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Larralde et al.

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[54] **HYDRAULIC MOTION COMPENSATING APPARATUS**

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[73] Assignee: **Vetco Offshore Industries, Inc.,** Ventura, Calif.

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Related U.S. Patent Documents

Reissue of:

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Issued: **Oct. 15, 1974**
Appl. No.: **274,880**
Filed: **Jul. 25, 1972**

[51] **Int. Cl.**[2] **B66D 1/48**

[52] **U.S. Cl.** **254/172;** 92/26; 175/5; 188/67

[58] **Field of Search** 254/172, 173, 189, 139; 175/5; 187/26, 17; 166/.5; 188/67; 92/24, 26, 108, 109, 110

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Primary Examiner—Robert W. Saifer
Assistant Examiner—James L. Rowland

[57] **ABSTRACT**

A compensating apparatus is suspended from a divided crown block mounted on a derrick of a floating drilling barge, the compensating apparatus including a single cylinder extending vertically between and carrying divided travelling block sheaves on opposite sides thereof, with drawwork lines passing over the divided crown block sheaves and divided travelling block sheaves, and with the upper portion of the cylinder extending between such lines and adapted to move upwardly between the crown block sheaves without interference. A piston structure, forming part of the compensating apparatus, is slidable in the cylinder, being connected to a hook, or the like, from which a running string, such as a drilling string, is suspended extends into an underlying well bore, liquid under pressure in the cylinder acting on the piston structure to support part or all of the weight of the running string. The piston structure and cylinder can be locked together mechanically when in a fully contracted condition to render the compensating apparatus ineffective.

25 Claims, 7 Drawing Figures

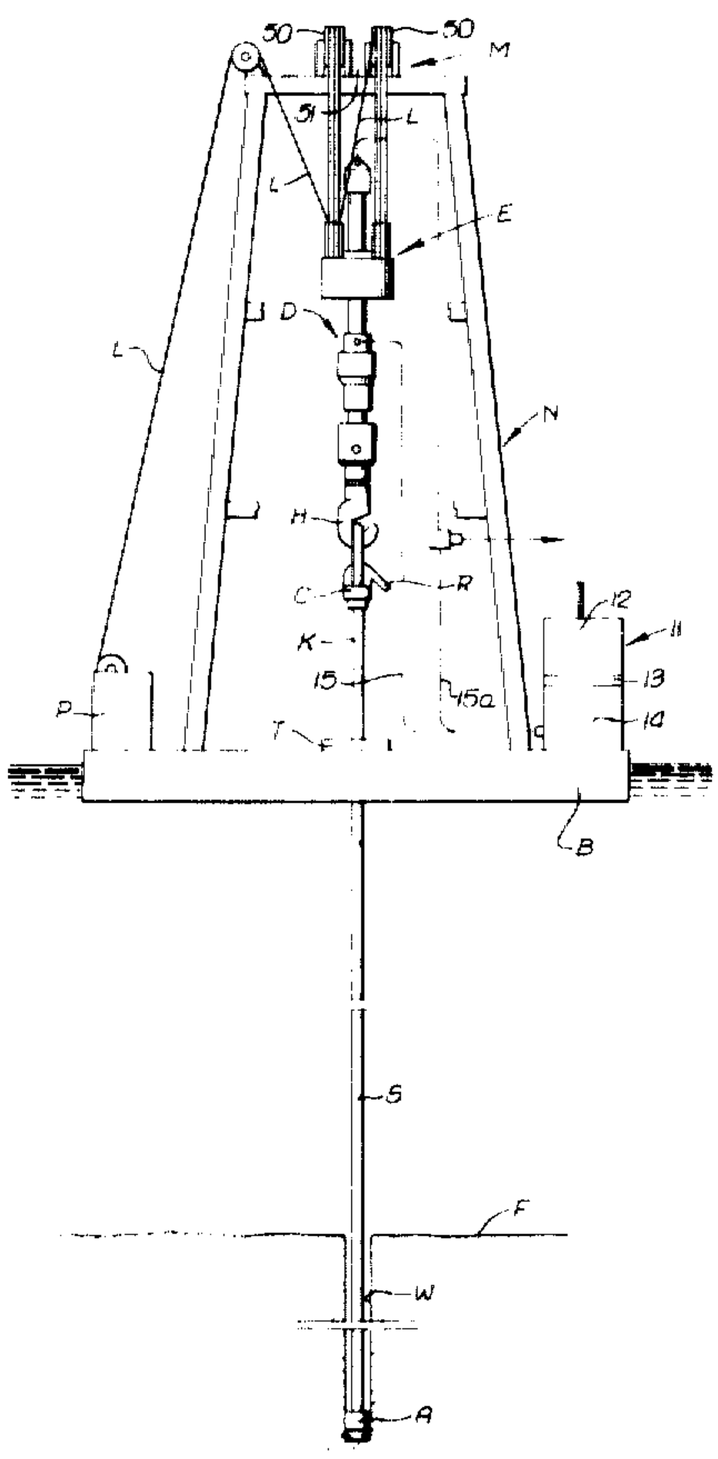

FIG. 1.

