June 30, 1931. H. N. MARSH 1,812,351

PIPE RACKING DEVICE

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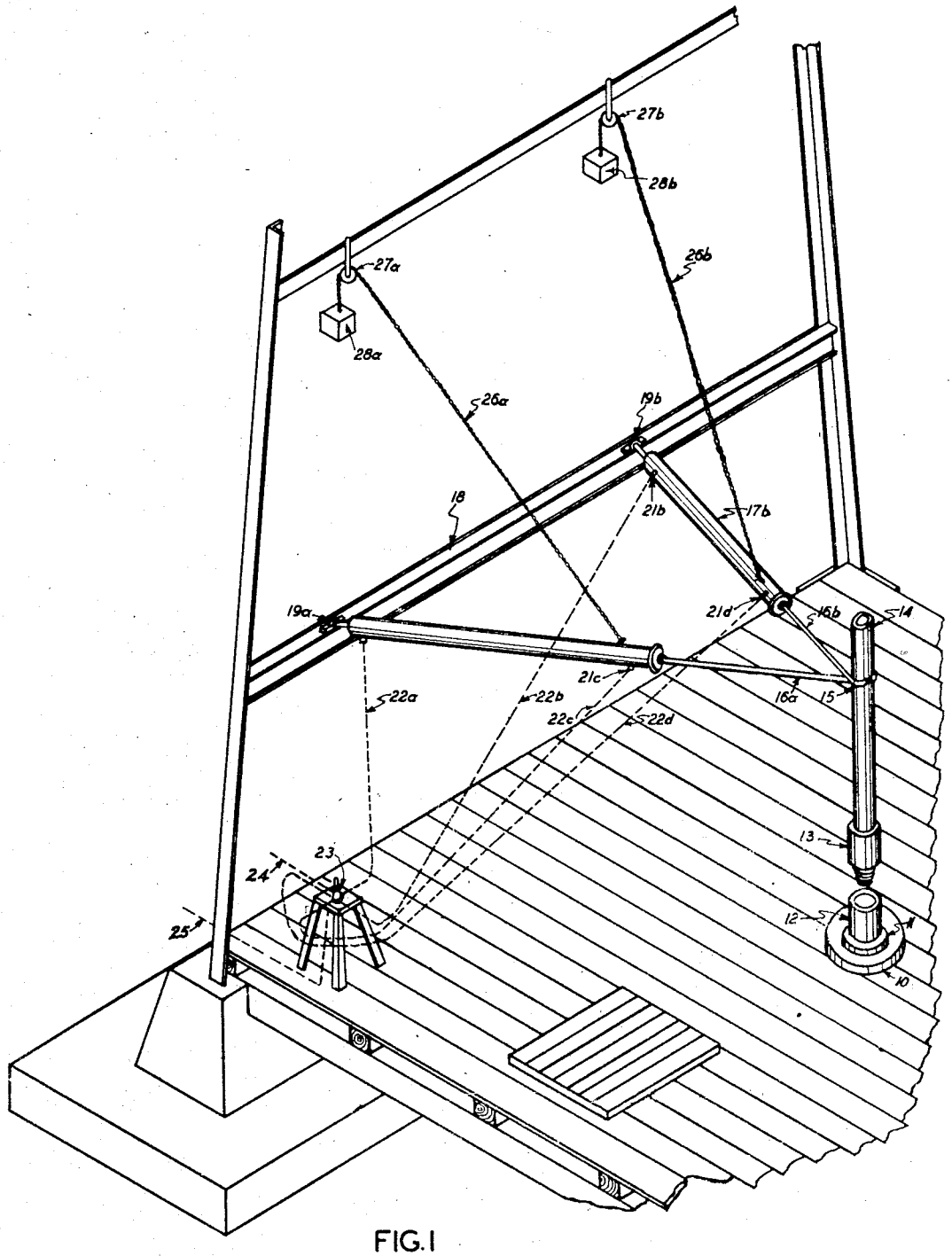


