

Oct. 5, 1954

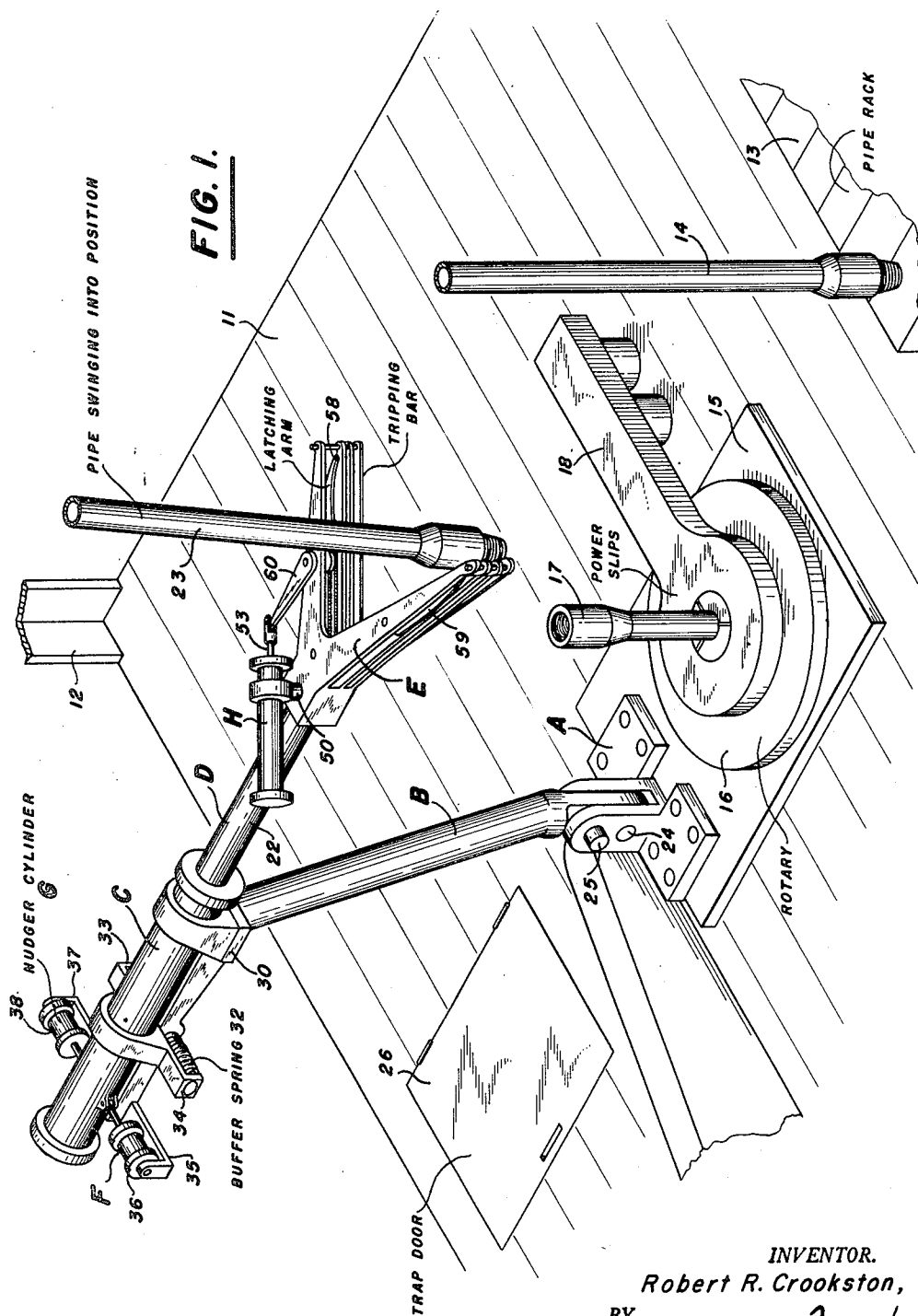
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2,690,847

