

Feb. 22, 1966

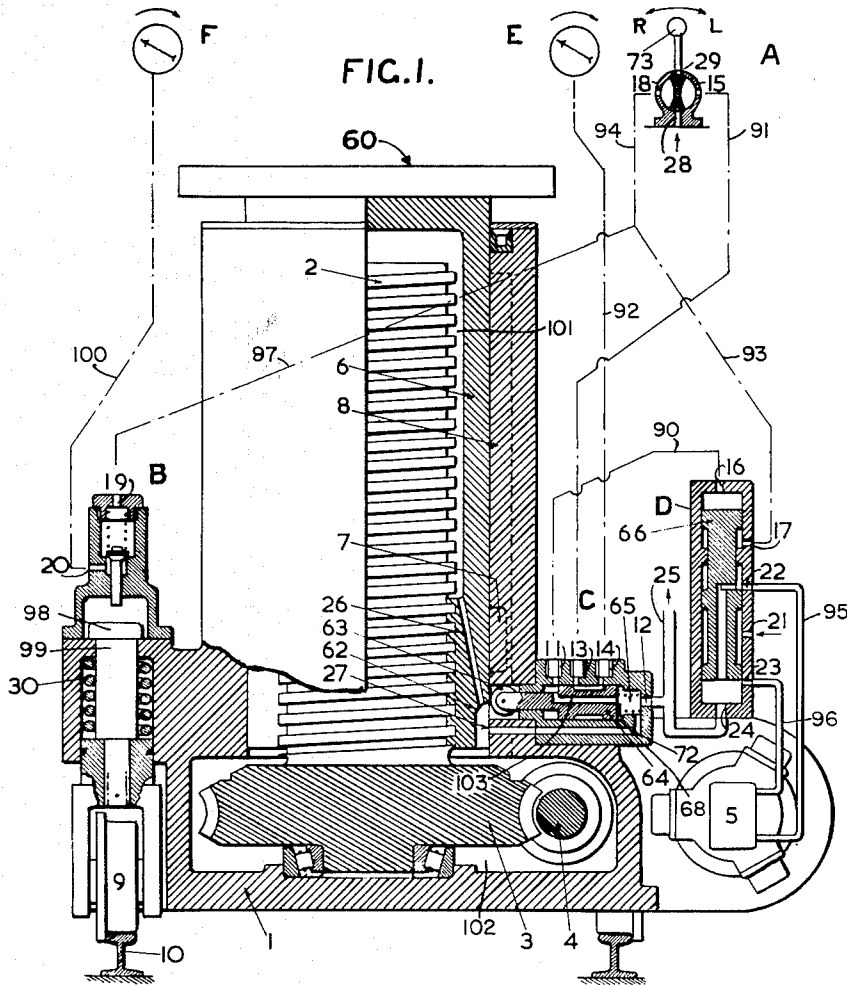
J. C. T. MATTOCKS ETAL

3,236,489

POWER OPERATED SCREW JACKS

Filed April 3, 1964

6 Sheets-Sheet 1



INVENTORS
JOHN CHARLES THOMAS MATTOCKS
FREDERICK ERNEST JOHN HOWARD

By: Norris & Gateman, Attorneys

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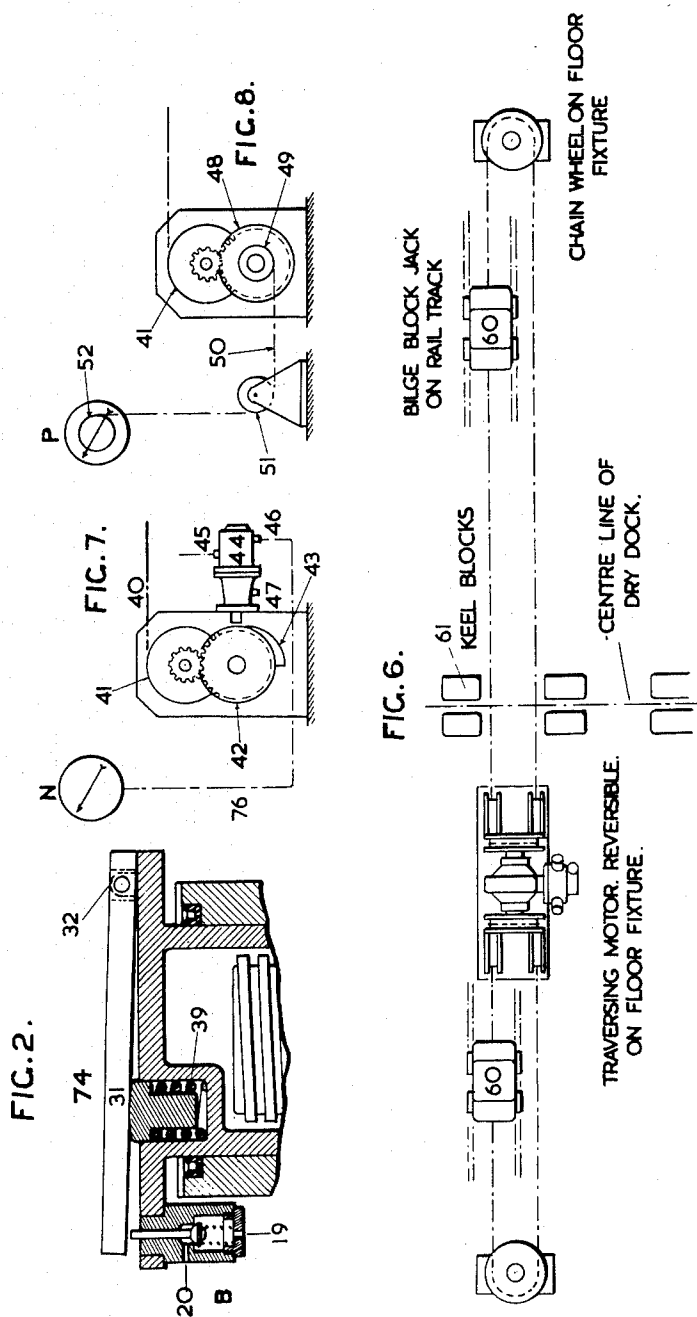