FIG. 1

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PIPE RACKING DEVICE

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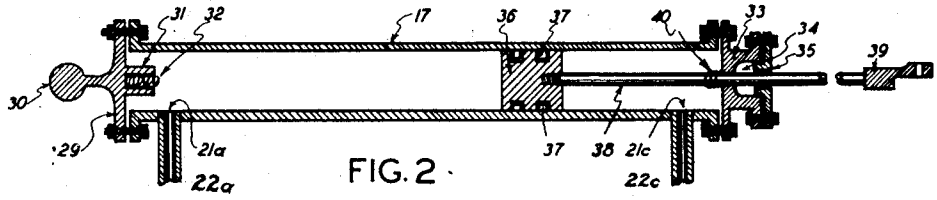


FIG. 2

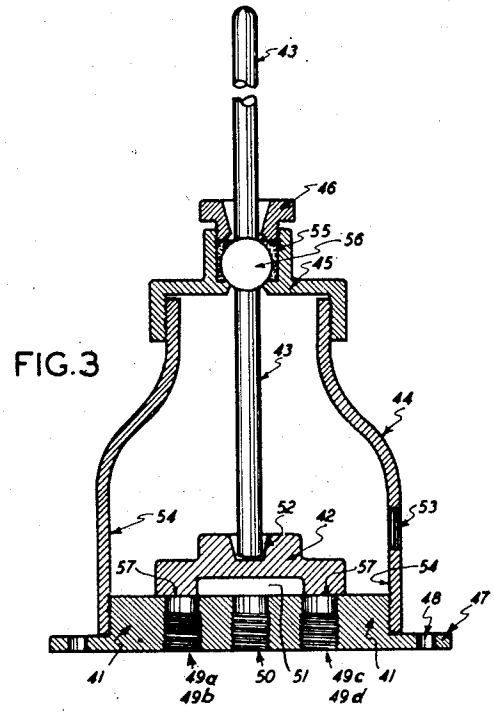


FIG. 3

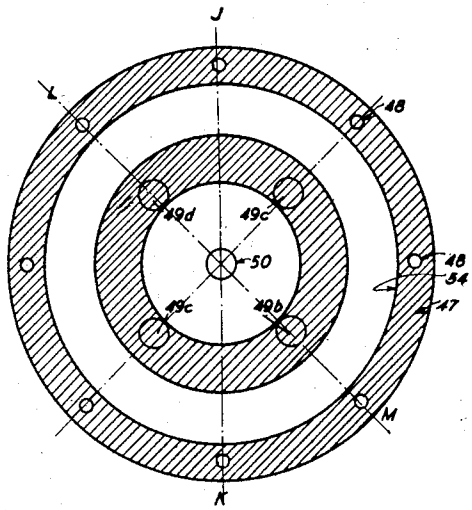


FIG. 4

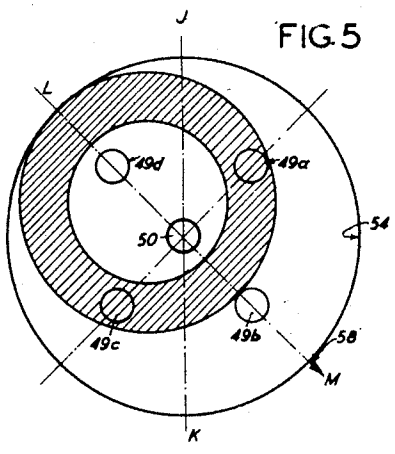


FIG. 5

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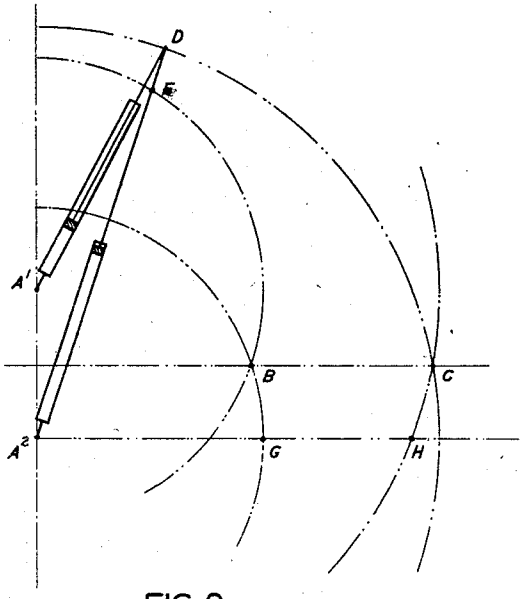


