

June 23, 1953

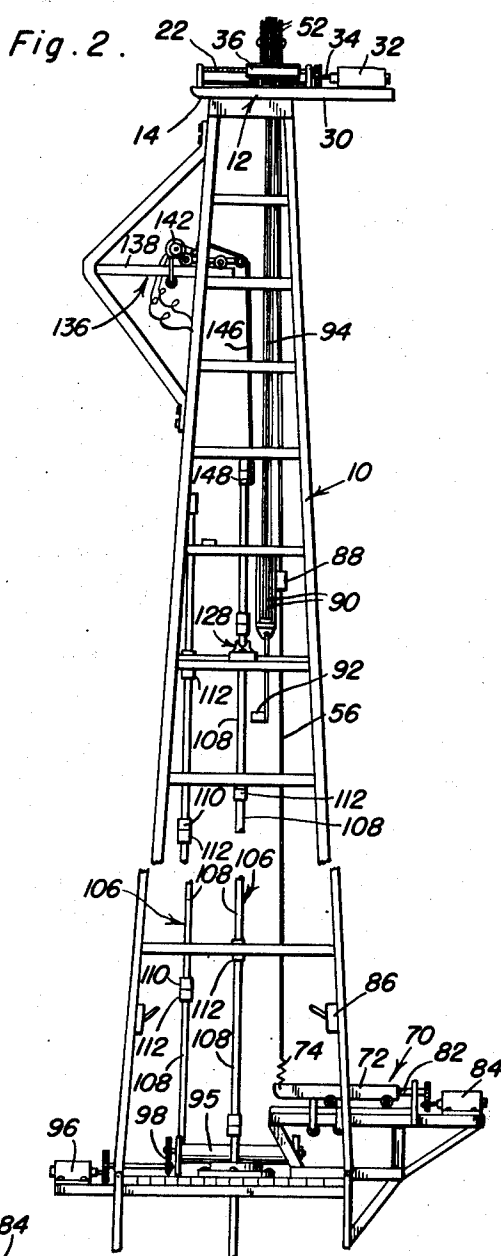
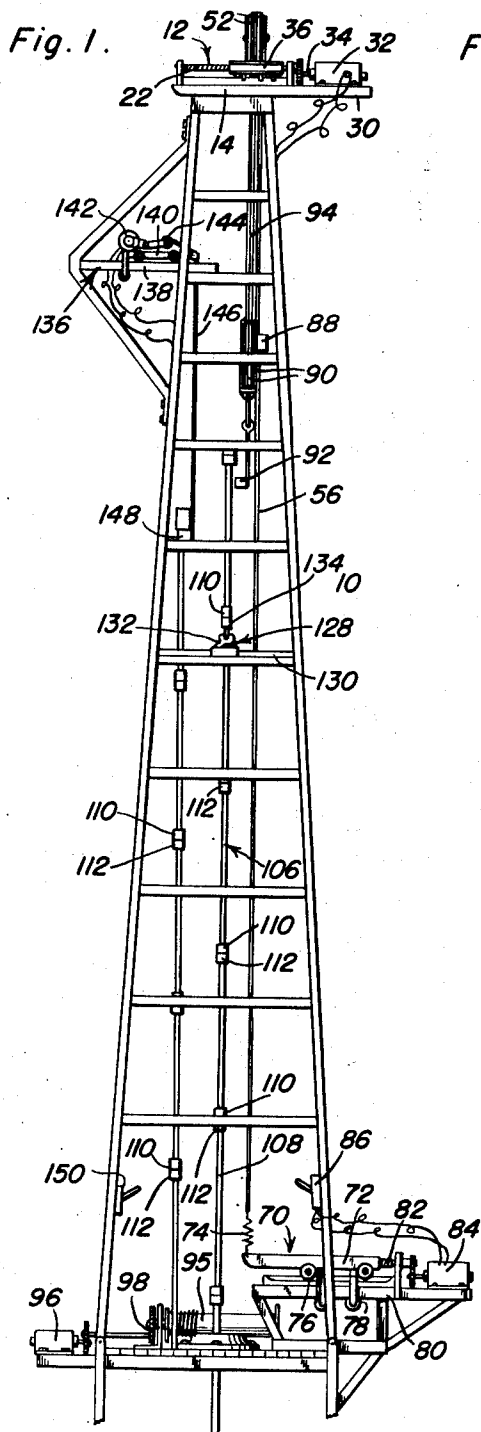
F. D. DE JARNETT

2,643,005

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 1



Frank D. DeJarnett
INVENTOR.