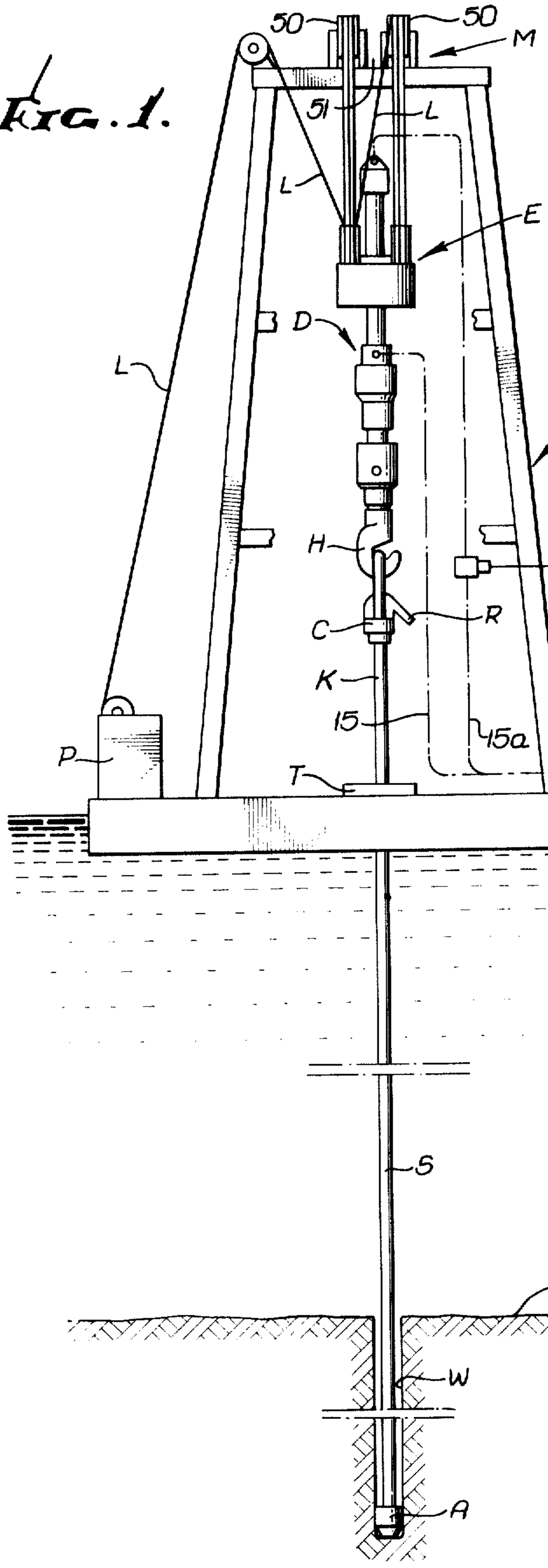
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FIG. 2.

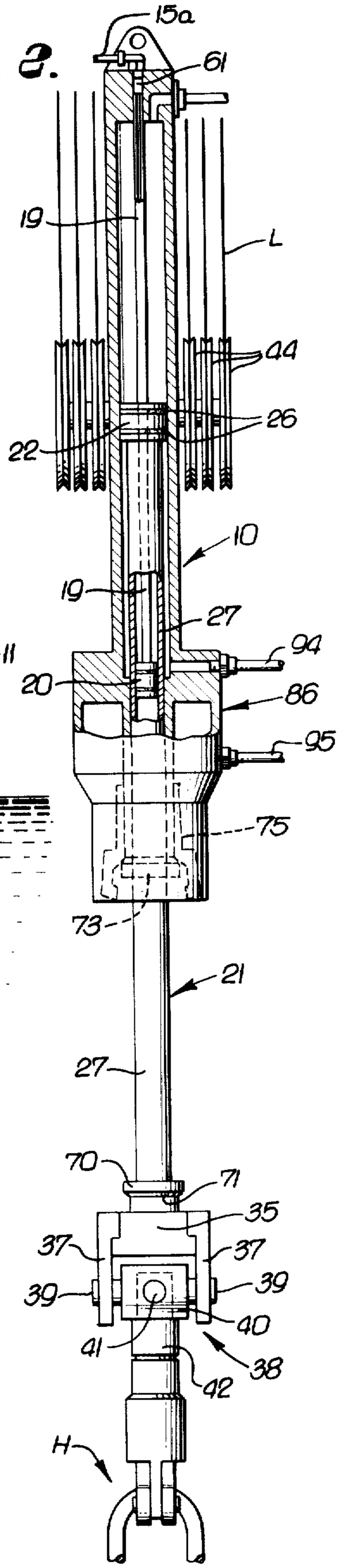
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FIG. 3a.

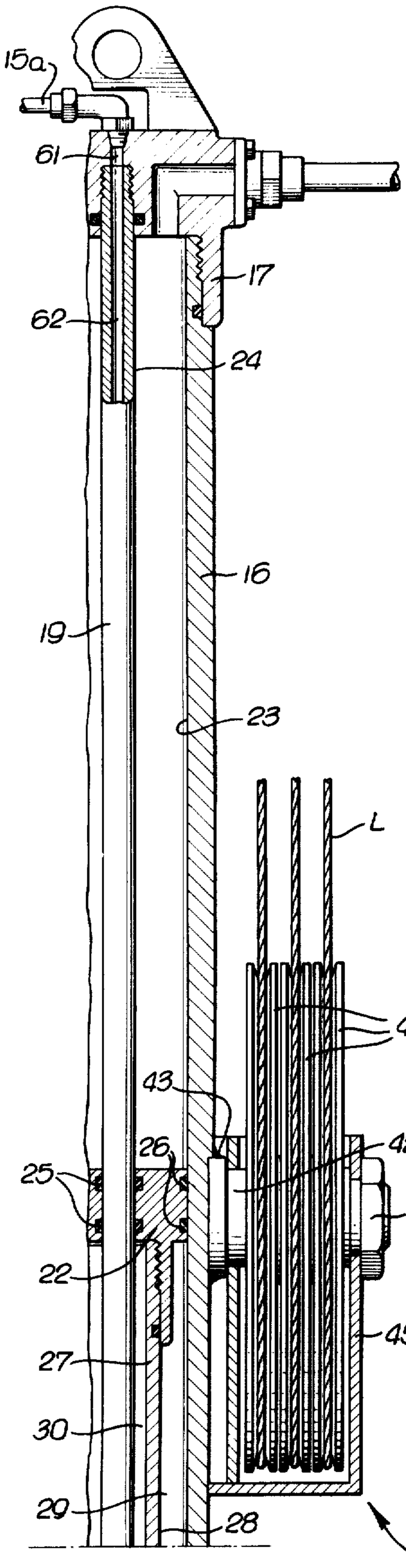

FIG. 3b.