FIG. 8

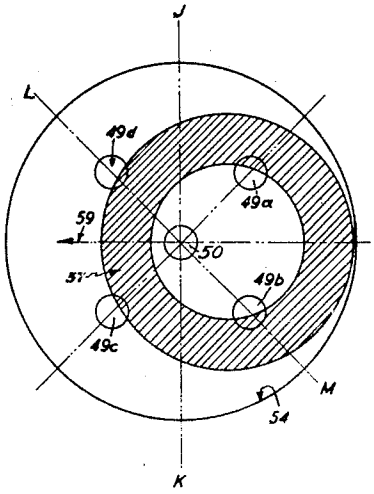


FIG. 6

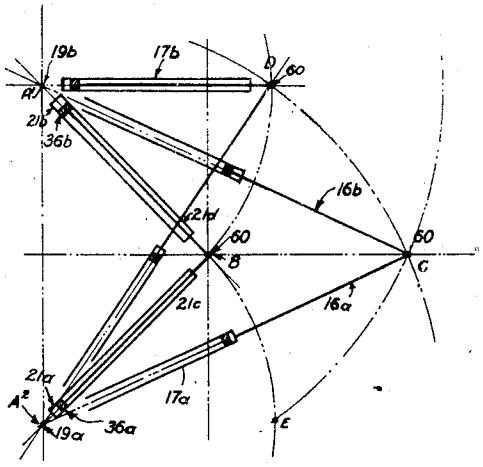


FIG. 7

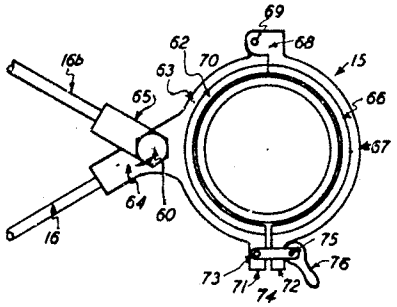


FIG. 9

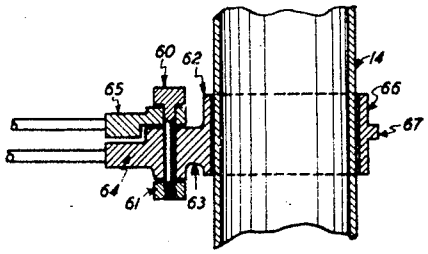


FIG. 10

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Patented June 30, 1931

1,812,351

UNITED STATES PATENT OFFICE

HALLAN N. MARSH, OF HUNTINGTON PARK, CALIFORNIA

PIPE RACKING DEVICE

Application filed November 22, 1930. Serial No. 497,560.

The object of my invention is to provide a power-actuated means for "racking" drill pipe within a derrick, that is to say, for moving the lower end of each stand of pipe from its original position over the casing head to a desired position in the corner of the derrick as the stand is unscrewed from the string. The same device may be used for "running in", each stand being then moved from its position in the corner of the derrick to exact register with the pipe already in the hole.

My device may best be understood on inspection of the attached drawings and the following description thereof, in which

Fig. 1 is an isometric projection of the assembled apparatus in a preferred form in which fluid actuated pistons operating in cylinders are utilized;

Fig. 2 is a detail of one of the operating cylinders, in longitudinal section;

Fig. 3 is a detail of the central valve, in vertical section;

Figs. 4 and 5 and 6 are diagrams of the bottom plate of the central valve, in place;

Figs. 7 and 8 are diagrams illustrating the functioning of the fluid cylinders;

Fig. 9 is a detail of a preferred form of pipe hook, in plan, and

Fig. 10 is a detail of the hook in vertical section.