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INVENTORS
JOHN CHARLES THOMAS MATTOCKS
FREDERICK ERNEST JOHN HOWARD
By: Norris & Bateman, Attys

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6 Sheets-Sheet 3

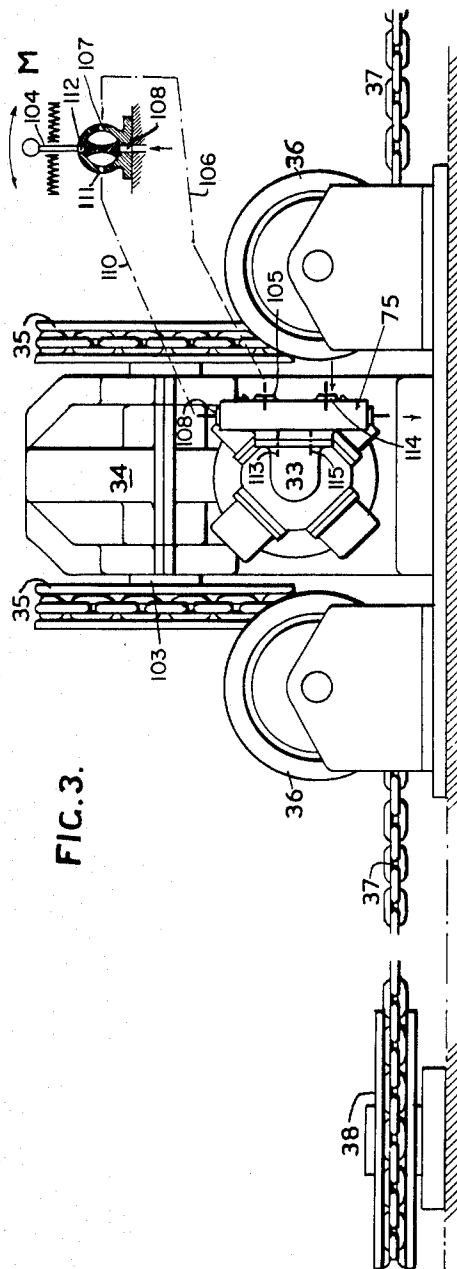


FIG. 3.

