

Oct. 28, 1952

M. E. TRUE

2,615,681

DEVICE FOR HANDLING PIPES

Filed March 27, 1950

3 Sheets-Sheet 1

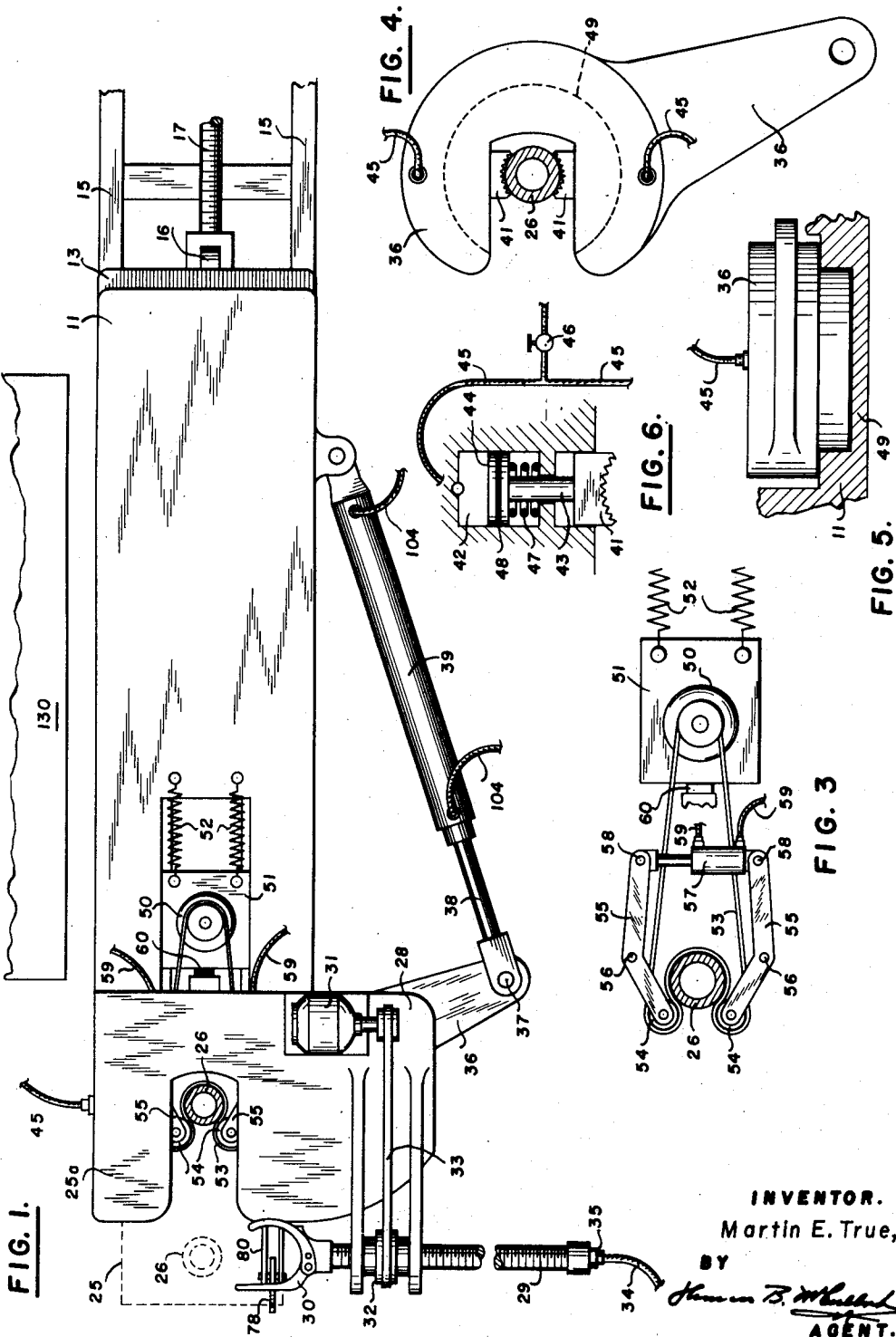


FIG. 1.

FIG. 4.

FIG. 6.

FIG. 3

FIG. 5.