Referring first to Fig. 1, 10 is the usual rotary table, 11 a spider, 12 the upper end of a string of drill pipe resting in the spider, 13 the lower end of a stand of drill pipe, broken away at 14 but assumed to be suspended from the crown block by means of an elevator not shown. It may be assumed for purposes of illustration that the drill pipe is being run out and that the suspended stand has just been broken from the string and slightly raised.

15 is a pipe hook shown in detail in Figs. 9 and 10 or any other form of hook or clamp which may be preferred. Any means for releasably encircling or grasping the pipe will answer the purpose of my invention.

16*a* and 16*b* are piston rods attached to pistons shown in Fig. 2, one of these rods being rigidly attached to clamp 15 and the other swivelling thereon. These pistons work inside cylinders 17*a* and 17*b* which are supported from any convenient derrick member, as for instance a head board 18, by the ball and socket joints 19*a* and 19*b*. The outer ends of the rods are attached to the pipe hook as shown in Figs. 9 and 10.

Each of the cylinders has an opening at each end as at 21*a*, 21*b*, 21*c* and 21*d*, and each of these openings communicates by means of a flexible conductor 22*a*, 22*b*, 22*c* and 22*d* with a corresponding opening or port in the central valve 23 which is detailed in Figs. 3 and 4. This valve is also provided with an inlet pipe 24 communicating with any source of steam (or other fluid) under pressure and with an exhaust pipe 25.

The outer ends of the cylinders are supported by light chains or cables 26*a*—26*b* running over idler sheaves 27*a* and 27*b* to counterweights 28*a*—28*b*. These sheaves should offer a certain amount of frictional resistance, so that when the pipe hook is raised or lowered by hand, thus moving the cylinders up or down, it will remain in the position in which it is placed or should be slightly heavier than needed to balance the cylinders, and means provided for limiting the upward movement of the cylinders at a substantially horizontal position. If preferred, a closed coil spring may be inserted in each of the cables 26*a*—26*b* and the counterweights and sheaves dispensed with, the length of the cable being so adjusted that the normal position of the cylinder is substantially horizontal.

Referring now to Fig. 2, 17 is either one of the cylinders 17*a* or 17*b* of Fig. 1. This cylinder may be flanged at each end. To the inner or left end as shown is flanged a head 29 on which is formed a ball 30 which makes part of the ball and socket joint 19. Inside this head is formed a socket 31 in which is placed a stiff coil spring 32 which acts as a buffer for the piston.

To the outer or right end of the cylinder is bolted a head 33 having a stuffing box 34 and a gland 35 for packing the piston rod.

A piston 36 is placed within the cylinder and provided with split rings 37 or other suitable packing. To this piston is attached the piston rod 38 which passes through the

stuffing box 34 and terminates in the half-yoke 39 as further described in connection with Figs. 9 and 10. A stiff coil spring 40 is placed around the rod at this end to act as a buffer for the piston.

The ports 21*a* and 21*c* should be formed on the lower side of the cylinder in order that it may free itself of any condensate—that is, if steam, air or gas is the actuating medium. If the pistons are actuated by a liquid this is not essential. Into these ports are fitted the conducting pipes or tubes 22*a* and 22*c* as shown in Fig. 1.

Referring now to Figs. 3 and 4, the control valve 23 may consist of a bottom plate 41, a sliding disc 42 actuated by a universal operating handle 43, a body 44, a cap 45 and a packing gland 46.

The bottom plate is provided with a flange 47 having the bolt holes 48 by means of which the assembly is rigidly fastened to any convenient support in such manner that the upper end of the handle is convenient to the hand of the operator. The upper surface of the plate is faced true and smooth and the plate is provided with four drilled and tapped holes 49*a*, 49*b*, 49*c* and 49*d* (to which conductors 22*a*, 22*b*, 22*c* and 22*d* are respectively connected) and 50 (to which exhaust pipe 25 is connected).