INVENTORS
JOHN CHARLES THOMAS MATTOCKS
FREDERICK ERNEST JOHN HOWARD

By: Norris & Battenman, Attys

Feb. 22, 1966

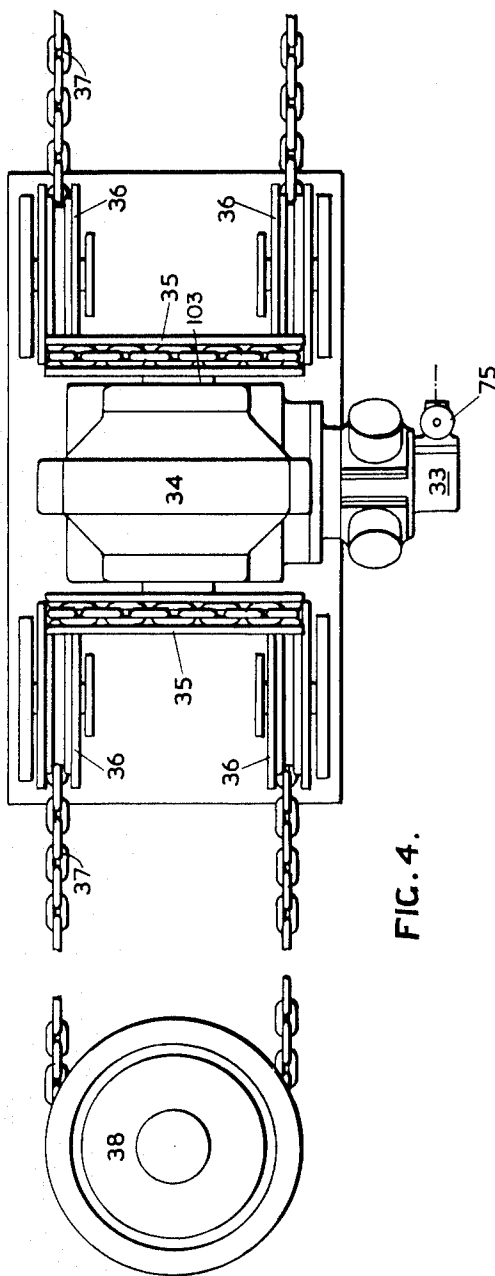
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6 Sheets-Sheet 4



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JOHN CHARLES THOMAS MATTOCKS
FREDERICK ERNEST JOHN HOWARD
By: Norris & Bateman, Attys