BY *Oliver A. O'Brien*
and *Harvey E. Jacobson*
Attorneys

June 23, 1953

F. D. DE JARNETT

2,643,005

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 2

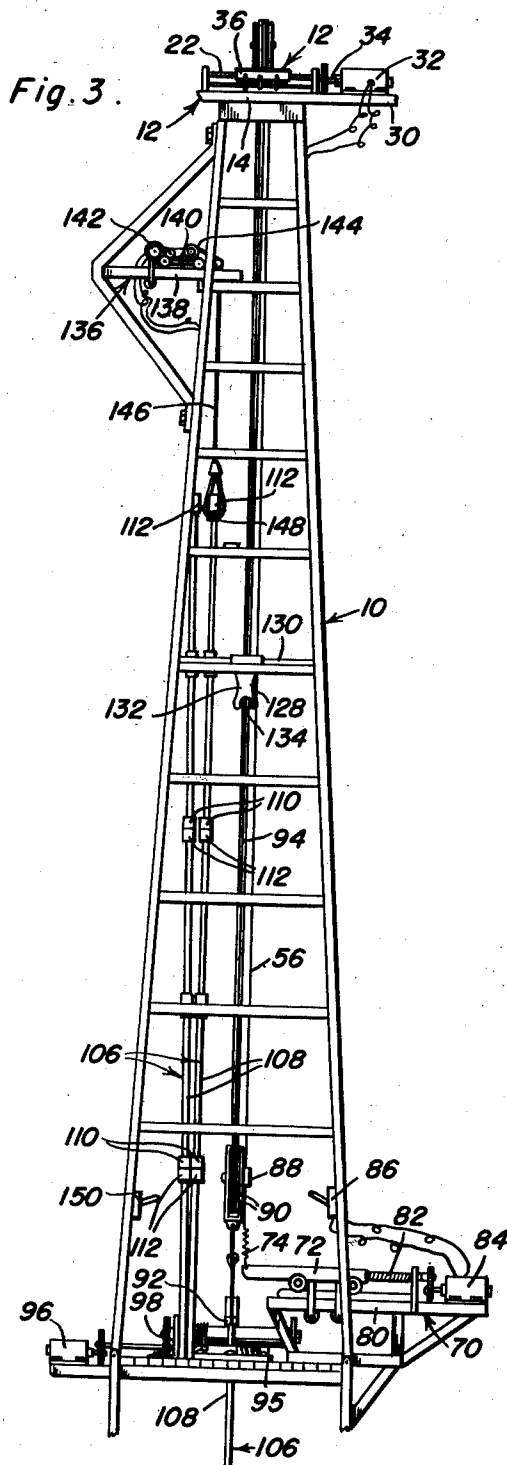
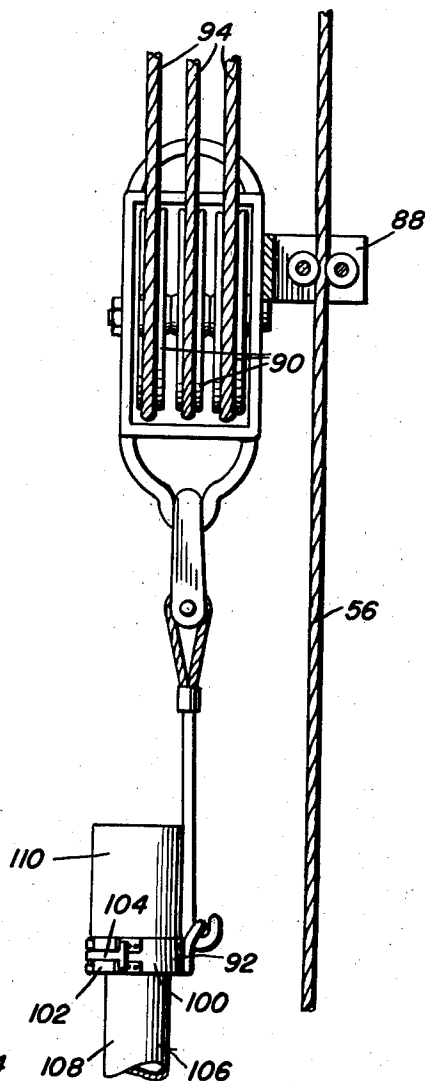


Fig. 4.



Frank D. DeJarnett
INVENTOR.

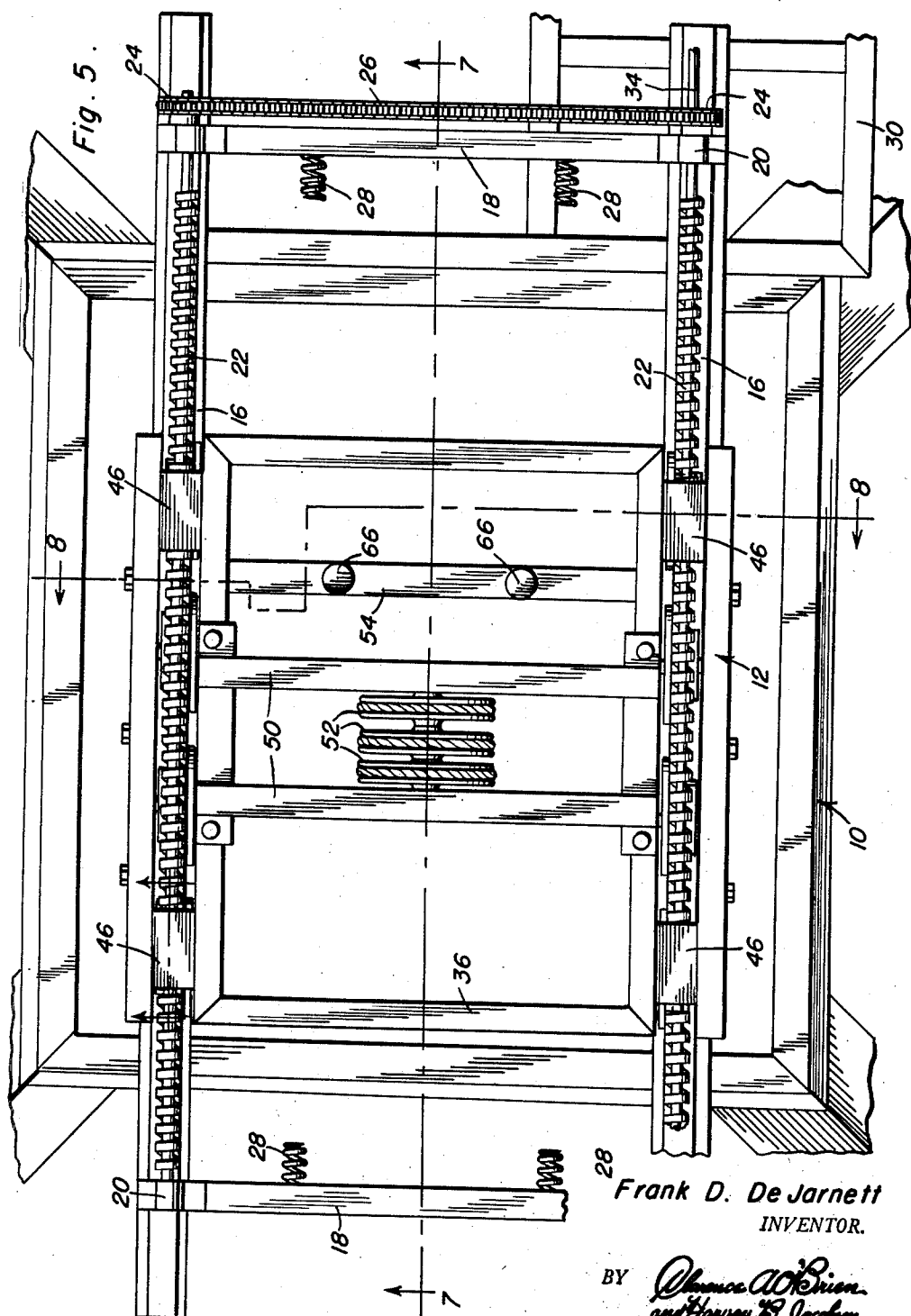
BY *Charles A. O'Brien*
and *Harvey E. Jackson*
Attorneys