On this bottom plate, which acts as a valve seat, rides the disc 42 which has a recess 51 in its lower side and a tapering socket 52 in its upper side. The socket engages the lower end of the operating handle 43 by which the disc is moved over the valve seat into any desired position. A fluid inlet 53 is provided in the body at any convenient point. Suitable packing 55 is inserted in the packing box to prevent the escape of actuating fluid from the body, this packing bearing on a ball 56 through which the handle 43 passes.

Figs. 4, 5 and 6 show the preferred relation between the width of the lower face of the disc (indicated by the shaded band 57) and the diameter and spacing of the ports 49 and 50, the circle 54 indicating the inner circumference of the body 44 at the point where it joins the bottom plate.

The handle 43 being free, by reason of the ball joint 55—56, to move in any direction, the lower face 57 of the disc 42 may be placed in any desired position on the seat formed by the upper face of the bottom plate 41. It will be evident that there are three extreme positions for the disc on the seat, to-wit: the central position shown in Fig. 4; a position against the wall of the body on the center line of two opposite ports, as shown in Fig. 5, and a position against the wall on a line intermediate two adjacent ports as shown in Fig. 6. All other possible positions of the disc on the seat are either reversals or intermediates of two of these extreme positions.

With the disc in the position shown in Fig. 4 all the ports are closed and no fluid is passing through the valve, the handle being then in an upright position.

On moving the upper end of the handle in the direction indicated by arrow 58 in Fig. 5 the disc is moved into the position shown in that figure, in which port 49*b* is open and admitting fluid to one end of one of the cylinders, port 49*d* is open and in communication with exhaust port 50 through the recess 51 permitting escape of fluid from the opposite end of the same cylinder, and ports 49*a* and 49*c* are closed.

By moving the upper end of the handle in the direction indicated by the arrow 59 in Fig. 6 the disc is moved into the position shown in that figure, in which ports 49*c* and 49*d* are open and admitting fluid into an end of each of the two cylinders 17*a* and 17*b* while the opposite ends of these cylinders are exhausting through ports 49*a* and 49*b* into port 50.

Fig. 7 is a diagram illustrating the extent and character of the movement which may be imparted to the pipe hook 15 by controllably admitting a fluid into one or the other end of either cylinder and thus moving the piston to the end of its stroke. In this diagram the ball and socket joints 19*a*—19*b* are so spaced that when both pistons 36*a* and 36*b* are completely retracted the cylinders 17*a* and 17*b* stand at a 90° angle. In this piston position the swivelling pin 60 of the pipe hook 15 (see Fig. 8) is in the position B.

If now both pistons be moved to the outer end of their stroke the pin 60 will be advanced on a line perpendicular to the line A—A, to position C.

If piston 36*b* be completely retracted while piston 36*a* remains extended, pin 60 will move along the arc C—D to the position D. There is, of course, a corresponding position E which may be reached by reversing the above movement.

The pin 60, and with it the pipe hook 15 and the lower end of the pipe stand, may therefore be placed anywhere within the figure bounded by the arcs B—D, D—C, C—E and E—B. By placing the joints 19*a* and 19*b* closer together the area of this figure may be increased slightly as to the depth B—C and materially as to the length D—E. By reducing the angle A—B—A to 45° and by placing the point A*a* in a corner of the derrick a placement figure similar to that indicated by D—F—B—G—H—C—D in Fig. 8 may be produced, in which the line A2—H in a line parallel to the edge of the derrick floor. The position of this or any other figure on the actual floor of a derrick would be governed by the length of the cylinders and the piston stroke.

Referring again to Fig. 4 and also to Fig. 7, if in setting the valve 23 in permanent position the bottom plate be so oriented that the

line J—K of Fig. 4 is parallel to the base line A1—A2 of Fig. 7 and the pipes 22 of Fig. 1 are connected into the ports 49 of Fig. 4 in the order given in that figure—that is to say, pipe 22*a* to port 49*a*, etc., then the movement imparted to pin 60 and the lower end of pipe stand 14 will be in the direction in which the operating handle 43 of the valve is moved.