DEVICE FOR POSITIONING PIPE IN A DRILLING DERRICK

Filed July 15, 1953

4 Sheets-Sheet 1



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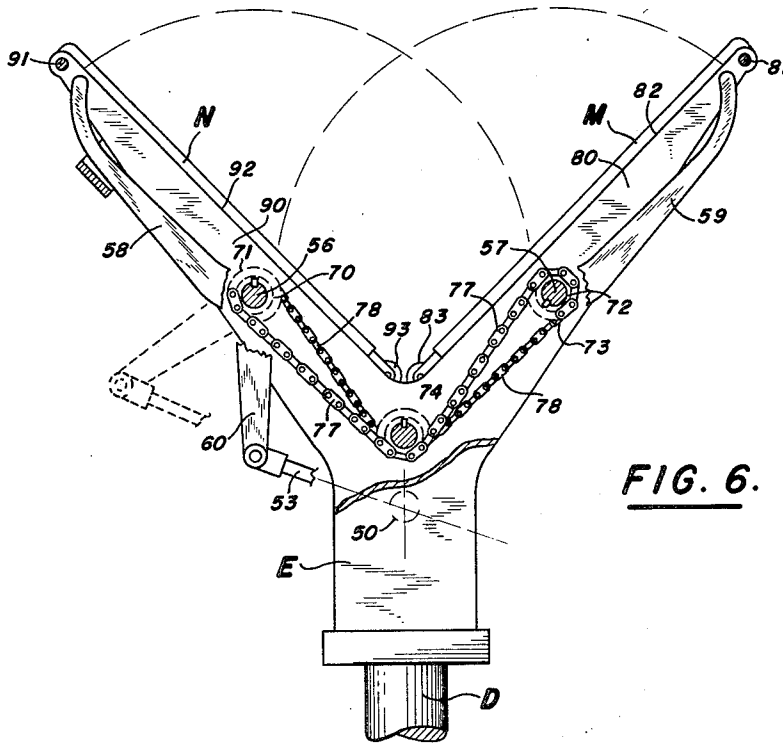


FIG. 6.

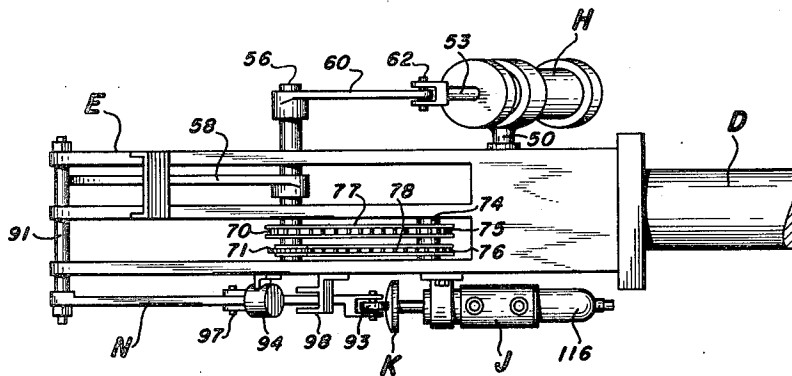


FIG. 7.