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3 Sheets-Sheet 2

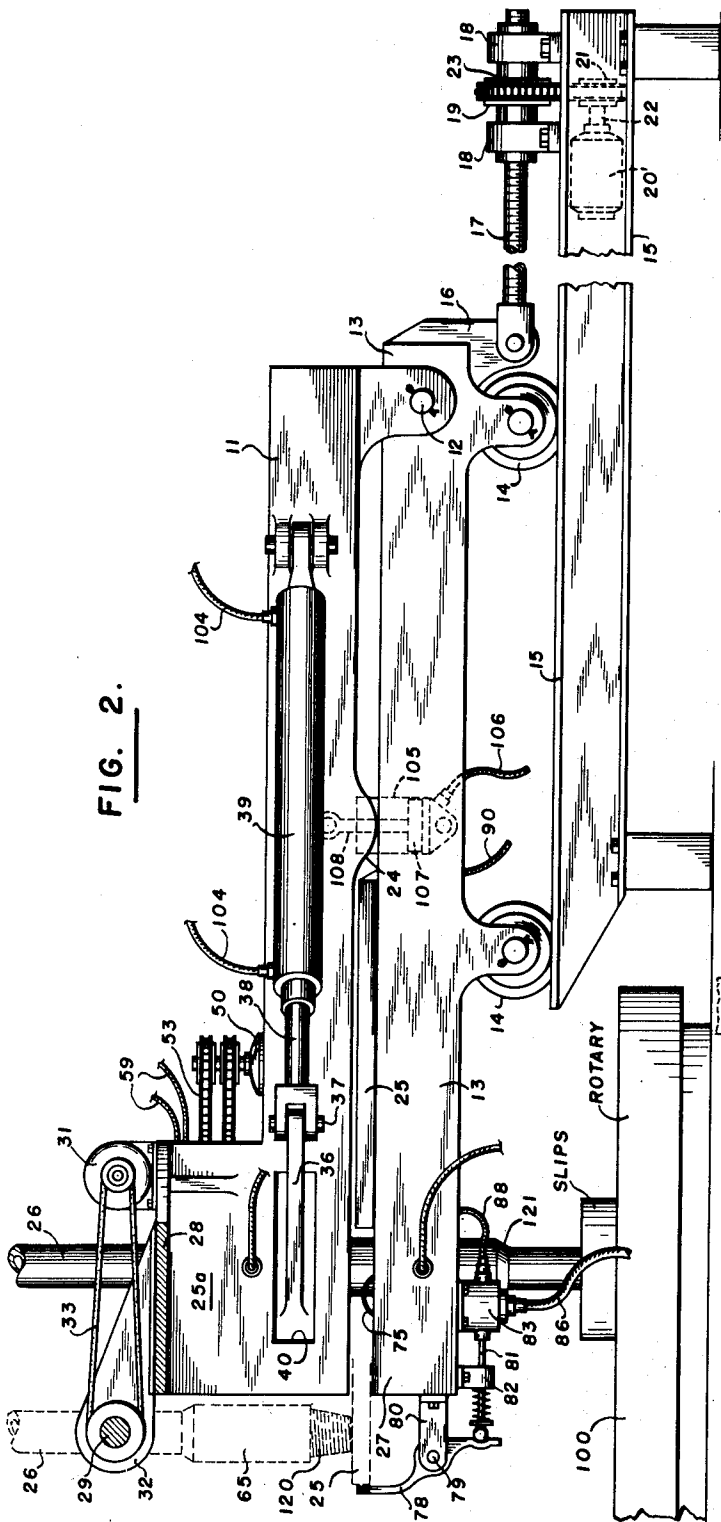


FIG. 2.