F. D. DE JARNETT

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 3



Frank D. De Jarnett
INVENTOR.

BY

Clarence A.'Brien
and Harvey B. Jacobson
 Attorneys

June 23, 1953

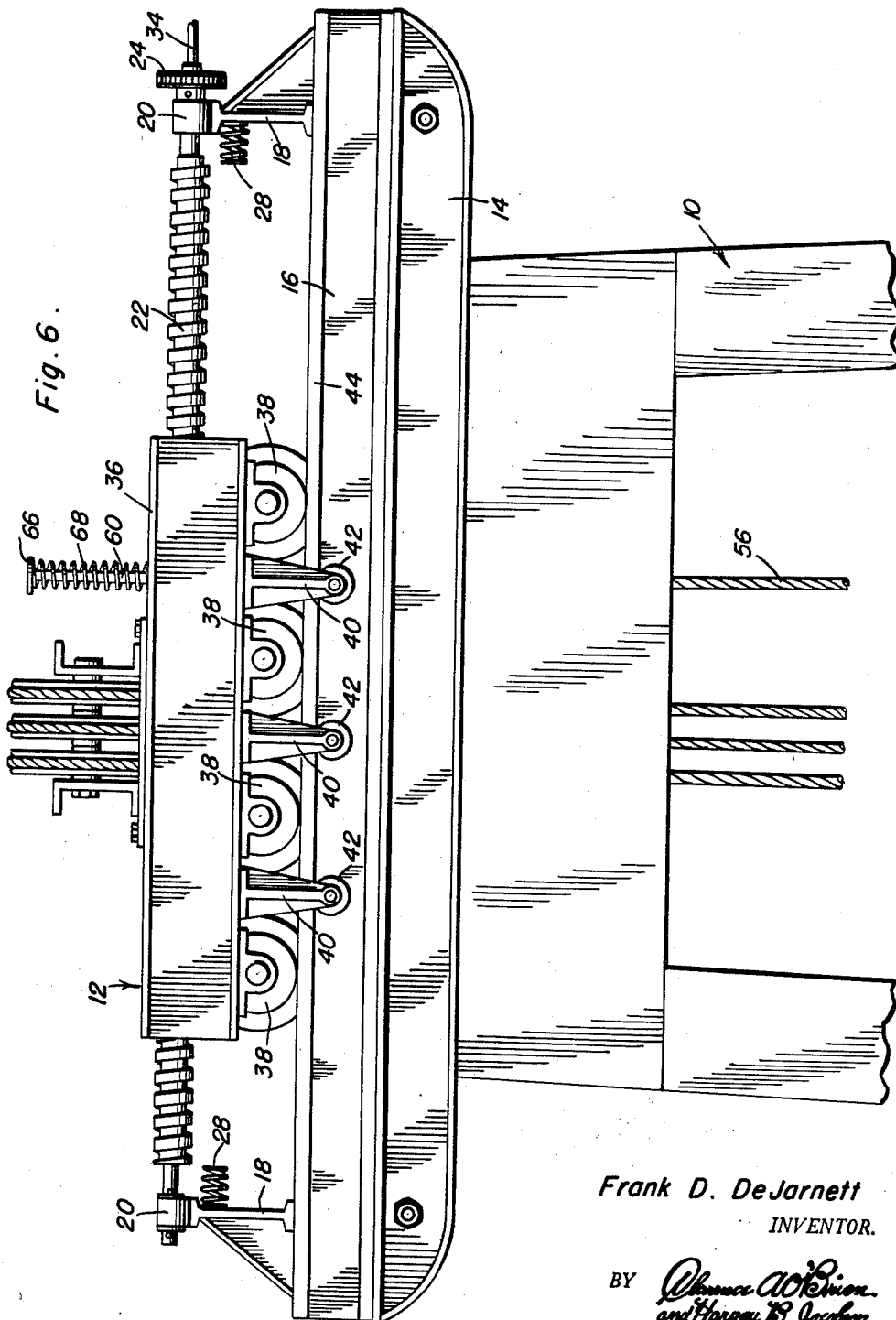
F. D. DE JARNETT

2,643,005

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 4



Frank D. DeJarnett
INVENTOR.