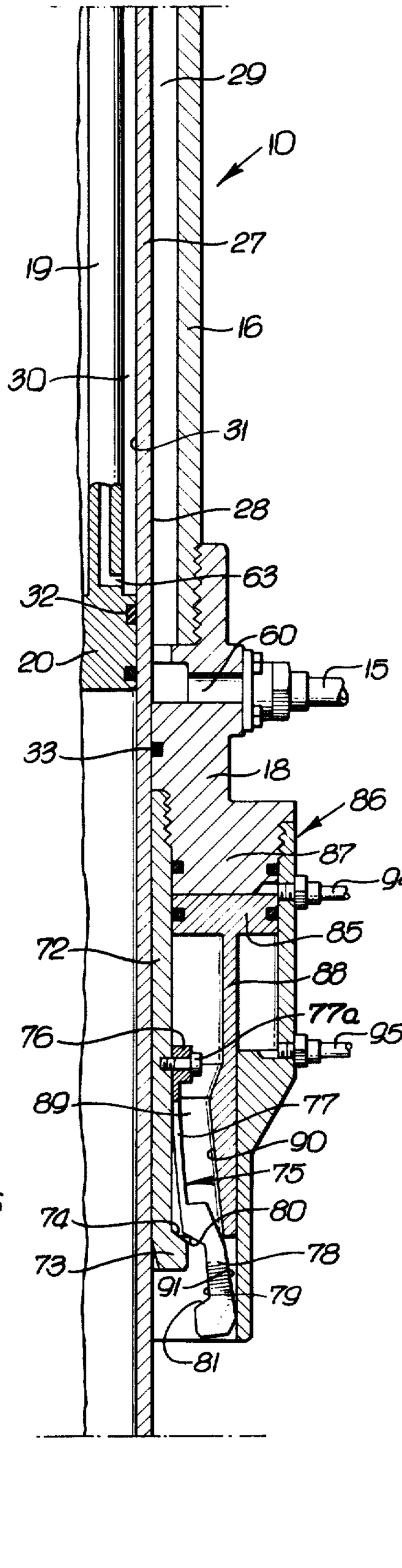

FIG. 3c.

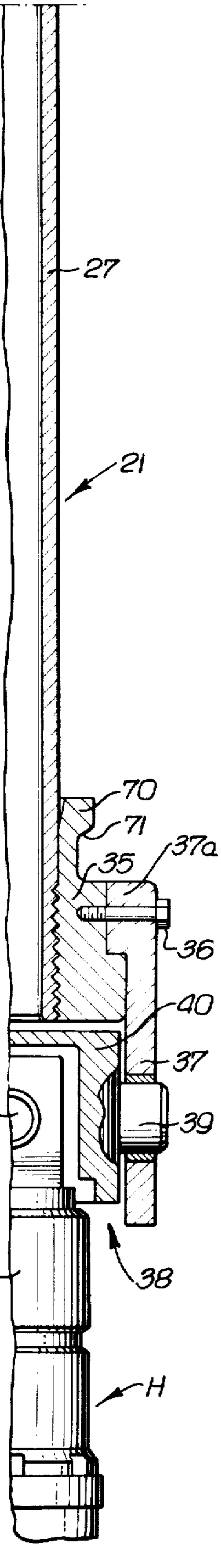

FIG. 4a.

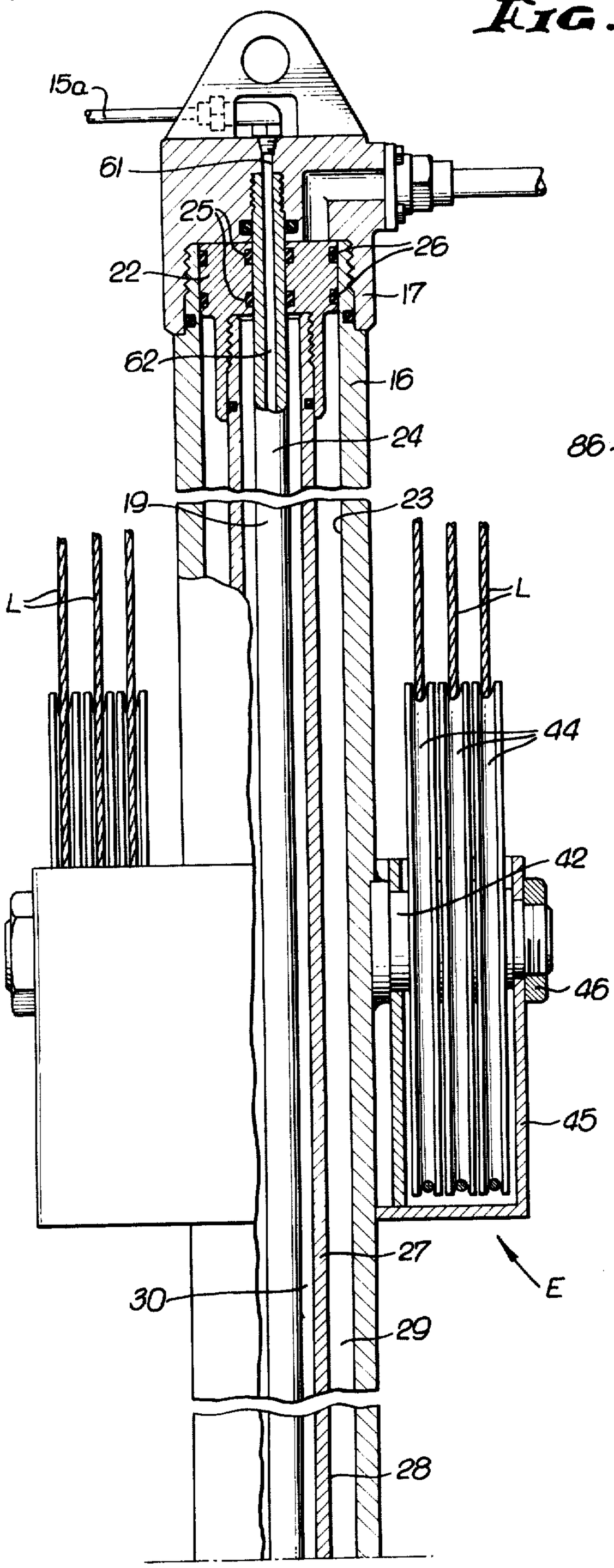
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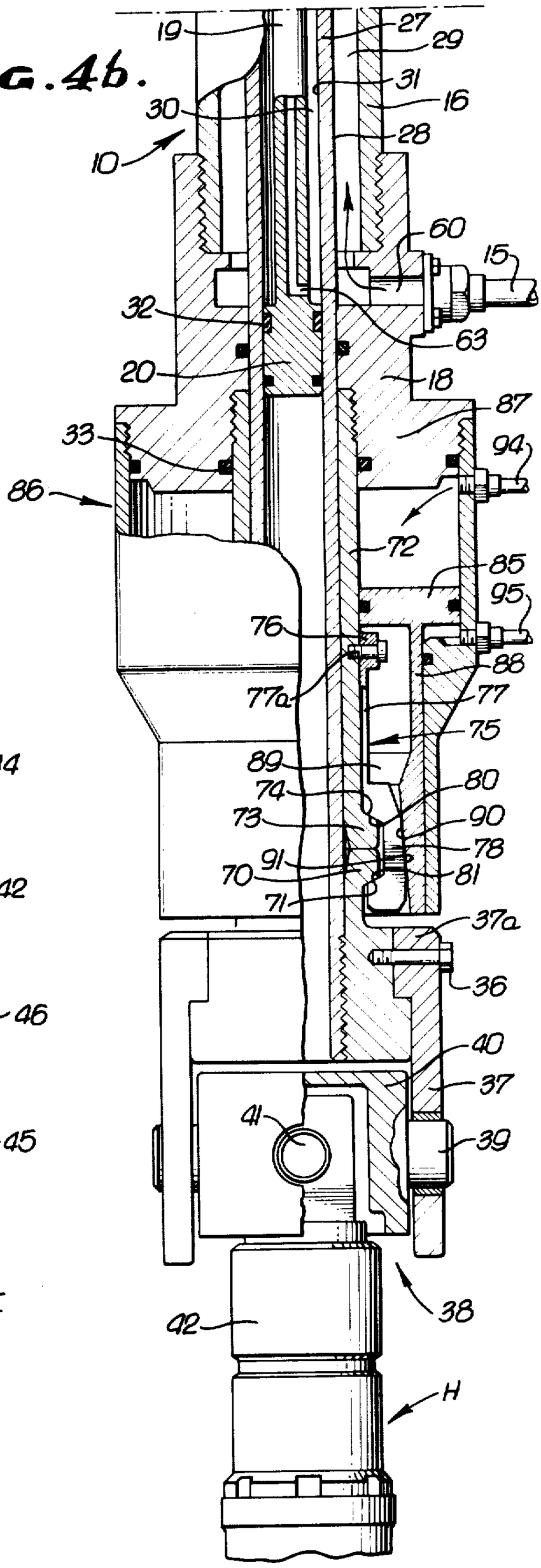
FIG. 4b.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HYDRAULIC MOTION COMPENSATING APPARATUS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