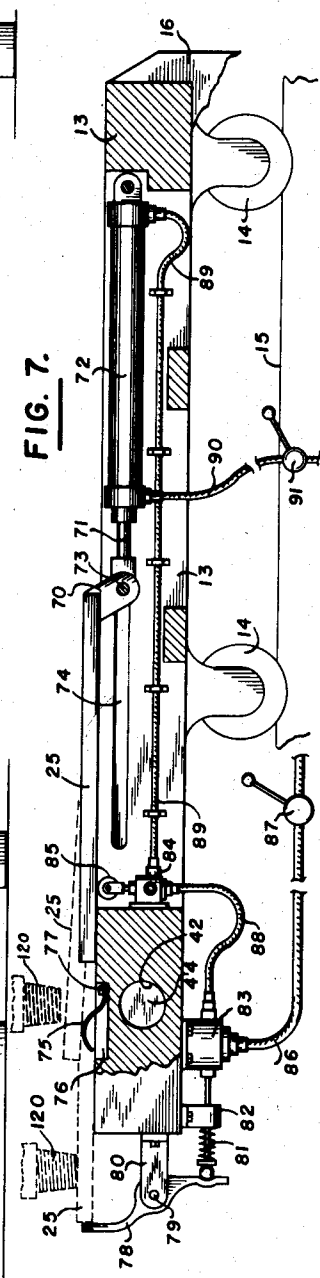


FIG. 7.

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3 Sheets-Sheet 3

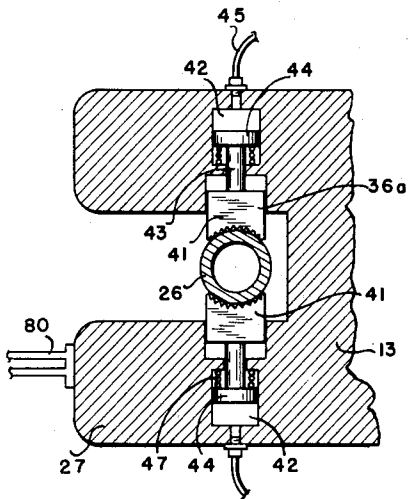


FIG. 8.

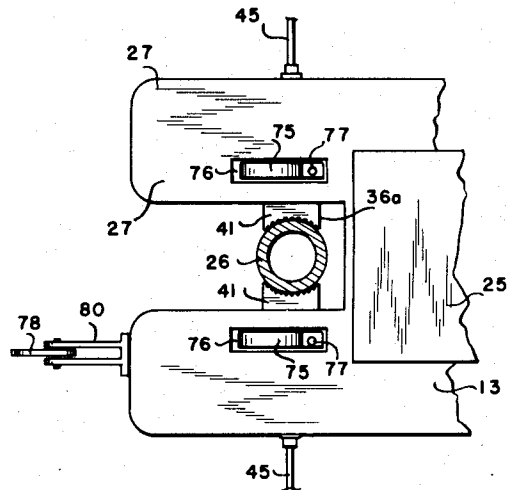


FIG. 9.

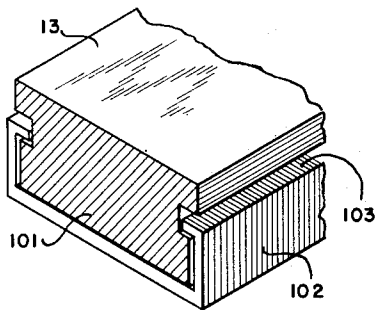


FIG. 11.

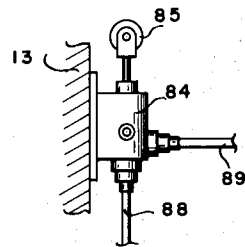


FIG. 10.

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UNITED STATES PATENT OFFICE

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DEVICE FOR HANDLING PIPES

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Application March 27, 1950, Serial No. 152,130

2 Claims. (Cl. 255—35)

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The present invention is directed to apparatus for handling pipe. More particularly the invention has to do with handling vertical stands of pipe either coming out of or going into a borehole in the earth.

It is common to employ tonging and spinning means for making up and breaking out stands of pipe from a length of pipe in a borehole. The apparatus of the prior art have employed separate pieces of equipment which were cumbersome and dangerous to the workers handling the pipe. Furthermore, the prior art equipment causes the workman to expose himself to movement of heavy equipment and to whipping back and forth of spinning chains which frequently are hazardous to life and limb.

It is therefore the main object of the present invention to provide improved apparatus for handling vertical stands of pipe with minimum effort and exposure to manpower.

Another object of the present invention is to provide integral pipe handling equipment for removing from or adding to lengths of pipe to a string of pipe in a borehole.