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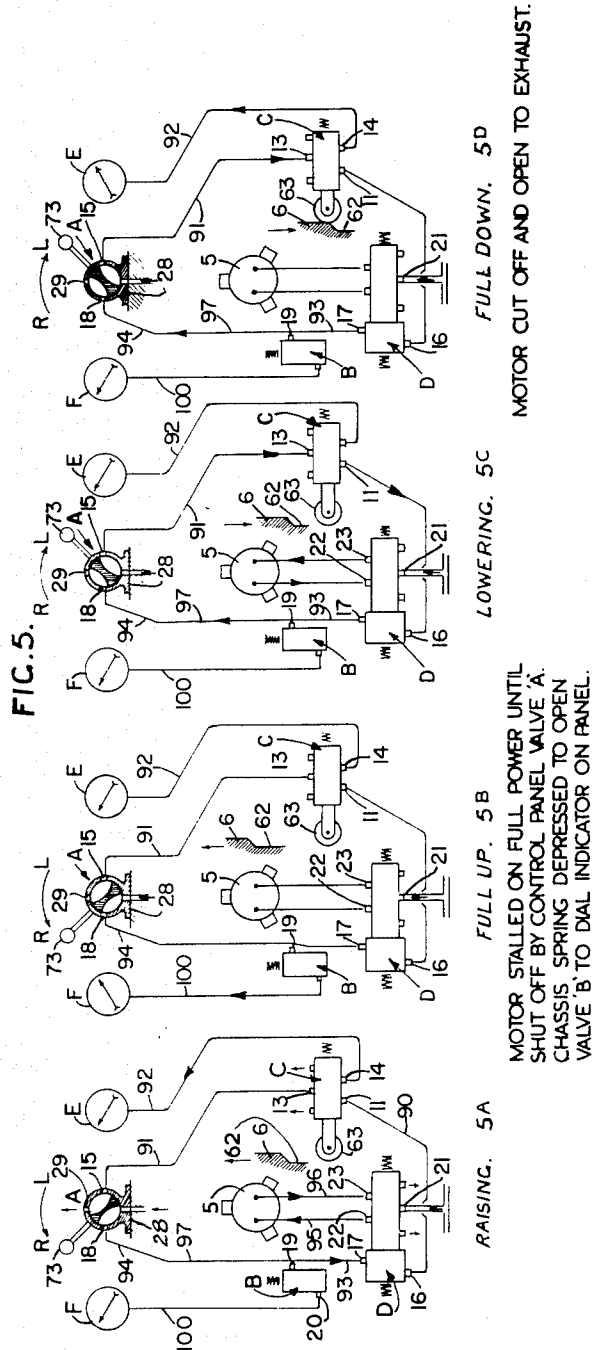
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6 Sheets-Sheet 5



INVENTORS
JOHN CHARLES THOMAS MATTOCKS
FREDERICK ERNEST JOHN HOWARD

By: Norris & Bateman, Attys

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6 Sheets-Sheet 6

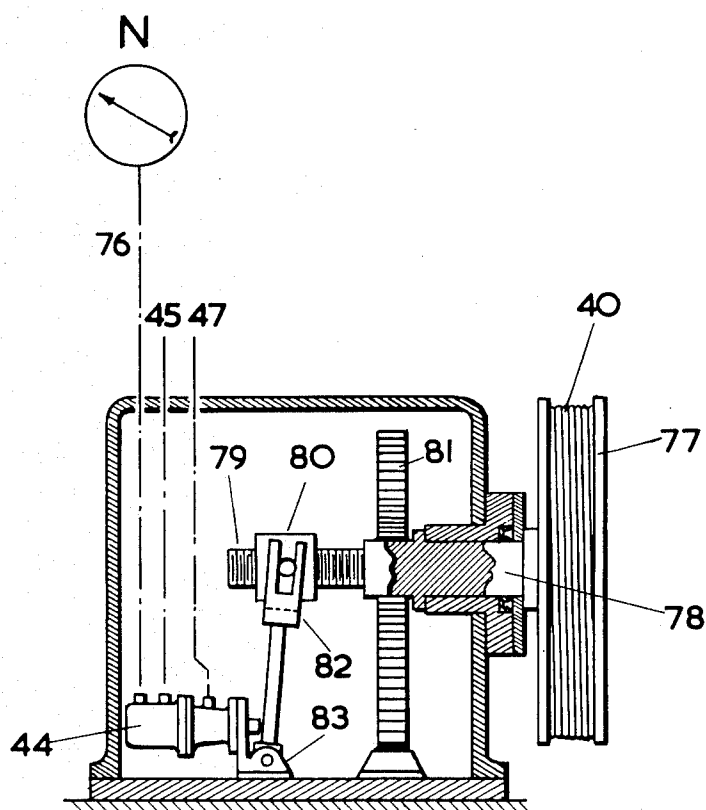


FIG. 9.