BY

Charles A. DeJarnett
and Harry B. Jackson
Attorneys

June 23, 1953

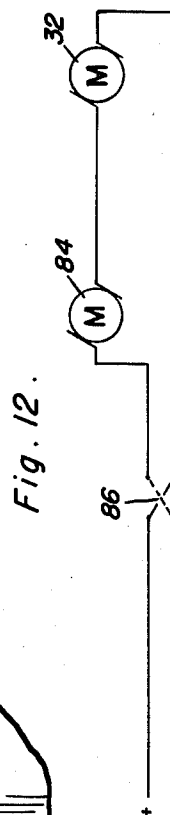
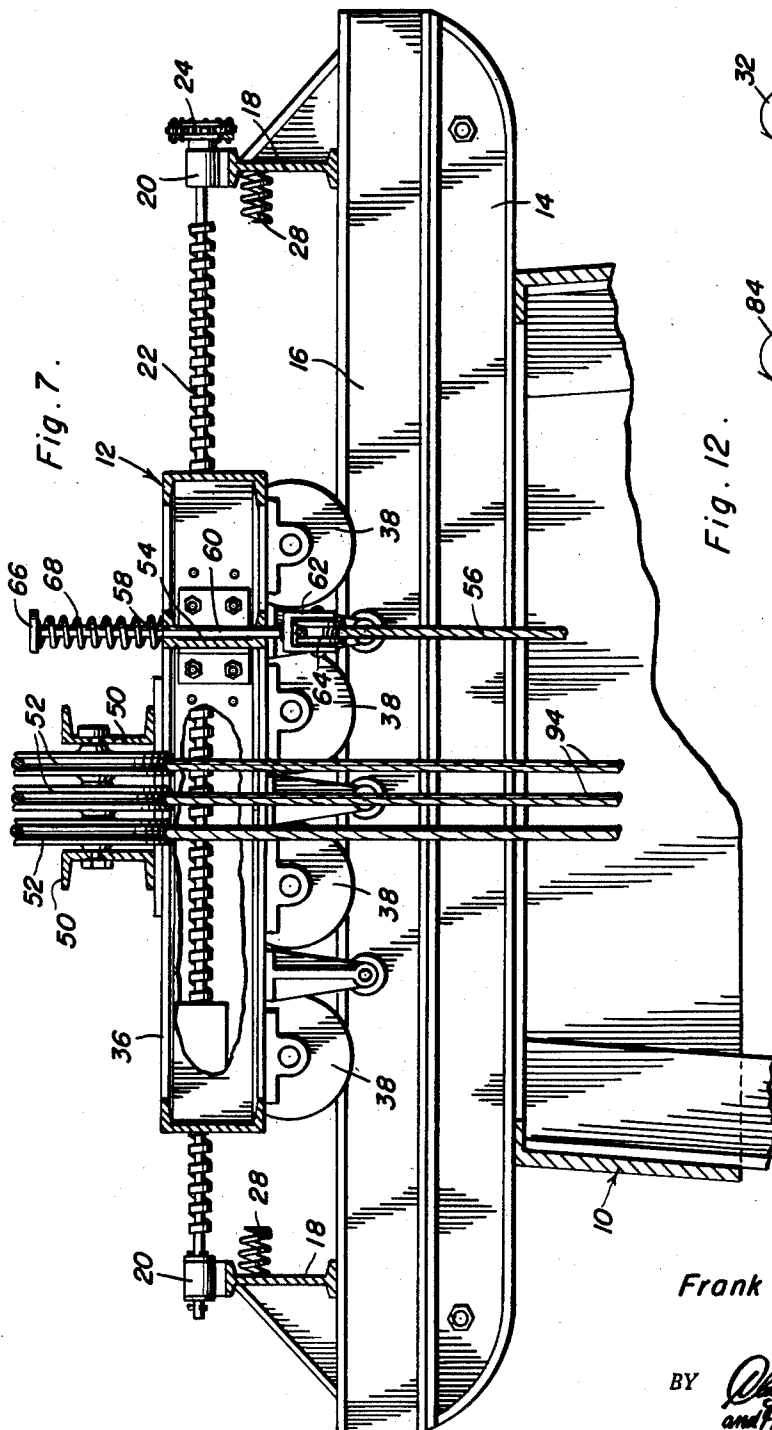
F. D. DE JARNETT

2,643,005

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 5



Frank D. DeJarnett
INVENTOR.