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4 Sheets-Sheet 4

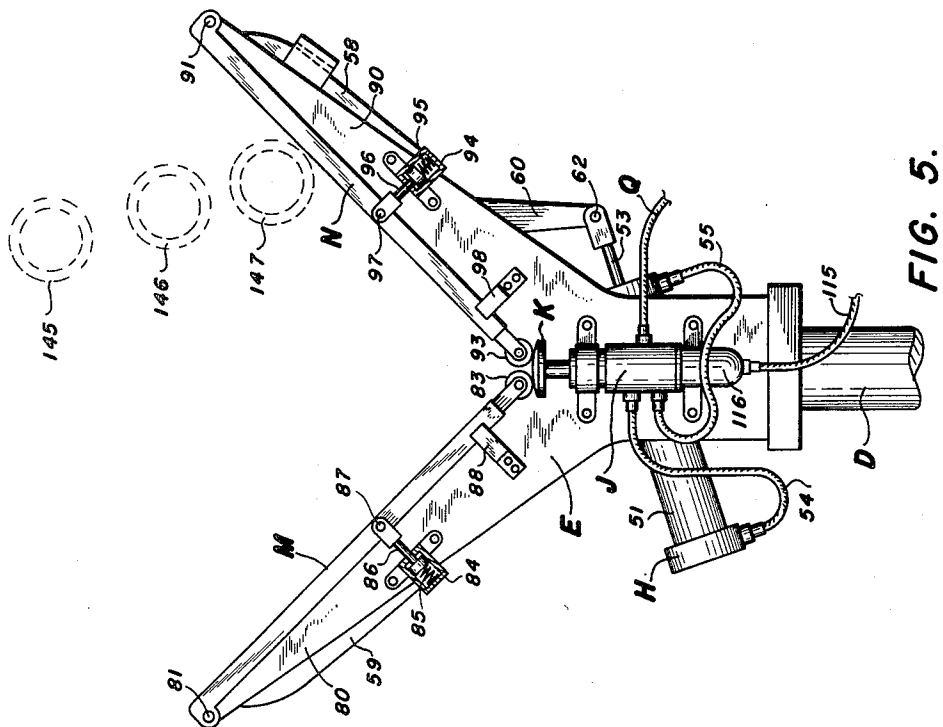


FIG. 5.

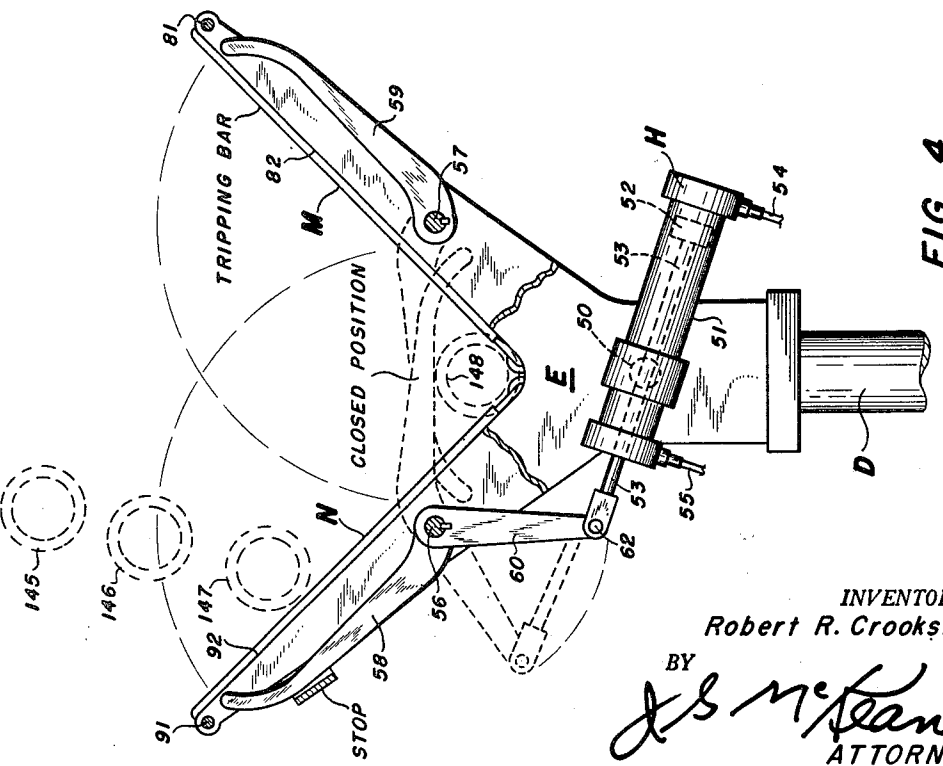


FIG. 4.

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DEVICE FOR POSITIONING PIPE IN A
DRILLING DERRICK

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2 Claims. (Cl. 214-2.5)

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This application is directed to a positioning means for positioning vertical joints of drilling pipe preparatory to screwing the joints of pipe together.