The present invention relates to apparatus for controlling the stress in a running string, and more particularly to apparatus used on or in connection with a floating vessel or barge for maintaining the strain in a running string, such as a pipe string, substantially constant while being used in the performance of diverse functions in a subaqueous well bore, such as drilling and completion operations therein, despite vertical movement of the vessel while such operations are being performed.

It has been proposed to provide a compensating apparatus between the travelling block and hook of a well bore ring mounted on a vessel floating in a body of water and used in drilling a subaqueous well bore, or performing other operations therein, to maintain the stress in a running string, such as a string of drill pipe, used in drilling the well bore underlying the body of water, at a substantially constant value. Such compensating apparatus includes a cylinder supported from the travelling block and a piston slidable therein connected to the hook, a desired liquid pressure being maintained in the cylinder for exerting an upward supporting force on the piston, which supporting force remains substantially constant despite relative telescopic movement between the cylinder and piston portions of the compensating apparatus, resulting from heaving of the drilling vessel under tide, wind and wave conditions.

In the application of James W. E. Hanes and Edward Larralde, Ser. No. 69,759, filed Sept. 4, 1970, for "Motion Compensating Apparatus," now Pat. No. 3,714,995 it has been proposed to avoid reduction in the extent of vertical movement available in a derrick mounted on the floating vessel, as a result of interposing a compensating apparatus between the travelling block and hook. The length added between the travelling block and hook materially lessens the available maximum travel of the drawbacks or hoisting apparatus, requiring the raising and lowering of shorter stands of drill pipe in the well bore, which thereby increases the time required in making a round trip of the pipe in the well bore. In U.S. Pat. No. 3,714,995, significant height saving advantages have been realized when used with standard crown blocks from which the travelling block is suspended by the drawworks lines. Such height advantages result from employing a pair of cylinders and pistons which straddle or overlap the travelling block, such pair of cylinders and pistons of necessity being eccentric with respect to the center line or axis of the travelling block and hook suspended therebelow, which introduces a bending or binding tendency in the compensating apparatus.

By virtue of the present invention, a compensating apparatus is provided which is so related to the travelling block and hook as to provide for an increase in the maximum stroke of the compensating apparatus without adversely affecting the required height of the derrick.

A further objective of the present invention is to provide a divided crown block, with a single compensating cylinder and associated piston suspended therefrom which will be concentrically disposed with respect to the hook therebelow, in order that the mass of the apparatus and the forces acting thereon are applied in a concentric manner, thereby eliminating any tendency for bending, binding or seizing to occur in parts of the apparatus, and also minimizing wear of the seals and bearings embodied in the apparatus.

Yet a further object of the invention is to employ the cylinder of the compensating apparatus as a portion of the travelling block itself, as by mounting the sheaves of the travelling block on opposite sides of the cylinder, this arrangement being employed in connection with a divided crown block, the divided or split crown block having a gap therebetween into which the cylinder can move, thereby resulting in increase in the stroke or travel of the apparatus.