BY *Albion A. Olson*
and *Harvey B. Jordan*
Attorneys

June 23, 1953

F. D. DE JARNETT

2,643,005

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 6

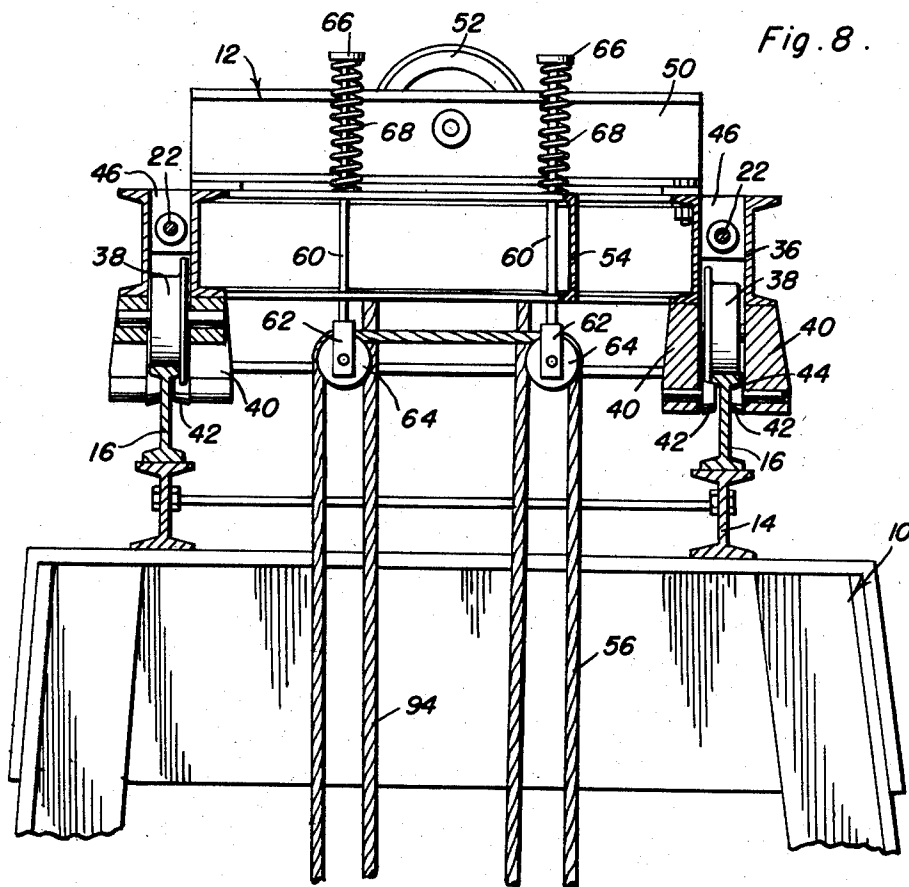


Fig. 8.

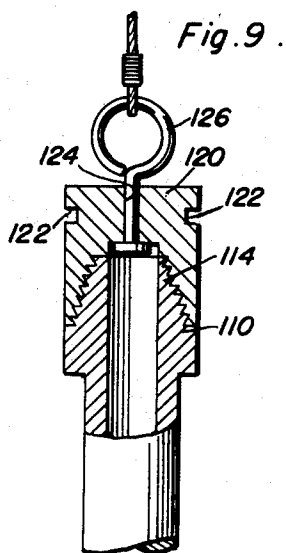


Fig. 9.

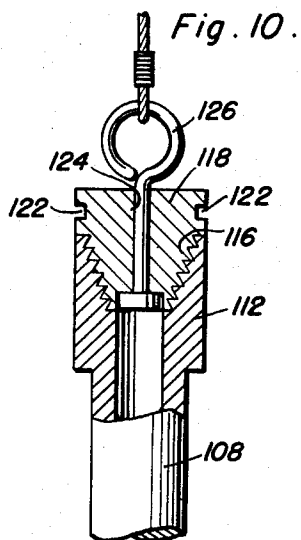


Fig. 10.

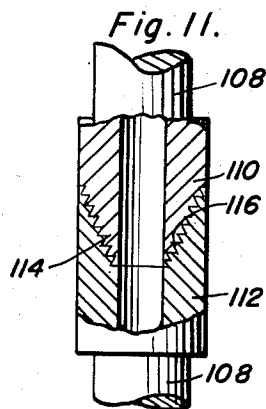


Fig. 11.

Frank D. DeJarnett
INVENTOR.