A still further object of the present invention is to provide efficient equipment for conducting operations mechanically which heretofore were performed manually.

The apparatus of the present invention may be described briefly as involving a carriage which is adapted for movement on a trackway which is mounted on the floor of a derrick. Pivotably attached to the carriage is a housing member in which is arranged a tonging means and a spinning means. The carriage and the housing define corresponding slotted openings to allow the carriage to move up to and around a vertical stand of pipe. The slotted opening of the carriage has built thereinto a back-up tong, while the make-up tongs are located adjacent the slotted opening of the housing and the spinning means are arranged above the make-up tongs. Carried by the housing is an extensible and retractable arm carrying on a free end thereof a hook which is adapted to grasp and release a vertical stand of pipe. The arm moves perpendicular to the movement of the carriage and housing and is mounted above and slightly ahead of the housing to allow grasping and releasing of stands of pipe. Arranged between the carriage and the housing is a slidable plate which is adapted to move along an axis substantially parallel to the longitudinal axis of the carriage, the purpose of the slidable plate being to act as a rest for a pipe stand when it is lifted out of the box or

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the housing pivoting upwardly. The device of the present invention is provided with power means for moving the carriage along the track, power means for actuating the back-up and make-up tongs and power means for actuating the spinning means and the extensible and retractable arm as well as the hook thereon. The apparatus of the present invention also includes means for stopping the travel of the slidable plate at predetermined points.

The present invention will be further described by reference to the drawing in which

Fig. 1 is a view looking downward on a portion of the apparatus of the present invention showing its relationship to an elevated pipe rack;

Fig. 2 is a side view of the device of the present invention, the dotted lines showing a stand of pipe being supported by the plate ahead of the housing;

Fig. 3 is a detail of the spinning means of Figs. 1 and 2;

Fig. 4 is a detail of the tongs embodied in Figs. 1 and 2;

Fig. 5 is a further detail of a portion of the tong of Fig. 4;

Fig. 6 is a detail of the hydraulic mechanism for operating the tong of Fig. 4;

Fig. 7 is a detail side view with parts cut away of the carriage of Fig. 2 showing the arrangement of the slidable plate and the stopping means;

Fig. 8 is a top sectional view of the carriage of Figs. 1 and 2 showing the slotted portion thereof and the arrangement of the back-up tongs;

Fig. 9 is a top fragmentary view of the bifurcated portion 27 of the carriage and the plate 25;

Fig. 10 is a view of the valve of Fig. 7; and

Fig. 11 shows an alternative embodiment of a carriage and track assembly to that of Fig. 2.

In the several figures of the drawings identical numerals will be employed to designate corresponding parts.

Referring now to the drawing, numeral 11 designates a housing which is pivotally attached at pin 12 to a carriage 13 which is arranged on flange wheels 14 to travel on a trackway 15 which is adapted to be mounted on the floor of the derrick. Carriage 13 is attached by attachment means 16 to an externally threaded member 17 which is journaled in journaling means 18. A rotating nut 19 is carried by member 17 to provide power thereto, rotating nut 19 being provided with internal threads to correspond to and cooperate with the external threads of member 17. A power means such as a motor 20 is

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arranged on or adjacent track 15 and carries a pulley 21 on shaft 22. A chain or belt 23 transmits power from pulley 21 to rotating nut 19 and causes carriage 13 to be moved back and forward along trackway 15 depending on the direction of rotation of the shaft 22 of motor 20.

The housing 11 is supported on carriage 13 by a protuberance above the carriage 13 sufficient to allow movement therebetween of a slidable plate 25 as will be described further.