The objects and advantages of the device of the present invention will be seen from the following description taken in conjunction with the drawing in which

Fig. 1 is in the form of an isometric drawing showing an embodiment of the present invention in relation to the conventional drilling equipment in a drilling derrick;

Fig. 2 shows a portion of the mechanism of Fig. 1 with compressed air control mechanism;

Fig. 3 is a fragmentary view partly in section showing a portion of the device of Fig. 1;

Fig. 4 is a top view of a portion of the device of Fig. 1;

Fig. 5 is a bottom view of a portion of the device shown in Fig. 4;

Fig. 6 is a fragmentary view with parts cut away showing details of construction of the mechanism of Figs. 4 and 5; and

Fig. 7 is a side view of the portion of the device shown in Figs. 4 and 5.

Turning now specifically to the drawing and first to Fig. 1, a derrick floor 11 of a drilling derrick, one corner post of which is shown as 12, is provided with a pipe rack 13 with a section of pipe 14 racked thereon. At the center of the drilling derrick is mounted a rotary table consisting of a stationary portion 15 and a rotating portion 16. The upper end of the drill stem 17 is shown suspended by means of power slip assembly 18. This equipment is conventional in a rotary drilling derrick.

An embodiment of the pipe handling assembly of the present invention consists of a base A which is secured to the stationary portion 15 of the rotary table, an up-right member B mounted on the base member, a power piston and cylinder assembly C mounted on the up-right member B, a piston rod D and a pipe receiving member E.

The power piston and cylinder assembly consists of a cylinder 20, piston 21, and piston rod 22 which has one end secured to piston 21 and the other end secured to pipe receiving member E.

In Fig. 1, by way of illustration, the lower end of a suspended section of pipe 23 is shown. The lower end is in the position which a stand of pipe supported by the elevators (not shown) may assume as it is moved from racking position to the center of the derrick.

Up-right member B is secured to base member A by means of a hinge pin 24 and a releasable

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latch indicated schematically as 25. In normal operation the releasable latch 25 maintains the assembly in the position as shown in Fig. 1 but when it is desired to get the pipe centering device out of the way of the derrick floor so that other drilling operations may be performed, the trap door 26 shown in the derrick floor may be opened, the releasable latch released and the structure pivoted about pin 24 and lowered so that the cylinder 20 of assembly C enters the opening of the trap door and is below the surface of the floor so that in this position the portions of the assembly above the derrick floor are base member A and supporting member B lying substantially flat on the derrick floor and pipe receiving portion E and the piston rod 22 extending vertically into the air.

Cylinder 20 of assembly C is pivotally mounted on up-right member B. A ring 30 embraces cylinder 20 and projecting therefrom is a pivot pin 31 fitting into a corresponding recess in member B. In order to bias cylinder 20 in a predetermined position, a pair of springs 32 and 33 is provided with the inner ends of the springs resting against member B and the outer ends resting against a collar 34 which encircles the cylinder and transmits the bias from the springs to said cylinder. Mounted further toward the rear of member B is a pair of small power piston and cylinder assemblies F and G. A mounting member 35 extends from member B to provide the mounting means for cylinder 36 of assembly F and a member 37 secured to member B provides the mounting means for the cylinder 38 of the G. As shown in greater detail in Fig. 2, a piston 39 with a piston rod 40 attached thereto is arranged within cylinder 36 with an end of the piston rod secured to the cylinder 20 of assembly C. Similarly, assembly G consists of a cylinder 38 with piston 41 therein and a piston rod 42 with one end attached to piston 40 and its other end secured to cylinder 20 of assembly C. Piston and cylinder assemblies F and G provide means for moving cylinder 20 arcuately which in turn gives the pipe receiving member E arcuate movement when such movement is desirable in order to move the pipe slightly to get it to take its proper position.

The details of the construction of the pipe receiving member and its associated mechanism are shown in Figs. 4, 5, 6, and 7.

A piston and cylinder power assembly H is mounted on pipe receiving member E by a pivotal mounting means 50. The piston and cylinder assembly H consists of a cylinder 51, piston

52 slidably mounted therein with piston rod 53 secured thereto. Compressed air is supplied to the ends of piston 51 by means of lines 54 and 55. Shafts 56 and 57 are carried by member E and have secured thereto pipe latching arms 58 and 59, respectively. In Fig. 4 the arms 58 and 59 are shown in their open positions by full lines and are indicated in their pipe latching positions by dashed lines. A lever arm 60 has one end fixed to shaft 56 and its other end secured to the free end of piston rod 53 by pivot 62. Thus, it will be seen that longitudinal movement of piston rod 53 causes arm 58 to move arcuately.