A further object of the invention is to provide a lock device between the cylinder and piston portions of the compensating apparatus which is concentrically disposed with respect to the cylinder and piston portions of the apparatus, enabling the compensating apparatus to be rendered inoperative during "round tripping" of the drill pipe, or the like, suspended from the apparatus, the lock being operative upon full telescopic or contracted movement of the piston structure within the cylinder. The locking together of the travelling block and hook, and their release from one another, can be effected from a remote point under the control of the operator.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense.

REFERRING TO THE DRAWINGS

FIG. **1** is a diagrammatic view of an apparatus embodying the invention, illustrated in connection with a rig mounted on a floating vessel for drilling a well bore underlying a body of water;

FIG. **2** is a diagrammatic, enlarged view, parts being shown in section, of the compensating apparatus illustrated in FIG. **1**;

FIGS. **3a**, **3b** and **3c** together constitute an enlarged quarter sectional view, parts being shown in elevation, of the apparatus disclosed in FIG. **2**, FIGS. **3b** and **3c** being lower continuations of FIGS. **3a** and **3b**, respectively; and

FIGS. **4a** and **4b** together constitute an enlarged longitudinal section of the apparatus disclosed in FIGS. **3a**, **3b** and **3c**, parts being illustrated in elevation, disclosing the compensating apparatus fully contracted and locked in an inoperative position, FIG. **4b**, being a lower continuation of FIG. **4a**.

An apparatus is illustrated in the drawings in connection with the drilling of a vertical well bore W from a subaqueous floor F above which a drilling barge B, or other floating vessel, is located, the barge being suitably anchored against lateral displacement for the purpose of holding a drilling string S in centered relation with respect to the well bore. A drill bit A is secured to the lower end of the drill string, such as a string of drill pipe *or drill* casing, the upper or kelly portion K of the drill

string passing through the usual rotary table T rotated by a suitable drive mechanism (not shown). The upper end of the kelly is secured to a swivel C, which is, in turn, suspended from a hook H connected to the lower portion of a motion compensating apparatus D operatively connected to a travelling block structure E suspended from a crown block structure M, mounted on the upper portion of the derrick N, through the use of the usual lines L connected to a drawworks P mounted on the drilling barge, the drawworks permitting the drill string S to lower as the well bore W is cut by the bit A.

A mudline R is connected to the swivel C for the purpose of pumping drilling mud, or the like, down the drill string S for discharge from the bit A, for the purpose of removing the cuttings produced by the latter. While the drill bit A is rotated by the drill string S, appropriate drilling weight is imposed thereon. Usually, the drilling weight is provided by a suitable length of drill collars disposed in the lower portion of the drill string immediately above the drill bit, the drill string above the drill collars being maintained in tension by the drawworks P, lines L and compensating apparatus D.

The compensating apparatus D permits the floating vessel B and the mechanism carried thereby to shift vertically relative to the well bore W, without appreciably modifying the stress in the drill string S, and, therefore, the drilling weight imposed on the drill bit A. Through maintenance of liquid pressure in the compensating apparatus, the tension or strain in the drill string S is maintained substantially constant at a selected value, despite the heaving of the floating vessel in the body of water. A system for maintaining pressure of the liquid in the cylinder **10** of the compensating apparatus at a selected constant value includes an accumulator arrangement **11**, disclosed diagrammatically in FIG. **1**, in which the pressure of a gas **12** in the accumulator is transferred through a piston **13** to a liquid medium **14** in the accumulator, and through the lines **15**, **15**a to the cylinder of the compensating apparatus. One such system is illustrated in the application of Edward Larralde, Ser. No. 222,919, filed Feb. 2, 1972, for "Variable Rate Hydraulic-Pneumatic Weight Control and Compensating Apparatus."

As specifically shown, the compensating apparatus includes the cylinder structure **10**, embodying an elongate outer cylinder sleeve **16** threadedly connected at its upper end to an upper cylinder head **17**, and at its lower end to a lower cylinder head **18**. Disposed within the outer cylinder sleeve **16** is a coaxial inner cylinder sleeve **19** threadedly secured to the upper head **17** and terminating in a lower head **20**. A piston structure **21** is shiftable longitudinally along both inner and outer cylinder sleeves **19**, **16**, the structure including an upper annular piston **22** slidably sealing against the inner wall **23** of the outer sleeve **16** and the outer wall **24** of the inner sleeve, leakage between the piston and sleeves being prevented by suitable inner and outer seal rings **25**, **26** mounted on the piston and sealingly engaged with the outer and inner walls **24**, **23**. This piston is threadedly or otherwise suitably secured to a tubular piston rod **27**, the outer periphery **28** of which is spaced laterally from the inner cylinder wall **23**, to define an annular cylinder space **29** therebetween, the piston rod also being spaced laterally from the inner sleeve **19** to provide an annular space **30** therebetween. The inner head **20** is in slidable relation to the inner wall **31** of the tubular piston rod, leakage of fluid therebetween being prevented by suitable seal rings **32** on the inner head slidably and sealingly engaging against the inner wall of the tubular piston rod. The lower cylinder head **18** carries a suitable rod seal **33** sealingly engaging against the periphery **28** of the piston rod **27**.

The piston rod **27** extends through the lower cylinder head **18** and has its lower portion threadedly secured to a lower lock member **35** suitably secured, as by means of a plurality of screws **36**, to an adapter **37** having an upper inner flange **37**a resting upon an outer flange **35**a of the lock member **35** and forming part of a gimbal **38** secured to the lower hook H, which depends therefrom and which is coaxially arranged with respect to the cylinder sleeves **16**, **19** and the piston structure **21**. The gimbal includes trunnions **39** extending from opposite sides of a cross-head **40**, and which are pivotally mounted in the adapter **37**, the cross-head having a transverse pin **41** connected to the upper portion **42** of the hook and lying in the same plane as the trunnions **39**, being disposed 90 degrees with respect thereto. It is apparent that the hook H can pivot about the axis of the transverse pin **41** and also about the axis of the trunnions **39**, which provides for a universal movement of the hook with respect to the piston rod **27**.