INVENTORS
JOHN CHARLES THOMAS MATTOCKS
FREDERICK EARNEST JOHN HOWARD

By: Norris + Bateman, attys

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3,236,489

POWER OPERATED SCREW JACKS

John C. T. Mattocks, Romford, and Frederick E. J. Howard, Hornchurch, England, assignors to The Globe Pneumatic Engineering Company Limited
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18 Claims. (Cl. 248—354)

This invention relates to lifting jacks and operating means therefor and is particularly concerned with such jacks for use as bilge blocks for ships in dry docks.

According to the invention there is provided, in combination, a liquid-tight screw jack for use as a bilge block for stabilizing ships in dry docks and provided with springs, compressible upon operation of the jack to enable the thrust exerted to be transmitted to the surface upon which the jack rests, a reversible fluid-operated driving motor for the ram of the jack and remote controlled means for supplying fluid under pressure to said motor.

The invention will be described in detail with reference to the accompanying drawings in which:

FIGURE 1 is a part sectional elevation of a mobile form of screw jack with fluid supply connections shown diagrammatically;

FIGURE 2 is a part sectional elevation of the upper end of a stationary form of screw jack;

FIGURE 3 is an elevation and;

FIGURE 4 is a plan view of driving means for a pair of mobile screw jacks;

FIGURES 5a to d are diagrammatic views showing the setting of the valves in the fluid circuit at different positions of the ram of the jack;

FIGURE 6 is a diagrammatic plan view showing a pair of mobile screw jacks and driving means therefor arranged on the floor of a dry dock; and

FIGURES 7, 8 and 9 are elevational views of alternative forms of device for the remote indication of the positions of a pair of mobile screw jacks relative to the main keel blocks in a dry dock.

Referring now to FIG. 1 the jack 60 basically comprises a casing 1 containing a screw 2 secured to a worm wheel 3 meshing with a worm 4 driven by a fluid motor 5 through reduction gearing. The shaft of the motor is preferably provided with an extension (not shown) capable of operation by a handle to permit manual release of the jack when that part of a ship's plating adjacent thereto has to be repaired or cleaned. The screw 2 is in threaded engagement with a ram 6 which is prevented from rotating by a lug 7 thereon entering a groove 8 in the casing 1. The jack 60 is provided with four wheels 9 which, in the disengaged condition of the jack, run freely on rails 10. Secured to the casing 1 is a multi-way valve C the spool 64 of which carries a cam follower 63 urged by a spring 65 into engagement with the ram 6 which is formed at its lower end with a cam surface 62. The valve spool 64 controls inlet ports 11 and 13 connected to an outlet port 16 in a self-centering multi-way valve D and an outlet port 15 in a remotely situated manually operated valve A through lines 90 and 91 respectively and outlet ports 12 and 14 connected to an exhaust conduit 25 and through a line 92 to a remotely situated dial indicator E, respectively. The valve D is also secured to the casing 1 and is provided with a spool 66, controlling inlet ports 17 and 21 connected through lines 93 and 94 to an outlet port 18 of the valve A and to a pressure fluid supply main, respectively, and outlet ports 22 and 23 connected to the motor 5 through lines 95 and 96 respectively. A further outlet port 24 is connected to the exhaust conduit 25. The outlet port 18 of the valve A is also connected through the line 94 and a line 97 to the inlet

port 19 of a valve B secured to the casing 1 operable by a tappet 98 on a stem 99 movable vertically relative to the casing 1, to connect port 19 to an outlet port 20, connected through a line 100 to a dial indicator F situated at the same remote point as the indicator E and valve A, preferably on the cope of a dock wall. Connected passages 26, 27 and 72 are provided in the ram 6, casing 1 and valve C, respectively, so that air at atmospheric pressure, which would otherwise be trapped in the ram and worm wheel chambers 101 and 102 respectively as the ram is raised and lowered may be vented to exhaust. The valve A is connected to the pressure fluid supply main through a port 28 and to exhaust through a port 29. Springs 30, interposed between the casing 1 and the wheels 9 are compressed upon raising the ram 6 into its load engaging position and enable the thrust exerted to be transmitted to the rails 10 and prevent any relative movement between the wheels and the rails.