The movement from shaft 56 is transmitted to shaft 57 to cause the two shafts to work in unison by the mechanism shown in Figs. 6 and 7. A pair of gears 70, 71 is fixed to shaft 56 and a corresponding pair of gears 72, 73 is fixed to shaft 57. In the drawing for purposes of simplification, the gears 70, 71 and 72, 73 are shown as dashed circles. A shaft 74 is mounted on member E at the center of the V-shaped opening and a pair of gears 75, 76 is rotatably mounted on said shaft to serve as idlers. Gears 75, 76 like gears 70, 71 are shown as circles to simplify the drawing. A heavy chain 77 has one end made fast to gear 70 and is passed around idler gear 75 and has its other end secured to gear 72. A second chain 78 has an end secured to gear 71 and is passed around the idler gear 76 and has its other end made fast to gear 73. In closing the arms 58, 59, the mechanical movement from shaft 56 is transmitted to shaft 57 by means of the chain 77 and when retracting the arms the mechanical movement is transmitted from shaft 76 through chain 78 to shaft 57.

The cylinder and piston power assembly H, which controls the position of arms 58 and 59, is actuated by valve assembly J on which a tripping member K projects so that the valve is actuated by movement of the tripping bars M and N.

As shown in Fig. 4, tripping bar M is attached to the outer end of arm 80 of pipe receiving member E by means of pivot 81 and extends adjacent the edge 82 of arm 80 but is spaced away therefrom into the V-shaped opening. The free end of tripping bar M terminates in a roller 83 which is in contact with tripping member K of valve J. Tripping bar M is biased away from surface 82 of arm 80 by a spring biased bar positioner such as a spring 85 contained in a body 84 mounted on arm 80, and a piston rod 85 pivotally attached to tripping bar M.

Tripping bar N is similar to bar M and is attached to arm 90 of member E by pivot 91 and extends along the edge 92 of arm 90 but is spaced away therefrom into the V-shaped opening of member E with its free end terminating in a roller 93 which rests against tripping member K. Tripping bar N is biased away from surface 92 by a spring biased bar positioner such as a spring 95 contained in a cylinder 94 attached to arm 90 and a piston rod 96 which is pivotally attached to arm N. Bar guides 88 and 98 attached to arms 80 and 90, respectively, aid further in guiding the tripping bars M and N in their predetermined paths.

The compressed air circuit for actuating the cylinder and piston power assemblies C, F, G and H is shown in Fig. 2. In this figure an addition to the piston and cylinder power assemblies listed is valve J which has been previously mentioned. In addition, hand actuated valves O and P are shown. Compressed air for powering the

system is supplied by a suitable means, not shown in the drawing, such as an air compressor. For convenience the compressed air inlets are all designated by the common reference letter Q.

Hand operated valves O and P are conventional three-way bleeder type valves. In order to simplify the drawing, the bleeder outlets are not shown. Valve O is supplied with air from compressed air supply line Q and has a delivery to line 110 which is connected to the head end of cylinder 20 of the piston and cylinder assembly C. The other delivery line 114 of valve O is connected through fitting 115 to the piston rod end of cylinder 20 of the piston and cylinder assembly C, and is connected by line 114 and branch line 115 to the piston actuator 116 of valve J. Valve O is provided with the usual operating handle 117. It will be obvious that by manipulation of operating handle 117 compressed air may be supplied from line Q through valve O and line 110 to apply compressed air pressure in space 118 of cylinder 20 thus forcing piston 21 to the right, as shown in Fig. 2, while compressed air is being bled from space 119 in cylinder 20 through line 114 and from piston actuator 116 of valve J through the bleeder port, not shown in the drawing, of valve O. Similarly, by manipulating handle 117 compressed air is supplied to piston actuator 116 of valve J and to space 119 and is bled from space 118 to manipulate the valve element of valve J and to force piston 21 to its left position.