The travelling block structure E is actually integrated into the cylinder **10**. Thus, the cylinder sleeve **16** has trunnions or bearing supports **42** suitably secured, as by use of welding material **43**, on opposite sides of the cylinder substantially below the upper cylinder head **17**, there being a plurality of sheaves **44** rotatably mounted on each of said trunnions through suitable intervening roller or other bearings (not shown), the bearings and a housing **45** enclosing the lower portion of the sheaves being retained on the trunnions **42** by a suitable nut **46** threaded on the outer portion of each trunnion.

It is apparent that the travelling block E is split or divided, being arranged on opposite sides of the cylinder **10**, which permits the drawworks lines L to pass successfully over such sheaves **44** and corresponding sheaves **50** forming a part of the crown block M, the crown block being split or divided and providing a gap **51** between its two portions. It is apparent that the crown block is suitably supported on the upper end of the derrick N.

The travelling block E and the compensator apparatus D secured thereto can be elevated by the drawworks P to a maximum position in which the split travelling block sheaves **44** are disposed closely adjacent to the crown block sheaves **50**, the cylinder **10** entering the gap or space **51** between the crown block sheaves. Accordingly, a maximum range of travel is achievable, offsetting the length added to the apparatus by the compensator portion D of the apparatus disposed below the sheaves **44** and intervening between the sheaves **44** and the hook H.

The liquid under pressure from the accumulator **11** can pass into and out of the annular cylinder space **29** through an inlet and outlet port **60** in the lower cylinder head to which one of the liquid lines **15** is suitably connected. The liquid under pressure in such annular cylinder space acts in an upward direction over the annular piston **22** across the annular area of the cylinder space **29** to exert an upward force on the piston, the tubular piston rod **27** and the hook H and other apparatus suspended therefrom. Similarly, the liquid under pressure can pass through the line **15**a connected to an inlet and outlet port **61** in the upper cylinder head **17**, and

through a central passage **62** in the inner cylinder sleeve **19** which communicates through a lower port **63**, immediately above the inner head **20**, with the annular space **30** between the outer wall **24** of the inner cylinder sleeve and the tubular piston rod **27**, this liquid under pressure also acting in an upward direction over the inner portion of the annular piston **22** and assisting in the supporting of the piston rod **27** and the mechanism suspended therefrom.

As the drilling barge or vessel heaves in the water, the liquid under pressure will pass into and out of the annular cylinder spaces **29**, **30**, permitting longitudinal travel of the outer and inner cylinders **16**, **19** along the piston rod **27** without substantially affecting the pressure of the liquid in the cylinder spaces **29**, **30**, which continues to exert a substantially constant upward force on the piston **22** and the piston rod depending therefrom, the liquid passing into and from the accumulator **11**, with the pressure of the gas **12** maintaining the substantially constant unit pressure in the liquid **14**. Thus, a constant stress or tension is maintained on the drilling string S, without varying its relative position within the well bore W as the drilling barge B and cylinder **10** move vertically under the action of wind, wave and tide.

At times, it is desirable for the motion compensator apparatus D to be rendered inoperative, as, for example, during withdrawal of the drill pipe S, or its relowering from the drilling barge into the well bore. With the apparatus illustrated, the cylinder **10** and piston structure **21** are mechanically locked together when the piston **22** occupies its uppermost position within the cylinder **10**; in effect, securing the hook H in a predetermined position with respect to the travelling block E so that they operate as a unit during the raising and lowering of the travelling block. As disclosed, the lower lock member **35** secured to the piston rod **27** has an external lock flange **70** thereon provided with a downwardly facing lock surface **71**. The lower cylinder head **18** has an upper lock member **72** threadedly secured thereto and depending therefrom, and through which the piston rod **27** is slidable, which also has an upper external lock flange **73** thereon provided with an upwardly tapering lock surface **74**, which are oppositely disposed with respect to the lower lock flange **70** and its lock surface **71**. A collet type of lock device **75** is carried by the upper lock member **72**, this lock device including an upper head **76** suitably secured to the upper lock member **72** by means of a plurality of screws **77a**. Integral with and depending from the head **76** are a plurality of circumferentially arranged spring-like arms **77** terminating in lock dogs **78**, each dog having an inner recess **79** in which the upper and lower lock flanges **73**, **70** can be received when they are disposed adjacent to one another. The dogs **78** have upper lock surfaces **80** and lower lock surfaces **81** spaced from one another and defining the upper and lower ends of the recesses **79**, and which conform to the upper and lower lock surfaces **74**, **71** on the flanges **73**, **70**.

Normally, the spring arms **77** shift the lock dogs **78** laterally outwardly into a position permitting upward movement of the lower lock flange **70** through the lower ends of the lock dogs, and into a position substantially contacting the upper lock flange **73**, as illustrated in FIG. **4b**. With the lock flanges in such abutting or adjacent position, the lock dogs **78** can be shifted inwardly to a position in which the upper and lower lock dog surfaces **80**, **81** engage the companion lock surfaces **74**, **71** on the lock flanges **73**, **70**, thereby securing the piston **21** and cylinder **10** to one another, preventing their relative longitudinal movement.

As specifically disclosed, the actuation of the lock device **75** may be effected from a remote point. Thus, an annular piston **85** is provided within a lock cylinder **86**, the upper portion of which is threadedly secured to the lower cylinder head **18**, which actually constitutes an upper head **87** of the lock cylinder. The annular piston is disposed in the space between the upper lock member **72** and the cylinder **86**, an actuator sleeve **88** integral with and depending from this piston **85** being provided which extends downwardly within a lower cylinder portion **89** of substantially lesser internal diameter than the upper portion of the cylinder **86**, and in which the sleeve **88** is slidable. The spring arms **77** and lock dogs **78** are disposed within the lower cylinder portion **89**. The lower portion of the sleeve is constituted as an internal cam **90** having its inner surface inclined in a downward and outward direction and adapted to engage companion cam surfaces **91** on the lock dogs, for the purpose of shifting the dogs **78** laterally inwardly upon downward movement of the piston **85** and its sleeve **88** within the cylinder **86**. Such downward movement occurs as a result of feeding hydraulic fluid through a line **94** connected to the upper portion of the cylinder **86** and adapted to direct liquid under pressure into the cylinder above the piston **85**, for the purpose of forcing the piston **85** and its cam **90** downwardly when the lower lock member **35** abuts the upper lock member **72**, causing the cam to shift the lock dogs **78** inwardly to the locking position illustrated in FIG. **4b**. The angle of taper of the cam surface **90** and the companion surfaces **91** on the dogs is relatively small, actually constituting a self-locking angle, such that the dogs **78** are retained in a position locking the piston structure **21** and cylinder structure **10** against longitudinal movement with respect to each other in the absence of fluid pressure in the cylinder **86** above the lock piston **85**.