All parts of the jack 60 are suitably sealed against ingress of water and all piping is led to a common manifold (not shown) on the jack from which flexible hose pipes are taken to supply and exhaust mains in the dock floor and, where necessary, to the remote control point on the cope of the dry dock.

In the position of the parts shown in FIG. 1, both ends of valve D are connected to exhaust, one directly through port 24 and the other through line 90 and port 11, passage 103 of spool 64, chamber 68 and port 12 of valve C. Movement of the operating member 73 on the valve A to the "raise" position R connects port 17 of valve D to the supply main through ports 18 and 28 and lines 93 and 94 and opens a line 92, 91 from indicator E to exhaust through ports 14, 13, 15 and 29.

Fluid supplied through the port 17 moves the valve spool 66 to connect port 21 to port 22 and thus provide for the supply of operating fluid through line 95 to the motor 5 which in turn drives the screw 2 through worm 4 and worm wheel 3 to raise the ram 6. Fluid passing through motor 5 flows through conduit 96 and ports 23 and 24 into exhaust conduit 25. During this time fluid exhausts from valve D through port 16 into conduit 90, and through port 11, passage 103, chamber 68 and port 12 of valve C into exhaust conduit 25. The flow connections are then as shown in FIGURE 5a. As the ram 6 rises the spring 65 urges the spool 64 of valve C to the left, as seen in FIGURE 1, in order to maintain the cam follower 63 in engagement with the cam surface 62. This breaks the connection between ports 13 and 14 and establishes a connection between ports 11 and 13. As a result fluid flows out of port 16 of valve D through conduit 90, through port 11, passage 103 and port 13 of valve D into conduit 91 and thence to port 15 and outlet port 29. As the ram 6 thrusts against the ship's bilge the casing 1 moves downward relatively to the wheel mountings compressing the springs 30 and acting through them to press the wheels 9 into firm holding engagement with the rails 10 and the valve B is opened by the tappet 98 to connect the pressure fluid supply main to the indicator F through ports 28 and 18 of valve A, fluid lines 94 and 97, ports 19 and 20 of valve B and line 100. This condition is illustrated in FIGURE 5b. Upon movement of the valve actuating member 73 to the "lower" position L the connections will be reversed, as shown in FIGURE 5c. Port 16 of valve D is then connected to the supply main through line 90, ports 11 and 13 of valve C, line 91 and ports 15 and 28 of valve A, and port 17 of valve D is connected to exhaust through lines 93 and 94 and ports 18 and 29 of valve A. The indicator E remains connected to exhaust through line 92 and ports 14 and 12 of valve C and indicator F is again connected to ex-

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haust through line 100, ports 20 and 19 of valve B, lines 97 and 94 and ports 18 and 29 of valve A. Fluid supplied through port 16 of valve D moves the valve spool 66 to connect port 21 to port 23 whereby fluid is supplied through line 96 to drive the motor 5 in the opposite direction to rotate the screw 2 through worm 4 and worm wheel 3 in a direction to lower the ram 6. When the ram reaches its lowermost position the valve B closes, the cam follower 63 leaves the cam surface 62 and the valve spool 64 is restored to the position shown in FIGURES 1 and 5d wherein the port 16 is once again connected to exhaust through the port 11 and spool 64 and the indicator E is connected to the supply main through line 92, ports 14 and 13 of valve C, line 91 and ports 15 and 28 of valve A. With both ends of valve D again connected to exhaust the valve spool 66 reassumes its central position shown in FIGURE 1 wherein the supply of pressure fluid to the motor 5 is cut off.