BY *Charles A. O'Brien*
and Harvey B. Jackson
Attorneys

June 23, 1953

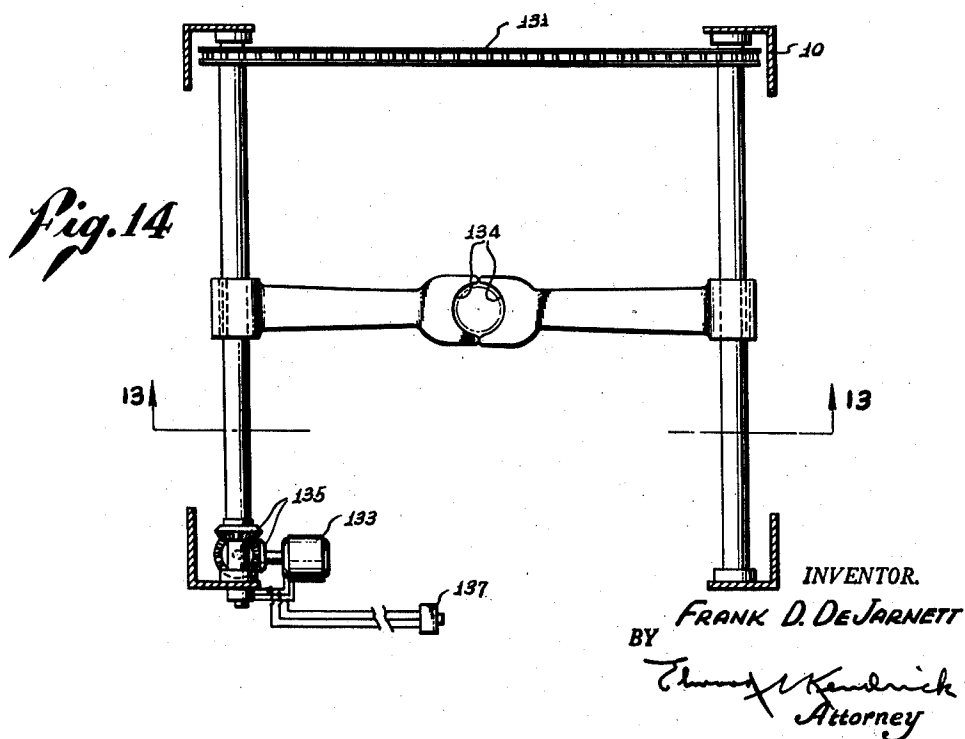
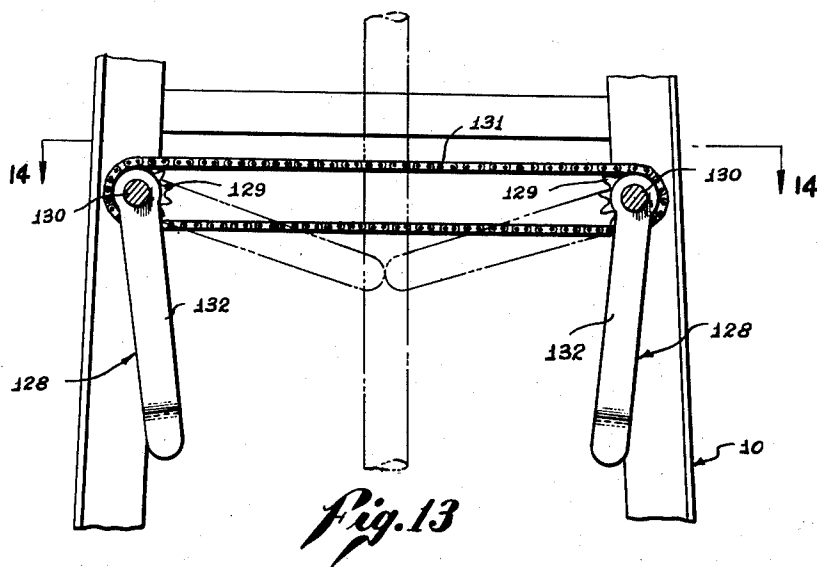
F. D. DE JARNETT

2,643,005

WELL PIPE HANDLING EQUIPMENT

Filed March 12, 1948

7 Sheets-Sheet 7



UNITED STATES PATENT OFFICE

2,643,005

WELL PIPE HANDLING EQUIPMENT

Frank D. De Jarnett, Long Beach, Calif., assignor
of one-half to Paul A. Medearis, Torrance,
Calif.

Application March 12, 1948, Serial No. 14,563

9 Claims. (Cl. 214-2.5)

1

This invention relates to well pipe handling equipment and more particularly to the handling of drill pipe.

In the conventional handling of stands of well pipe, particularly drill pipe, much time is consumed in idle use of the pipe elevating equipment owing to the fact that it has heretofore been employed to hold a stand of pipe in raised position while the latter is being coupled to or uncoupled from a string of pipe already in the well hole. Moreover, the pipe elevating equipment has also been employed for the purpose of transferring pipe stands to and from the pipe rack and hence, long periods of time have frequently elapsed while the elevator was being so used. This has resulted in serious loss of man hours since a crew is normally kept waiting at the foot of the drill rig or derrick for the return of the elevator to lowered position for coupling to the string of pipe yet in the well hole.

I am well aware that prior efforts have been made to overcome these difficulties, particularly as exemplified in Patent No. 2,226,947, issued December 31, 1940, to Waldo Sheldon, and while the similarity of purpose of the Sheldon patent is recognized, it falls short of accomplishing the complete and substantially automatic handling of stands of well pipe, and of effecting the desired economies.

The primary object of this invention is to effect economies in both the time and labor expended in introducing a stand of well pipe, such as drill pipe, into a well, or extracting a stand of such pipe from a well.

Another object of the invention is to assure controlled descent of the pipe elevator so as to avoid conflict with a stand of pipe, while the latter is being connected or disconnected to a string of pipe already in the well.

A further object is to positively hold a stand of well pipe in alignment with a well hole while it is being connected or disconnected to the string of pipe contained within the well hole.

A still further object is to transfer an elevated stand of pipe toward or away from axial alignment with the well hole while the elevator is being lowered and to avoid conflict of the elevator with the pipe coupling or uncoupling operations.

The above and other objects may be attained by employing this invention which embodies among its features a pair of upper and lower carriages movable horizontally in unison above a well hole, a vertical guide cable coupled to the two carriages for movement therewith, a well pipe elevator supported by the upper carriage and

2

guided by the guide cable to move longitudinally thereof.

Cooperating features included in the above combination are a transfer means supported between the cranes to move a stand of well pipe into or out of alignment with the well hole and a well pipe stabilizer movable into and out of a position above the well hole to hold a stand of well pipe in alignment with the well hole during its coupling or uncoupling with relation to a string of pipe within the well hole.