In the event the lock is to be released, liquid under pressure is forced through a suitable line **95** communicating with the cylinder **86** below the piston when it is in its lower position, this fluid acting in an upward direction on the piston, to elevate the piston **85** and its associated sleeve **88** within the cylinder **86** and relative to the lock dogs **78**, placing the piston and sleeve in the position illustrated in FIG. **3b**. When the cam surface **90** is out of [arrangement] *engagement* with the lock dogs **78**, the spring arms **77** will inherently expand to their outer position, permitting the piston rod **27** to move freely within the cylinder **10**. If this were not to occur, a relative downward force exerted on the piston rod **27**, as by the weight suspended therefrom, will cause its tapered lock surface **71** to force the lock dogs **78** to their lateral outward or unlocked position illustrated in FIG. **3b**.

By virtue of the apparatus described, a compensating apparatus has been provided that permits a desired maximum movement of the travelling block without requiring an undue derrick height. The divided crown block M and the straddling relationship between the cylinder **10** and the sheaves **44** permit the apparatus to be elevated within the derrick to such an extent that the full required elevation of the drilling string within the derrick can occur, in essentially the same manner as if a compensating apparatus were not present. The dividing of the crown block permits the cylinder **10** to pass between its two portions without interference, enabling a

greater elevation of the travelling block to occur, as compared to the provision of an unsplit or undivided crown block. Even in the absence of a split crown block, the required travel of the travelling block E can still occur without interference by the compensator apparatus D, because of the straddled or overlapping relation between the split travelling block and the compensator cylinder **10**. The provision of a single compensator cylinder and a single piston operating therein, related in a concentric manner to the apparatus suspended therefrom, results in forces being applied to the several parts in a concentric manner, thus eliminating bending, binding or seizing tendencies on the parts, as well as minimizing loads on seals and bearing surfaces. The concentric locking device enables the compensator portion of the apparatus to be rendered inoperative, permitting joint movement of the travelling block E and the hook H to the same extent as if the compensating apparatus D were not present. With the apparatus in a locked condition, there is no necessity for retaining liquid under pressure in the cylinder **10**. The concentric locking device is simpler than the type of locking device illustrated in U.S. Pat. No. 3,714,995, the ease of effecting locking and unlocking being greatly increased. Such selective locking or unlocking of the travelling block and hook can be effected from a remote point under the control of the operator.

We claim:

1. An apparatus for maintaining a predetermined stress in a running string disposed in a well bore and which is supported by a rig, including a derrick and a suspension mechanism supported from the upper portion of the derrick: comprising a travelling block structure adapted to form part of the suspension mechanism; a hook structure adapted to support the running string therebelow; a motion compensating apparatus disposed between and connected to said block structure and hook structure; said motion compensating apparatus comprising cylinder means coaxial of said hook structure; piston means slidable in said cylinder means and connected to said hook structure; said travelling block structure being split and fixedly mounted to said cylinder means on opposite sides of said cylinder means substantially below the upper end of said cylinder means and with said cylinder means disposed between said split block structure; and means for maintaining a fluid medium under pressure in said cylinder means for exerting an upward force on said piston means as said piston means and cylinder means move longitudinally relative to one another in both longitudinal directions.

2. An apparatus as defined in claim **1**; said block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof.

3. An apparatus as defined in claim **1**; said block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof; said cylinder means projecting upwardly beyond said sheaves.

4. An apparatus as defined in claim **1**; and means for releasably locking said piston means and cylinder means to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means.

5. An apparatus as defined in claim **1**; collet means for releasably locking said piston means and cylinder means to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means; and means movable longitudinally along one of said cylinder means and piston means for selectively shifting said collet means to locking or unlocking position.

6. An apparatus as defined in claim **1**; collet means for releasably locking said piston means and cylinder means to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means; and hydraulically operable means movable longitudinally along said cylinder means for selectively shifting said collet means to locking or unlocking position.

7. An apparatus as defined in claim **1**; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable; said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member; said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealed relation to said outer and inner members; and means for directing said fluid medium under pressure into the space between said piston rod and inner wall of said outer member for action upon said piston; said piston rod being laterally spaced from said inner member to provide a second annular space therebetween; and means for directing said fluid medium under pressure into said second annular space for action upon said piston.

8. An apparatus as defined in claim **1**; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable; said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member; said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealed relation to said outer and inner members; and means for directing said fluid medium under pressure into the space between said piston rod and inner wall of said outer member for action upon said piston; and means for releasably locking said piston rod and outer member to each other when said piston and piston rod are substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means.

9. An apparatus as defined in claim **1**; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable; said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member; said piston means fur-

ther comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealed relation to said outer and inner members; and means for directing said fluid medium under pressure into the space between said piston rod and inner wall of said outer member for action upon said piston; collet means for releasably locking said piston rod and outer member to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means; and means movable longitudinally along said outer member for selectively shifting said collet means to locking or unlocking position.

10. An apparatus for maintaining a predetermined stress in a running string disposed in a well bore and which is supported by a rig, including a derrick: comprising a suspension mechanism including a split crown block structure adapted to be supported from the upper portion of the derrick; a travelling block structure below said crown block structure and suspended therefrom by lines passing around both structures; a hook structure adapted to support the running string therebelow; a motion compensating apparatus disposed between and connected to said travelling block structure and hook structure; said motion compensating apparatus comprising cylinder means coaxial of said hook structure; piston means slidable in said cylinder means and connected to said hook structure; said travelling block structure being split and fixedly mounted to said cylinder means on opposite sides of said cylinder means substantially below the upper end of said cylinder means and with said cylinder means disposed between said split block structure; and means for maintaining a fluid medium under pressure in said cylinder means for exerting an upward force on said piston means as said piston means and cylinder means move longitudinally relative to one another in both longitudinal directions.