For example, if the upper end of the handle be moved toward J on the line J—K, the disc will be moved in the opposite direction or toward K, ports 49*c* and 49*b* will be opened to exhaust and ports 49*d* and 49*a* will be opened to fluid pressure. The cylinders being connected to these ports as just described, cylinder 17*b* receives fluid at its outer end and the piston moves inwardly while cylinder 17*a* receives fluid at its inner end the piston moves outwardly. The pin 60 which is the point of junction of the two piston rods is thereby moved in the general direction in which the hand grip of the handle 43 is displaced, a movement which may or may not be in a straight line according as one or the other of the intake ports is to the greater extent uncovered by a simultaneous displacement of the handle to right or left.

Again, if the hand grip is moved toward L on the line L—M of Fig. 4 the disc is moved in the opposite direction or toward M, port 49*d* is opened to pressure and 49*b* to exhaust, pressure is admitted to the outer end of cylinder 17*b* and the piston is thus moved inwardly, the piston in cylinder 17*a* remains stationary as both its corresponding ports 49*c* and 49*a* remain closed, and the pin 60 moves toward A1 in an arc described around the point A*a*, and in the general direction in which the hand grip is moved.

In using this device, for instance in running out, the string would be lifted until a stand runs out of the hole, the string lowered into the spider and the stand broken away and unscrewed in the usual manner. The stand would then be lifted a short distance, hanging from the blocks over the casing head.

The gate of the pipe hook would then be opened and the hook advanced by admitting fluid into the left end of one or both cylinders until it partly encircles the pipe, the gate then being closed. Ordinarily the cylinders would be of such length and so placed that the pipe hook would come substantially over the casing head when both of the pistons are entirely extended.

Fluid is then admitted to the left end of the cylinder nearest the pipe rack and the pipe thus moved outwardly into a position parallel to the position in which it is to be placed in the rack and fluid is then admitted into the left end of the further cylinder to move the pipe inwardly to its final position. In practice these two movements would be practically simultaneous and accomplished by so moving the valve handle as to open two ports simultaneously to varying extent. With practice the operator can so control the movement of the pistons as to impart to the upper end of the stand the "kick" which swings the upper end of the pipe around the end of the finger board.

While I do not restrict myself to any particular form for the pipe hook 15 I prefer to use the form shown in Figs. 9 and 10 in which: 60 is a swivel pin and 61 a nut retaining it in place, 62 is a half collar having a rib 63 which is projected tangentially at one side to form a lug 64 in which piston rod 16*a* is rigidly fixed, 65 is a block rigidly fixed to the end of piston rod 16*b* and swivelling on the pin 60.

A second half collar 66 has a rib 67 and carries a yoke 68 which swivels on a pin 69 passing through a lug 70 on half collar 62. The opposite ends of half collars 62 and 66 have mating lugs 71 and 72, a pin 73 passes through lug 71 and retains on end each of two straps 74, the opposite ends of which are retained by a pin 75 which passes through a hand eccentric 76. On releasing this eccentric it may be swung on the straps to clear the end of lug 72, after which the gate 62 may be swung open on the pin 69. Any preferred form of pipe hook or clamp may be used if desired, but it is desirable that one of the piston rod ends be rigidly inserted into a fixed portion of the hook to prevent the entire hook swivelling on the pin 60.

As said, steam, air or a liquid may be used to actuate the pistons in the cylinders. Steam and air flow at higher velocities than liquid and can be made to impart a snappier motion to the pipe clamp, but both have the drawback that, being compressible, the piston is not positively locked in a fixed position when both ports are closed. Steam has the further drawback that it will rapidly contract by condensation, leaving the piston entirely free to move. A liquid actuated piston, while more sluggish, is positively locked in the position which it assumes when either of the valves leading to its cylinder is closed.

I claim as my invention:

1. A device for racking pipe in a derrick, comprising: a pair of cylinders, the inner end of each said cylinder being swingingly attached to a suitable portion of said derrick; pistons working within said cylinders; rods attached to said pistons and passing through the outer ends of said cylinders; a pipe hook; an attachment of the outer end of each said rod to said hook, and means for controllably admitting an actuating fluid into either end of each said cylinder.