In the drawings:

Figure 1 is a side view of a drill rig or derrick equipped with this improved well pipe handling apparatus, and showing a stand of drill pipe in elevated position with the elevator disconnected therefrom and the stabilizer in pipe engaging position;

Figure 2 is a view similar to Figure 1, illustrating the elevator in the process of being lowered and the transfer mechanism coupled to the upper end of the stand of drill pipe ready to move it to one side of the well hole;

Figure 3 is a view similar to Figures 1 and 2, showing the previously disconnected and elevated stand of pipe moved by the transfer mechanism to one side of the well hole and the elevator connected to the upper end of a string of pipe within the well, ready to elevate a stand of pipe therefrom;

Figure 4 is a fragmentary enlarged view of the elevator and guide cable therefor;

Figure 5 is a plan view of one of the horizontally movable cranes;

Figure 6 is a side view of the crane illustrated in Figure 5;

Figure 7 is a longitudinal sectional view taken substantially along the line 7-7 of Figure 5;

Figure 8 is a transverse sectional view taken substantially along the lines 8-8 of Figure 5;

Figure 9 is an enlarged fragmentary sectional view of the upper end of a length of drill pipe showing one type of coupler for coupling either the elevator or the transfer means thereto;

Figure 10 is a view similar to Figure 9, illustrating a modified form of coupler;

Figure 11 is a fragmentary side view of a typical drill pipe coupling, showing portions thereof in section more clearly to illustrate the details of construction;

Figure 12 is a wiring diagram;

Fig. 13 is a vertical sectional view taken on a line 13-13 of Fig. 14 showing the construction of a pair of stabilizers included in the invention; and

Fig. 14 is a horizontal sectional view taken on

a line 14—14 showing the two stabilizers engaging a stand of pipe.

Referring to the drawings in detail, a conventional drill rig or derrick is designated generally 10 and supports at its upper end a horizontally movable crane designated generally 12. This crane is best illustrated in Figures 5 through 8 inclusive and comprises a bed frame 14 which is adapted to be mounted atop the derrick 10 and supports a pair of spaced parallel horizontally disposed rails 16. Extending upwardly from the rails 16 adjacent opposite ends are transversely extending stops 18 which also form supports for bearings 20 in which opposite ends of screws 22 are journaled. These screws extend longitudinally of the frame 14 above the rails 16 and are equipped with drive sprockets 24 over which is trained an endless chain 26. Suitable buffer springs 28 are supported on the opposed faces of the stops 18 for a purpose to be more fully hereinafter explained. Mounted on an extension 30 of the frame 14 is a suitable reversible motor 32, the drive shaft 34 of which has driving connection with one of the sprockets 24 and it will thus be seen that when the motor 32 is energized, the sprockets 24 will be driven in unison.

A carriage 36 is mounted on flanged wheels 38 which run on the tracks 16, and depending from the carriage 36 are spaced arms 40 carrying at their lower ends stabilizing rollers 42 which are adapted to engage under outwardly extending flanges 44 formed on the tracks 16, to prevent the carriage 36 from jumping the tracks or rails 16. Extending laterally from opposite sides of the carriage 36 are nuts 46 which are provided with internally threaded bores through which the screws 22 operate. It will thus be seen that as the motor 32 is set into operation, and the screws 22 are rotated, the carriage 36 will be moved longitudinally of the frame 14. It will be understood of course, that the motor 32 is of the reversible type so that the carriage 36 may be moved forwardly or backwardly along the tracks 16. Extending transversely of the carriage 36 are spaced parallel supporting bars 50 between which cable guiding sheaves 52 are rotatably supported. Extending transversely of the carriage 36 in spaced parallel relation to the cross-bars 50 is a cross-bar 54 which forms a support for the elevator guide 56.

As illustrated in Figure 7, the cross-bar 54 has formed in the upper and lower flanges thereof aligning openings 58 through which plunger rods 60 are mounted to slide. These plunger rods are provided adjacent their lower ends with yokes 62 having grooved supporting members comprising pulleys 64 mounted therein around which passes a cable forming the elevator guide 56. The rods 60 project above the top of the carriage 36 and are equipped with heads 66 which form stops for the upper ends of compression springs 68, the lower ends of which bear against the top of the cross-bar 54, yieldingly to urge the yokes 62 upward so as to place the cable 56 under tension.

Means generally 70 to cooperate with the crane 12 is supported adjacent the lower end of the drill rig or derrick 10 and is provided with a horizontally movable carriage 72 to one end of which is coupled a pair of spaced retractile coil springs 74 to which are coupled the lower ends of runs of the cable forming the elevator guide. The carriage 72 is movable on suitable supporting rollers 76 and carries hold-down rollers 78 which are adapted to engage the underside of a frame 80. Drive screws 82 are arranged longitudinally

of the frame 80 for engagement with suitable nuts (not shown) on the carriage 72 so that when the screws 72 are rotated, the carriage will be moved toward or away from the vertical axis of the drill rig or derrick 10. The suitable drive motor 82 of the reversible type is coupled to the screws 84 so that when the motor is energized, the screws will be rotated to advance or retract the carriage 72 relative to the vertical axis of the drill rig or derrick 10. The motors 32 and 84 are coupled in a conventional manner through a suitable reversing switch 86 to a suitable source of power so that they may be simultaneously energized to cause the carriages 36 and 72 to move in unison toward or away from the axis of the drill rig or derrick 10 and thus preserve the opposite runs of the cables forming the elevator guide 56 in a vertical position.