The housing 11 is constructed to define thereby a bifurcated portion 25a which is adapted to embrace a stand of pipe 26. Similarly carriage 13 also defines with the free end thereof a similar bifurcated portion 27 in which is arranged a back-up tong which will be described further. The bifurcated portion 25a of housing 11 is provided with a projection 28 which carries an extensible and retractable arm 29 which in turn carries on a free end thereof a hook 30 which is adapted to grasp and release vertical stands of pipe. The arm 29 may be extended and retracted in a derrick perpendicular to the direction of travel of the housing 11 and carriage 13 by power means 31 arranged on projection 28 and rotating nut 32 which is provided with internal screw threads to mesh with external screw threads of arm 29. A drive means such as a belt or chain 33 causes the arm 29 to be extended or retracted depending on the direction of travel of the power means 31. The hook 30 is provided with a fixed member and a movable member, the movable member being actuated by admission of a hydraulic fluid to an internal channel defined by arm 29 and communicating with actuating devices in hook 30. Hydraulic fluid may be admitted to the internal channel of arm 29 by a conduit 34 attached by coupling means 35 and allowing arm 29 to communicate with a source of hydraulic fluid not shown. Details of the apparatus and the operation thereof of arm 29 and hook 30, as well as the auxiliary elevator used therewith, may be found in pending applications U. S. Ser. No. 5,843 filed February 2, 1948, entitled "Apparatus for Racking Pipe in a Derrick," U. S. Ser. No. 98,250 filed June 10, 1949, entitled "Pipe Racking Apparatus," U. S. Ser. No. 98,740 filed June 13, 1949, entitled "Improved Apparatus for Moving Pipe," and U. S. Ser. No. 99,165 filed June 15, 1949, entitled "Apparatus for Handling Pipe," all in the name of Albert L. Stone.

Arranged in the bifurcated portion 25a of housing 11 is a spinning means and a tonging means, the spinning means being arranged above the tonging means. The tonging means are shown in detail in Fig. 4 and embodies a tong 36 which is attached by a pin 37 to a piston arm 38 which moves in a piston cylinder 39. An opening 40 in bifurcated member 25a provides for a movement of tong 36. Tong 36 is provided with dual jaws 41 which are adapted to bite into tool joint 65 of pipe stand 26 on actuation of the jaws by admission of hydraulic fluid to internal piston chambers 42, only one of which is shown in Fig. 4 for reasons of simplicity and brevity of the description. Jaw 41 is attached by a piston arm 43 to piston 44.

In Fig. 6 an arrangement is shown for admission of hydraulic fluid to piston 42 by conduit 45 controlled by valve 46 which connects to a source of hydraulic fluid not shown. When it is desired to actuate either of the jaws 41 hydraulic fluid would be admitted to cylinder 42 causing the piston to compress spring 47, piston 44

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being sealed by a seal ring 48. Release of pressure causes release of jaw 41 and allows the piston to be returned to the neutral position by the force of spring 47. The tong 36 is provided with a projecting shoulder 49 which is adapted to fit into an opening in the bifurcated portion 25a.

The spinning means is arranged above tonging means 36 in bifurcated portion 25a and is shown in detail in Fig. 3. The spinning means includes a power means 50 arranged on a plate 51 in housing 11 which is slidable thereon and is spring loaded by springs 52 which are attached to the housing 11 and to plate 50 as shown in Figs. 1 and 3. The spinning means includes a continuous belt or spinning chain or metallic member 53 which is adapted to fit around pipe stand 26 as shown in Fig. 3. Supplying tension on the spinning means 53 are rollers 54 carried on eccentric arms 55 which are pivoted at pins 56 to the bifurcated member 25a. Connecting to and actuating arms 55 is a piston cylinder assembly 57 which connects to arms 55 at points 58. The piston cylinder assembly 57 is provided with conduits 59 for admission of hydraulic fluid thereto. The spinning means include a stop member 60 to limit the travel of the motor plate 51.

As described before, the carriage 13 has arranged to slide thereon a slidable plate 25. This plate is arranged between housing 11 and carriage 13 and is connected by an attachment 70 to piston arm 71 which is connected to a piston in a piston cylinder 72; the latter is arranged on and fixed to the carriage 11. A pin 73 attaching the piston arm 71 to the plate 25 travels in a slot 74 in carriage 13. Carriage 13 is provided with springs 75 resting in depressions 76 and attached to carriage 13 by nuts 77. At a free end thereof of carriage 13 is a stop member 78 pivoted by pin 79 on an arm 80 attached to carriage 13. The stop member 78 is arranged in operating relationship to a plunger 81 journaled in journaling means 82 which will close a valve 83 attached to the underneath of carriage 13. A second valve 84 is attached to carriage 13 and is provided with a roller plunger 85 which is in operative relationship with plate 25. A conduit 86 controlled by a valve 87 admits air or other hydraulic fluid to valve 83 and thence by conduit 88 to valve 84 and thence by conduit 89 to piston cylinder 72 while air or other hydraulic fluid is admitted to the other end of cylinder 72 by conduit 90 controlled by valve 91.

