever is connected with a conventional pressure gauge diagrammatically illustrated at **17**. This pressure gauge, apart from resisting a downward swing of the lever end **16**, is hydraulically, pneumatically or mechanically coupled with a rotary switch **18** controlling a pair of normally closed solenoid valves **4** and **8** by way of respective bank contacts **18***a* and **18***b*. A further bank contact **18***c* leads to a control circuit **26** for drive motor **25**. The operating circuits of valves **4** and **8** can be disconnected, as shown, by a circuit breaker **27** remote-actuated from a panel on platform **20** of relay circuits not further illustrated. Valve

4, when opened, allows air from the interior of float **1** to escape into the ambient air or water, depending on whether the pontoon **1** is floated (as shown in full lines) or submerged (with a limiting position shown in dot-dash lines), whereas valve **8** in series with a check valve **9** allows in its open state the introduction of air under pressure into the pontoon through a conduit **7** from a pressure accumulator **8** which is fed by a compressor **5** on platform **20**.

Let us assume, by way of example, that the anchor block **10** has an effective weight of 500 tons and that the individual buoyancy of each float **1**, **1'**, etc., when submerged, is to be maintained at approximately 300 tons. During transportation of the structure to the anchoring site this block is retracted into the well **22** of the float **1** which, naturally, must then be loaded lightly enough and contain a large enough volume of air to float with the weight **10** suspended therefrom; thus, the uplift of the pontoon loaded down by a proportional part of the superstructure **2**, **19**, **20** must be greater than 500 tons under the conditions assumed. Upon arrival at the site, motor control **26** is set in motion by a signal from the operator's cabin aboard the platform **20** to drive the reel **14** in a sense slowly paying out the cable **11***d* until the weight **10** hits bottom; during this operation, with the circuit breaker **27** open to prevent any untimely opening of valves **4** and **8**, gauge **17** measures the effective weight of block **10** and holds the switch **18** off its bank contact **18***c*. When the block **10** touches ground, the tension of hoisting cable **11***d* decreases while the float **1** begins to rise higher above the water level with continuing rotation of reel **14**. When the tension measured by gauge **17** has dropped to a certain level, e.g. of 200 tons, switch **18** engages its contact **18***c* to stop the motor **25**.

After the weights of all the pontoons interconnected by framework **19** have been thus stabilized, the platform **20** is fully loaded with remote manipulation of valve **4** or **8** from the operator's cabin (if necessary) to reduce the effective buoyancy of each float from its previous value in exces of 500 tons to a value lower than 500 tons so that subsequent operation of the hoist **11** will submerge the float instead of lifting the weight **10**. The operator on platform **20** then actuates the motor control **26** to drive the reel **14** of each float in the reverse sense, thereby tightening the cable **11***d* of the corresponding hoist and pulling the base **21** under water. Prior to that time or just before the base alights on the ground, circuit breaker **27** is closed so that switch **18** is able to control the buoyancy of the float **1** by opening the air-inlet valve **8** via contact **18***b* when the cable tension is less than a predetermined lower limit, e.g., 290 tons, and by opening the air-outlet valve **4** when that tension exceeds a predetermined upper limit, e.g., 310 tons, so as to maintain the buoyance per float at approximately 300 tons. If the load on the platform **20** is increased by up to 300 tons per supporting pontoon, the residual buoyance will prevent any settling of the base **21** in the ocean floor; larger loads will have to be placed thereon more gradually, at a rate determined by the response time of the control system, up to an upper limit dependent on the maximum buoyancy of the floats fully cleared of water.

The switch **18** may be provided with additional contacts, not shown, for keeping the valve **4** or **8** open until the cable tension as sensed by the gauge **17** reaches a value in the vincinity of the desired 300-ton level after rising above or falling below the assumed threshold of 310 or 290 tons, in a manner analogous to the operation of conventional thermostats or similar range-setting controls. In principle the buoyancy level maintained by this regulator could be a much smaller fraction of the total load, particularly if major load increases during operation are not to be expected.

The coupling of the pressure gauge **17** with hoist **11** through the intermediary of oscillatory member **13** renders the reading of that gauge independent of any frictional resistance encountered by the cable **11***d* in its passage around rollers **11***a*, **11***b* and **11***c* and reel **14**.

Naturally, the various elements and other sensitive devices within float **1** should be protected against the intruding sea water by suitable shielding not shown.

I claim:

1. A support for a structure rising from a body of water, comprising a float with a bottom opening; lever means in said float mounted above said opening with limited swingability about a horizontal fulcrum; weight means resting on the ground in said body of water; hoist means anchored to said lever means and said weight means while traversing said bottom opening; reversible drive means coupled to said hoist means for lowering said weight means to the ground and for subsequently drawing said float under the water level; first valve means near the top of said float for flooding said float by allowing the escape of air from its interior; second valve means near the top of said float for expelling water from the interior thereof by the admission of a gas under pressure; and sensing means coupled to said level means for resisting a swing of said lever means under stress from said weight means and for selectively operating said first and second valve means to vary the buoyancy of said float in a manner compensating for changes in the loading of said structure.

2. A support as defined in claim **1** wherein said opening is formed by a well for receiving said weight means in the body of said float.

3. A support as defined in claim **1** wherein said lever means comprises a substantially horizontal arm overhanging said opening, said hoist means including a cable with a fixed end secured to said arm and a reel on said lever means engaging a mobile end of said cable, said drive means being operatively connected with said reel.

References Cited

UNITED STATES PATENTS

2,972,973	2/1961	Thearle	61—46.5X
3,031,997	5/1962	Nesbitt	61—46.5X

FOREIGN PATENTS

1,012,370	12/1965	Great Britain	61—46.5

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U.S. Cl. X.R.

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