2. A device for racking pipe in a derrick, comprising: a pair of longitudinally extensible members, the inner end of each said member being swingingly attached to a suitable portion of said derrick; a pipe hook; an at-

tachment of the outer end of each said member to said hook, and means for controllably extending and retracting each said member.

3. A device for racking pipe in a derrick, comprising: a pair of cylinders, the inner end of each said cylinder being swingingly attached to a suitable portion of said derrick; means for swingingly supporting the outer ends of said cylinders and for returning said cylinders to a substantially horizontal position; pistons working within said cylinders; rods attached to said pistons and passing through the outer ends of said cylinders; a pipe hook; an attachment of the outer end of each said rod to said hook, and means for controllably admitting an actuating fluid into either end of each said cylinder.

4. A device for racking pipe in a derrick, comprising: a pair of longitudinally extensible members, the inner end of each said member being swingingly attached to a suitable portion of said derrick; means for swingingly supporting said members in a substantially horizontal position; a pipe hook; an attachment of the outer end of each said member to said hook, and means for controllably extending and retracting each said member.

5. A device for racking pipe in a derrick, comprising: a pair of cylinders, the inner end of each said cylinder being attached to a suitable portion of said derrick by a ball and socket joint; pistons working within said cylinders; rods attached to said pistons and passing through the outer ends of said cylinders; a pipe hook; an attachment of the outer end of each said rod to said hook, and means for controllably admitting an actuating fluid into either end of each said cylinder.

6. A device for racking pipe in a derrick, comprising: a pair of cylinders, the inner end of each said cylinder being swingingly attached to a suitable portion of said derrick; pistons working within said cylinders; rods attached to said pistons and passing through the outer ends of said cylinders; a pipe hook; an attachment of the outer end of each said rod to said hook, the attachment of one of said rods to said hook being rigid and the attachment of the other of said rods being pivotal, and means for controllably admitting an actuating fluid into either end of each said cylinder.

7. A device for racking pipe in a derrick, comprising: a pair of longitudinally extensible members, the inner end of each said member being swingingly atached to a suitable portion of said derrick; a pipe hook; an attachment of the outer end of each said member to said hook, the attachment of one of said members to said hook being rigid and the attachment of the other of said members being pivotal, and means for controllably extending and retracting each said member.

8. A device for racking pipe in a derrick, comprising: a pair of cylinders, the inner end of each said cylinder being swingingly attached to a suitable portion of said derrick; pistons working within said cylinders; rods attached to said pistons and passing through the outer ends of said cylinders; a pipe hook; an attachment of the outer end of each said rod to said hook, and hand operated valve means for controllably admitting an actuating fluid into either end of each said cylinder.

9. In a device substantially as and for the purpose set forth in claim 8: valve means adapted to admit actuating fluid into either end of either cylinder and to simultaneously open an exhaust channel communicating with the opposite end of said cylinder.

10. In a device substantially as and for the purpose set forth in claim 8: valve means comprising: a plate having four fluid inlet ports and an exhaust port; a housing over said plate; means for admitting fluid under pressure into said housing; a cupped disc riding on said plate, said disc being adapted to uncover one or two of said inlet ports and to simultaneously place the opposite of said inlet ports in communication with said exhaust port, and an operating rod passing through said housing for moving said disc on said plate.

11. In a device substantially as and for the purpose set forth in claim 8: valve means comprising: a plate having four fluid inlet ports and an exhaust port; a housing over said plate; means for admitting fluid under pressure into said housing; a cupped disc riding on said plate, said disc being adapted to uncover one or two of said inlet ports and to simultaneously place the opposite of said inlet ports in communication with said exhaust port, and an operating rod passing through said housing for moving said disc on said plate, said inlet ports being so oriented and connected to the ends of said cylinders that a movement of the outer end of said operating rod in any direction produces a movement of the pipe hook in substantially the same direction.

In witness that I claim the foregoing I have hereunto subscribed my name this 17th day of November, 1930.

HALLAN N. MARSH.