Valve P is supplied with air from compressed supply line Q. It has a delivery line 120 with branch lines 121 and 122, and a delivery line 123 connected to branch lines 124 and 125. Branch line 121 discharges in chamber 126 of unit F and branch line 122 discharges into chamber 127 of unit G. Branch line 124 discharges into chamber 128 of unit F and branch line 125 discharges into chamber 129 of unit G.

Valve P is supplied with a conventional operating handle 130. By suitable manipulation of valve handle 130 valve P may be set so that in one position it supplies compressed air to chamber 126 and bleeds air from chamber 128 from unit F while at the same time it supplies compressed air to chamber 127 and bleeds air from chamber 129 of unit G. This forces cylinder 20 of assembly C in the counterclockwise direction as viewed in Fig. 2. By manipulating operating handle 130 the valve setting of P may be changed so that compressed air is supplied to chamber 128 and bled from chamber 126 of unit F and simultaneously supplied to chamber 129 and bled from chamber 127 of assembly G. This causes cylinder 20 of assembly C to move in the clockwise direction as viewed in Fig. 2.

Valve J is a conventional bleeder type valve with its inlet supplied with air from line Q and having delivery outlets 140 and 141. Valve J is provided with mechanical tripping member K and piston actuator 116. In order to simplify the drawing the mechanism of valve J is not shown in detail. When the movable valve element is moved to the right in fullest extent as shown in Fig. 2 (hereinafter called the first position for the valve) (piston actuator 116 is capable of forcing the movable valve element to assume this position) air passes from inlet line Q through the body of valve J through delivery line 140 and enters chamber 142 of piston and cylinder assembly H and at the same time air is bled from chamber 143 of assembly H through

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line 141. This biases piston 52 to the head end of the cylinder 51 of assembly H, and causes the arms 58 and 59 to be retained in the position shown by full lines in Fig. 4. When the valve mechanism of valve J is moved to the left, hereinafter termed the second position which movement is obtained by the mechanical movement of tripping member K to the left, compressed air passes from inlet line Q through delivery line 141 to chamber 143 and is bled from chamber 142 through line 140. This causes the piston 52 to be moved toward the piston rod end of the cylinder 51 of assembly H and in turn causes arms 58 and 59 to assume the position shown by dashed lines in Fig. 4.

The compressed air actuator 116 tends to bias the movable element of valve J, with attached tripping mechanism K to its first position. Thus when compressed air is allowed to enter through valve O and branch line 114 of piston and assembly C, it also passes through line 115 to piston actuator and forces the valve element of valve J to its first position at which time the arms 58 and 59 are in their open position as shown by the full lines of Fig. 4.

The device of the present invention is particularly adapted for engaging a swinging stand of pipe in a drilling derrick as it is suspended from the pipe elevators and is being moved from racking position to the center of the derrick. A view of such an operation is shown in Fig. 1 in which the lower end of a stand of pipe 23 is swinging into the V-shaped opening of member E. This is also indicated in Figs. 4 and 5 where the dashed circles 145, 146 and 147 indicate the consecutive positions assumed by the lower end of the pipe as it swings toward the pipe receiving assembly E.

In Fig. 1 and also Figs. 4 and 5 the pipe has not come into contact with one of the tripping bars. In Figs. 4 and 5 the dashed circle 147 is adjacent tripping bar N so that a slight additional movement of the pipe will bring it in contact with the tripping bar N which in turn will cause member K of valve J to move the valve element of valve J (not shown on the drawing) from its first position to its second position which in turn will cause arms 58 and 59 to be moved to the position shown by dashed lines in Fig. 4, thereby latching the section of pipe into the position shown by dashed circle 148 in the angle of the V-shaped opening of member E. As seen in Fig. 1 the assembly is so arranged that the pipe in this position coincides with the center line of the drill string so that upon lowering the stand of pipe the screw threads at the end engage with the screw threads of the upper end of the drill pipe in the borehole (member 17 in Fig. 1) and the two sections of pipe may readily be screwed together.