In Fig. 2 the device of the present invention is shown arranged around pipe stand 26 above rotary table 100 in operative relationship to the vertical stand of pipe as will be described.

Referring to Fig. 11 the carriage 13 may be modified to the extent that the flanged wheels 14 are replaced by a shoe 101 which rests in a bed or a flat track member 102 which is provided with shoulders 103 and provides a fixed support for the carriage 13. The embodiment of Fig. 11 may be used in lieu of the flanged wheels 14 of Fig. 2.

In the bifurcated portion 27 of carriage 13 are arranged back-up tongs 36a identical to make-up or break-out tongs 36 with the exception that in the back-up tongs the jaws 41 work in a fixed housing. Stating this otherwise, the purpose of the back-up tongs 36a is merely to hold the pipe while the make-up or break-out tongs 36 are exerting torque thereon. Since the jaws of the back-up tongs 36a are identical to the jaws of the break-out or make-up tongs 36 further de-

scription of them need not be had. Back-up tongs 36a are shown in Figs. 8 and 9.

The apparatus of the present invention is caused to operate by moving the carriage 13 up to a stand of pipe 26 in the rotary table 100; as the bifurcated portions 27 of carriage 13 and 25a of housing 11 embrace the external periphery of the pipe stand 26, the jaws 41 of the back-up tongs 36a and the break-up or make-up tongs 36 are in operative relationship. By admitting hydraulic fluid in the pistons 42 the jaws 41 bite into the external surface of the pipe 26 and hold it rigidly. Then by admitting hydraulic fluid through conduits 104 to piston cylinder 39 torque is applied to break-out or make-up tong 36 which breaks the connection of the pipe stand 26 at the tool joint 65. Hydraulic fluid is then admitted to conduit 86 by manipulation of valve 87 which allows the air or hydraulic fluid to travel through conduit 86, through valve 83, thence through conduit 88, valve 84 and conduit 89 actuating the piston in cylinder 72 and causing the plate 25 to move forward along an axis substantially parallel to the longitudinal axis of carriage 13. At the same time hydraulic fluid is introduced into a piston cylinder 105 by conduit 106 to cause piston 107 to force an arm 108 upward which in turn causes the housing 11 to pivot upwardly on pivot point 12 thus raising the disconnected portion of pipe stand 26 at tool joint 65 lifting the pin 120 out of the box 121. As plate 25 moves along an axis substantially parallel to the longitudinal axis of carriage 13 it encounters springs 75 which raise it slightly, which in turn lifts the plate off of the roller plunger 85 of valve 84. This stops the travel of plate 25 underneath the pin 120 of pipe stand 26. Release of hydraulic fluid to cylinder 42 of the break-out or make-up tong 36 allows the disconnected pipe stand 26 to rest on plate 25, the weight thereof in turn depresses the plate 25 on spring 75 and again allows actuation of valve 84 by roller plunger 85 which admits air or hydraulic fluid to cylinder 72 and causes the plate to travel outward as indicated by the dotted lines in Figs. 2 and 7 until it reaches stop member 78 which limits the travel of the plate 75 as will be described further.

Prior to the tonging and spinning operations the derrick man in the top of the derrick has been attaching an auxiliary elevator not shown but described in the pending applications of Stone supra and used in conjunction with the grab hook assembly referred to before. The disconnected pipe stand is now in position to be grasped by the hook 30 which is moved up to and around the pipe stand 26 by causing motor 31 to operate which rotates drive nut 32. As the hook 30 moves around the pipe hydraulic fluid is introduced by conduit 34 which causes the hook 30 to operate and grasp the pipe firmly. The motor 20 of carriage 13 is then caused to operate to withdraw the disconnected pipe stand 26 from the locus of the rotary table 100. The whole assembly including housing 11 and carriage 13 carrying pipe stand 26 moves backward until the hook 30 grasping the pipe is adjacent the elevated pipe rack 130 which may be provided with a steel mat. The hook 30 then is caused to operate again in conjunction with the auxiliary elevator which carries the load of the pipe stand 26, moves the disconnected pipe stand into racking position on the elevated pipe rack 30. The racking arm 29 and hook assembly 30 may then be moved out of position and back into inoperative

position as shown in Fig. 1 by reversing the direction of travel of motor 31 and finally stopping it in the desired position.