11. An apparatus as defined in claim **10**, said crown block structure comprising sets of sheaves laterally spaced from each other; said travelling block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof.

12. An apparatus as defined in claim **10**; said crown block structure comprising sets of sheaves laterally spaced from each other; said travelling block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof; said cylinder means projecting upwardly beyond, said travelling block sheaves and adapted to extend between said sets of sheaves of said crown block structure.

13. An apparatus as defined in claim **10**; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable; said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member; said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealing relation to said outer and inner members; and means for directing said fluid medium under pressure into the space between said piston rod and inner wall of said outer member for action upon said piston.

14. An apparatus as defined in claim **10**; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable; said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member; said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealing relation to said outer and inner members; and means for directing said fluid medium under pressure into the space between said piston rod and inner wall of said outer member for action upon said piston; and means for releasably locking said piston rod and outer member to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means.

15. An apparatus as defined in claim **10**, said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable; said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member; said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealing relation to said outer and inner members; and means for directing said fluid medium under pressure into the space between said piston rod and inner wall of said outer member for action upon said piston; collet means for releasably locking said piston rod and outer member to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means; and means movable longitudinally along said outer member for selectively shifting said collet means to locking or unlocking position.

16. An apparatus useful for maintaining a predetermined stress in a running string positioned in well bore and supported by a rig including suspension mechanism for which the running string is suspended, said apparatus including a travelling block structure adapted to form part of the suspension mechanism, a support structure adapted to support the running string therebelow, a motion compensating apparatus disposed between and connected to said travelling block structure and support structure, said motion compensating apparatus comprising cylinder means coaxial of said support structure, piston means slidable in said cylinder means and connected to said support structure, said travelling block structure being split and fixedly mounted to said cylinder means on opposite sides of said cylinder means substantially below the upper end of said cylinder means and with said cylinder means disposed between said split travelling block structure, and means on said cylinder means for connection to a source of fluid pressure for maintaining a fluid medium under pressure in said cylinder means for exerting an upward force on said piston means as said piston means and cylinder means

move longitudinally relative to one another in both longitudinal directions.

17. An apparatus as defined in claim 16; said travelling block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof.

18. An apparatus as defined in claim 16; said travelling block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof, said cylinder means projecting upwardly beyond said sheaves.

19. An apparatus as defined in claim 16; and means for releasably locking said piston means and cylinder means to each other when said piston means is substantially fully telescoped within said cylinder means to prevent relative longitudinal movement between said piston means and cylinder means.

20. An apparatus as defined in claim 16; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable, said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member, said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealed relation to said outer and inner members, means for directing a fluid medium under pressure into the space between said piston rod and inner wall of said outer member for acting upon said piston, said piston rod being laterally spaced from said inner member to provide a second annular space therebetween, and means for directing said fluid medium under pressure into said second annular space for action upon said piston.

21. An apparatus useful for maintaining a predetermined stress in a running string disposed in a well bore and which is supported by a rig which includes a derrick; said apparatus including a suspension mechanism including a split crown block structure adapted to be supported from the upper portion of the derrick, a travelling block structure below said crown block structure and suspended therefrom by lines passing around both structures, a support structure adapted to support the running string therebelow, a motion compensating apparatus disposed between and connected to said travelling block structure and support structure, said motion compensating apparatus comprising cylinder means coaxial of said support structure, piston means slidable in said cylinder means and connected to said support structure, said travelling block structure being split and fixedly mounted to said cylinder means on opposite sides of said cylinder means substantially below the upper end of said cylinder means and with said cylinder means disposed between said split block structure, and means for directing a fluid medium under pressure into said cylinder means for exerting an upward force on said piston means as said piston means and cylinder means move longitudinally relative to one another in both longitudinal directions.

22. An apparatus as defined in claim 21; said crown block structure comprising sets of sheaves laterally spaced from each other, said travelling block structure comprising one or moe sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof.

23. An apparatus as defined in claim 21; said crown block structure comprising sets of sheaves laterally spaced from each other, said travelling block structure comprising one or more sheaves rotatably mounted on said cylinder means at one side thereof and one or more sheaves rotatably mounted on said cylinder means at the opposite side thereof, said cylinder means projecting upwardly beyond said travelling block sheaves and adapted to extend between said sets of sheaves of said crown block structure.

24. An apparatus as defined in claim 21; said cylinder means comprising an outer member and an inner member therewithin and secured to said outer member, said inner and outer members being laterally spaced from each other to provide an annular space therebetween in which said piston means is movable, said piston means comprising a piston in said annular space slidably sealing against the inner wall of said outer member and the outer wall of said inner member, said piston means further comprising a piston rod secured to said piston and laterally spaced from said inner wall of said outer member and in slidable sealing relation to said outer and inner members, means for directing said fluid medium under pressure into the annular space between said piston rod and inner wall of said outer member for action upon said piston, said piston rod being laterally spaced from said inner member to provide a second annular space therebetween, and means for directing said fluid medium under pressure into said second annular space for action upon said piston.

25. On a floating drilling platform of the type having a derrick, an upper crown block assembly having a plurality of sheaves mounted on the derrick, a lower travelling block assembly having a plurality of sheaves, powered cable means interconnecting the travelling block assembly and the crown block assembly, a rotary carrier for supporting the drill string below the travelling block, and a hydraulic heave compensator between the travelling block assembly and the rotary carrier; said crown block being formed with a vertical opening passing between said sheaves and said heave compensator comprising a central cylinder mounted on the travelling block assembly and arranged to pass through said vertical opening while the travelling block is selectively raised by the cable means, a piston in said cylinder having a rod projecting downwardly to said carrier, and coupling means for selectively coupling said carrier to the travelling block assembly when the piston is raised in the cylinder.

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