After the section of pipe being handled has been engaged with the string of drill pipe in the borehole, the pipe receiving member E may be moved away from the center of the derrick by manipulating operating handle 117 of valve O, which bleeds air through line 110 from chamber 118 of assembly C, delivers compressed air through line 114 to chamber 119 of assembly C, and delivers compressed air through line 114 and branch line 115 to piston actuator 116 of valve J which in turn moves the valve element of valve J to its first position whereupon compressed air is delivered through line Q to valve J and line 140 to chamber 142 of assembly H. At the same time air is bled from chamber 143 of assembly H.

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This causes piston 52 of assembly H to move to the head end of cylinder 51 of assembly H and in turn causes the arms 58 and 59 to assume their open positions as shown by full lines in Fig. 4 and at the same time piston 21 of assembly C is caused to move toward the head end of cylinder 20. Thus this manipulation of operating handle of valve 117 of valve O causes the arms 58 and 59 to swing open to release the assembly from the stand of pipe and also causes piston 21 to move toward the head end of the cylinder to moving member E away from the stand of pipe. After the suitable operations have been performed at the center of the derrick it is desirable that the assembly E be moved into position, to guide a section of pipe that is being moved from the racking position to the center of the derrick. This may be done by actuating handle 117 of valve O to cause compressed air to be delivered through line 110 and be bled from line 114. The compressed air is imposed in chamber 118 and forces piston 21 to the piston end of cylinder 20, so that the assembly is ready to receive another section of pipe.

The piston assemblies F and G work in cooperation. That is to say, by manipulation of operating handle 130 of valve P the pistons 39 and 41 are simultaneously biased either in a clockwise or counterclockwise direction. By a suitable manipulation of operating handle 130 pistons 39 and 41 may cause cylinder 20 to oscillate about its pivotal mounting 31. This oscillatory movement may be useful when the axis of the section of pipe latched by the arms 58 and 59 (as indicated by 143 in Fig. 4) does not exactly coincide with axis of the string of drill pipe in the borehole. The failure of the axis of the positioned section and the axis of the drill pipe to coincide may, for example, result from the section of pipe becoming bent in use. By giving the section of pipe an oscillatory motion it will usually be moved enough so that the end of the section of pipe will slip into the end of the drill string so that the two pieces may then be readily coupled by screwing the threads together.

While a specific embodiment of the present specification has been described, it will be obvious that the various changes in the sizes and proportions of the several parts making up the assembly may be varied without departing from the scope of the invention.

I claim:

1. A device for use in the drilling derrick having a rotary table consisting of a stationary housing and a rotatable moving member at the center thereof comprising, in combination, an up-right supporting member, means securing said up-right supporting member to the stationary housing of the rotary table, a first power piston and cylinder assembly consisting of a first and second member one of which is a cylinder and the other of which is a piston with a piston rod attached thereto slidably arranged within the cylinder, means pivotally mounting said first member of the first piston and cylinder assembly on said supporting member with its axis horizontal for arcuate movement in a horizontal plane, a plurality of shock absorbing members secured to said supporting member and operably connected to said first member of the first piston and cylinder assembly for restricting the horizontal movement of said piston and cylinder assembly and biasing same to a predetermined horizontal axis, second and third power piston and cylinder assemblies each consisting of a first and a second

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member one of which is a cylinder and the other of which is a piston with a piston rod attached thereto slidably arranged within the cylinder, means fixing the first member of said second and third piston and cylinder assemblies to supporting members with their axes horizontal and perpendicular to said predetermined horizontal axis and means connecting said second and third piston and cylinder assemblies to said first member of said first piston and cylinder power assembly whereby said second and third piston and cylinder assemblies can oscillate said first piston and cylinder assembly about its pivotal mounting and a pipe receiving member secured to the second member of said first piston and cylinder assembly, said pipe receiving member having an opening for receiving a section of pipe and means for releasably clamping said section of pipe in said pipe receiving opening.

2. A device in accordance with claim 1 in which

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the means securing the up-right supporting member to the stationary housing of the rotary table includes a hinged joint arranged to allow said supporting member to rotate in a plane perpendicular to the axis of the first power piston and cylinder assembly and a releasable latch releasably locking the supporting member in an up-right position.

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