The power of the motor 5 is sufficient to raise the ram 6 into firm engagement with the underside of a ship's bilge while the ship is still afloat in the dock just prior to coming to rest upon the main keel blocks 61 (FIG. 6) of the dock floor. As water is pumped from the dock and the weight of the ship is taken on the keel blocks 61, a plurality of screw jacks 60, arranged in pairs each of which engages opposite sides of the keel of the ship at intervals along its length, steady the ship and replace the usual timber shoring to enable free access to a large area of the ship's plating in order to effect repairs and painting.

FIG. 2 shows a stationary jack 74 for use as a bilge block in dry docks having pre-arranged fixed positions for the blocks. The arrangement of valves is identical with that in FIG. 1 except that valve B is arranged at the upper end of the ram 6 which is provided with a thrust plate 31 hinged at 32 and adapted to compress a spring 39 and open the valve B when the ram engages a ship's bilge. The fluid flow sequence is as already described with reference to FIGURES 1 and 5.

Referring to FIGS. 3 and 4, a traversing device for a pair of jacks 60 (not shown) is fixed to the floor of a dry dock and includes a reversible fluid motor 33 coupled to a worm or spur reduction gear unit 34 the driving shaft 103 of which projects from both sides thereof and carries chain wheels 35. A chain 37 passes over each wheel 35 and also over guide wheels 36 and an end wheel 38 and is secured at its ends to the ends of a jack 60 as shown in FIG. 6 so that operation of the motor 33 in one direction or the other moves the pair of jacks 60 towards or away from the keel blocks 61. The motor 33 is fitted with a self-centering valve 75 similar to the valve D in FIG. 1 and is connected through the valve 75 to a manually operated valve M situated at the remote control point and similar to the valve A in FIG. 1. Movement of an operating member 104 on the valve M to the right as seen in FIGURE 3 connects a port 105 of valve 75 to the supply main through a line 106 and ports 107 and 108, and connects a port 109 to exhaust through a line 110 and ports 111 and 112. Fluid supplied through the port 105 moves the spool of the valve in a direction to connect a line 113 to the supply main through a port 114 to drive the motor in one direction. To drive the motor in the opposite direction the operating member 104 is moved to the left to connect the port 109 to the supply main through line 110 and ports 111 and 108 and the port 105 to exhaust through line 106 and ports 107 and 112. The spool of valve 75 will then be moved in the reverse direction to connect a line 115 to the pressure port 114. Movement of the jacks may be recorded on stainless steel measuring tapes at the remote control point connected to the jacks by light wire rope (not shown) passing over pulleys and held taut by bob weights or other suitable means.

Alternatively, as shown in FIG. 7, a wire rope 40 attached to a jack is wound round a drum 41 which is spring loaded or provided with other suitable means for

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keeping the rope in tension and drives, through reduction gearing, a wheel 42 provided with a cam 43 engaging the spring-loaded spindle of a standard pressure regulating valve 44 having an inlet 45 connected to the pressure fluid main and an outlet 46 connected by a line 76 to an indicator N at the remote control point. When the valve spindle is depressed by the cam 43 fluid passes through the valve, at a pressure proportional to the degree of depression of the spindle and therefore to the degree of movement of rope 40 and cam 43, to the indicator N which is calibrated in feet and inches. When the cam 43 is rotated out of the path of the spindle the valve inlet 45 closes and the fluid in line 76 flows to exhaust through a port 47.

In the alternative shown in FIG. 8, the drum 41 is geared to a wheel 48 carrying a drum 49 from which a rope 50 passes under a pulley wheel 51 and up the dock wall to a drum 52 on an indicator P situated at the remote control point and calibrated in feet and inches.