The foregoing operation describes the removal of pipe from a borehole. When returning pipe to a borehole the operations would be reversed, the arm 29 carrying the hook assembly 30 would be moved back adjacent the elevated pipe rack 130 by travel of the carriage 13 and housing 11 and the arm would then be caused to operate to grasp a stand of pipe on the elevated pipe rack 130. Meanwhile the derrick man would attach the auxiliary elevators and allow the arm 29 and hook 30 to move the stand of pipe 26 over into stabbing position. As the pin 120 of tool joint 65 would be stabbed into box 121 the pipe would then be spun up by actuation of the spinner moving in a reverse direction to that described in the spinning out operation. The tongs 36 and 36a, i. e. the break-out and make-up tongs in cooperation with the back-up tongs, would then be actuated to allow the jaws 41 to bite into the pipe and torque thereon would then be exerted through actuation of arm 38 by admission of hydraulic fluid to cylinder 39. The large elevators would then take hold of the stand of pipe, the slips which heretofore have been holding the pipe string, to which the new stand is being made up in the borehole, would be released and the elevators would come down in the derrick in accordance with conventional operations of going back into the hole.

The present invention may be employed in conjunction with a grab hook in the upper portion of a derrick such as described in the Stone applications supra, but if desired the grab hook embodied in the apparatus of the present invention may be eliminated and the operations of moving the pipe from the plate to the elevated pipe rack conducted manually. It would be preferred, however, to use the complete apparatus of the present invention embodying the grab hook rather than conduct such tedious operation by manpower.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. A device for handling vertical stands of pipe comprising, in combination, a carriage adapted for horizontal movement along a trackway arranged to be mounted on the floor of a derrick, said carriage defining with a first end a slotted opening; a housing mounted above said carriage and pivotally attached to said carriage at a second end thereof for vertical movement with respect to the first end of said carriage, said housing defining a slotted opening in correspondence with the slotted opening of said carriage; power means associated with said carriage and said housing for pivoting said housing upwardly; a first tonging means mounted on said carriage adapted to embrace a stand of pipe in said opening in said carriage to prevent rotation thereof; a second tonging means mounted on said housing adapted to embrace a stand of pipe in said opening in said housing to impart arcuate movement thereto with respect to the longitudinal axis thereof; a spinning means mounted on said housing adapted to rotate a stand of pipe positioned in the opening in said housing; and a slidable plate mounted on said carriage between said carriage and said housing adapted to be moved between said slotted openings along an axis substantially parallel to the longitudinal axis of said carriage and under

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a stand of pipe for moving said stand horizontally into and out of said slotted openings.

2. A device for handling vertical stands of pipe comprising, in combination, a carriage adapted for horizontal movement along a trackway arranged to be mounted on the floor of a derrick, said carriage defining with a first end a slotted opening; a housing mounted above said carriage and pivotally attached to said carriage at a second end thereof for vertical movement with respect to the first end of said carriage, said housing defining a slotted opening in correspondence with the slotted opening of said carriage; power means associated with said carriage and said housing for pivoting said housing upwardly; a first tonging means mounted on said carriage adapted to embrace a stand of pipe in said opening in said carriage to prevent rotation thereof; a second tonging means mounted on said housing adapted to embrace a stand of pipe in said opening in said housing to impart arcuate movement thereto with respect to the longitudinal axis thereof; a spinning means mounted on said housing adapted to rotate a stand of pipe positioned in the opening in said housing; a slidable plate mounted on said carriage between said carriage and said housing

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adapted to be moved between said slotted openings along an axis substantially parallel to the longitudinal axis of said carriage and under a stand of pipe for moving said stand horizontally into and out of said slotted openings; and stopping means mounted on said carriage on a leading edge of the first end thereof for limiting the horizontal movement of said plate.

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