In the device shown in FIG. 9, the rope 40 is wound round a drum 77, the shaft 78 of which enters a casing through a liquid-tight seal and is threaded at 79 to receive a threaded block 80. A volute spring 81 or other means is provided on the shaft for maintaining the rope 40 in tension. The block 80 is engaged by the forked end of a cross-head 82, hinged at 83 for movement into engagement with the spring-loaded stem of fluid pressure regulating valve 44. Upon rotation of the drum 41 and the block 80 moves along the threaded shaft and urges the cross-head into engagement with the stem of valve 44 which is depressed to admit fluid to the indicator N in the same manner as is described with reference to FIG. 7. The device of FIG. 9 enables a relatively large movement of the rope to be indicated by a relatively small movement of the stem of valve 44.

We claim:

1. Means for stabilising ships in dry docks comprising a liquid-tight jack having a casing, a screw rotatable in said casing, means restraining said screw against axial displacement, a threaded ram mounted on said screw for axial movement relative thereto into and out of engagement with a ship wall, spring means compressible in response to upward movement of the ram to transmit thrust to the surface on which the jack rests, a reversible fluid-operated driving motor mounted on the casing of said jack and having a mechanical driving connection to said screw, circuit means for supplying fluid under pressure to said motor, fluid-operated valve means mounted on the casing of said pack and in said circuit means for the directional control of operating fluid to said motor, and a manually actuated valve located in said circuit means at a remote point from said jack for controlling the flow of operating fluid to said motor-control valve.

2. The combination according to claim 1, wherein said spring means is interposed between the upper part of the casing of the jack and a hinged thrust plate on the ram of the jack.

3. The combination according to claim 1, wherein the jack casing is mounted on wheels running on fixed rails and said spring means are interposed between said jack casing and said wheels.

4. The combination according to claim 3, wherein a second fluid-operated motor is provided for driving the jack along said rails.

5. The combination according to claim 4, wherein said second motor drives a pair of said jacks simultaneously towards or away from each other.

6. The combination according to claim 4, wherein means are provided for remotely controlling the supply of fluid under pressure to said second motor.

7. The combination according to claim 1, including a fluid pressure responsive indicator and wherein said circuit means contains a further valve means operable in response to the position of said ram for actuating said indicator.

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8. In the combination defined in claim 7, said further valve means including a valve operable upon compression of said spring means to admit fluid under pressure to said indicator.

9. The combination according to claim 1, wherein the load sustaining capacity of the jack is considerably greater than its lifting capacity.

10. The combination according to claim 9, wherein the ratio of load sustaining capacity to lifting capacity is approximately 25 to 1.

11. The combination according to claim 1, wherein said circuit means includes means in said circuit means for automatically cutting off the supply of fluid to the screw-driving motor when the ram reaches its lowermost position.

12. The combination according to claim 11, wherein said automatic means includes a multi-way valve actuated by a cam surface on the ram.

13. The combination according to claim 12, wherein said multi-way valve controls the operation of a second multi-way valve for controlling the supply of fluid to said screw-driving motor.

14. The combination according to claim 13, wherein both multi-way valves are arranged on the jack and controlled by a manually operated multi-way valve at a point remote therefrom.

15. The combination according to claim 14, wherein the valves on the jack are piped to a common manifold thereon connected by flexible piping to inlet and exhaust pressure fluid terminals on the floor of a dry dock.

16. A jack assembly comprising a casing, a ram in said casing mounted for vertical displacement, a reversible

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fluid pressure motor operably connected to said ram, control circuit means for connecting said motor to a source of fluid pressure comprising a selector valve at said casing shiftable to operate said motor to raise or lower said ram, a remote manually operable control valve to control said selector valve, and an automatically operable valve in said circuit means at said casing responsive to the vertical position of said ram for permitting said control valve to actuate said selector to effect ram lowering operation of said motor.

17. In the jack assembly defined in claim 16, said automatically operable valve comprising a spring biased actuating member cooperating with cam means on said ram.

18. In the jack assembly defined in claim 16, remote indicator means automatically connected into said circuit means when the ram is in raised or lowered position.

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CLAUDE A. LE ROY, *Primary Examiner.*