Mounted for vertical sliding movement on the two spaced parallel runs of the cables forming the elevator guide 56 are two alignment means 88 respectively carried by a pipe elevator generally designated A. A pipe elevator A includes a block of carrying hoist sheaves 90 and a suitable coupling 92 by means of which the elevator may be detachably connected to a stand of drill pipe or well pipe. Hoist cables 94 are trained over the sheaves 90 and the sheaves 52, and one end of said hoist cable is connected to a conventional winding drum 95 mounted adjacent the floor of the drill rig or derrick 10, while the opposite end of the cable is suitably anchored preferably to the elevator A so that as the cable is wound upon the drum 95, the elevator will be raised, and when the cable is unwound from the drum, the elevator will be lowered. A suitable reversible motor 96 is coupled through the medium of a conventional gear train 98 to the drum 95, to cause the latter to be driven so as to wind the cable 94 onto the drum 95 or unwind it therefrom.

The coupling 92 carried by the elevator A which is suspended on the cable 94 comprises a substantially semicircular jaw member 100 to which is pivoted a cooperating jaw member 102 having a clasp 104 which is adapted to hold the parts detachably together about the upper end of a stand of pipe being extracted from or introduced into the well. Such a stand of pipe is designated 106 and may consist of a group of pipe lengths 108 which are equipped with conventional coupling heads 110 and 112. The heads 110 are equipped with externally screw-threaded axial bosses 114 which are adapted to be received in internally screw-threaded axial sockets 160 in the heads 112 for the purpose of joining the pipe lengths together in axial alignment.

In lieu of the sleeve-type coupling 100 previously described, I may find it advantageous to employ the plug-type coupling 118 illustrated in Figure 10, which is equipped with an externally screw-threaded boss to fit into the internally screw-threaded socket 112 of a pipe length or when the coupling 110 is presented upwardly, I may employ the socket-type coupling 120 illustrated in Figure 9 which is provided with an axial internally screw-threaded socket for the reception of the externally screw-threaded boss 114 on the coupling 110 of the uppermost length of pipe. Both the plug-type coupling 118 and the socket-type coupling 120 are equipped with spaced radial recesses 122 for the reception of a suitable spanner by which the coupling may be connected to the pipe length. Also, each such coupling is equipped with an axial opening 124

5

in which an eye 126 is swivelly fitted for connection to the cable. It will thus be seen that the couplings may be rotated axially when being connected or disconnected to a stand of well pipe without imparting rotary motion to the supporting cable.

In order to hold the stand of pipe in proper vertical position for connection to or disconnection from a string of pipe in a well hole, I provide intermediate the upper and lower ends of the drill rig or derrick 10 one or more well pipe stabilizers designated generally 128. As best shown in Figs. 13 and 14, each such stabilizer comprises a horizontally extending shaft or bar 130 upon which is pivotally supported a stabilizer arm 132 for movement in a vertical arc toward or away from the longitudinal axis of the well hole over which the drill rig or derrick 10 is located. The free end of the arm 132 is provided with an arcuate recess 134 which opens through the end of the arm and is adapted to receive a stand of pipe as is suggested in Figures 1 and 2 to hold the pipe in proper alignment with the axis of the well hole. During the hoisting or lowering of a stand of pipe, the stabilizers 128 are moved out of pipe contacting position by swinging them through a vertical arc about the axis of the shaft 130 as suggested in Figure 3, but when a stand of pipe is to be coupled to or uncoupled from a string of pipe in the well hole, the stabilizer or stabilizers are moved to hold the pipe axially of the well hole, as shown in Fig. 14.

For operating the two stabilizer arms 132 in synchronization each of the two shafts 130 may have keyed thereto a suitable sprocket wheel 129 and the two sprocket wheels may be operatively interconnected by suitable sprocket chain 131. The two stabilizer arms 132 may be power-actuated by a suitable reversible motor 133. The motor 133 is operatively connected to one of the shafts 130 through means including bevel gears 135, the motor being controlled by a suitable switch 137.

In order to transfer a stand of pipe which has been elevated and disconnected from the string of pipe in the well hole, or in order to transfer a stand of pipe from the pipe rack at one side of the drill rig or derrick 10 into a position to align with the well hole, I provide a transfer crane designated generally 136 which comprises a bed frame 138 which is supported on the drill rig or derrick 10 adjacent its upper end, and on the side opposite the elevator guide 56. A carriage 140 is movable on the bed frame 138 toward and away from the axis of the well hole through the medium of a suitable drive motor 142, and carried by the carriage 140 is a winding drum 144 to which one end of a suspension cable 146 is coupled. The opposite end of the cable is equipped with a suitable pipe engaging coupling 148 of the type illustrated in Figure 4. The drive motor 142 is coupled through a suitable control switch 150 near the floor of the drill rig or derrick 10 for manipulation by an attendant. It is to be understood that the carriage 140 moves along the bed frame 138 for a distance sufficient to cause the cable 146 to move a stand of pipe into alignment with the axis of the well hole, and with the reversal of the drive motor 142, the carriage 140 will return to a position adjacent the side of the drill rig or derrick 10 remote from the elevator guide 56 for the stacking or racking of the stands of pipe.

In use, the carriage 36 of the crane 12 and the lower cooperating carriage 72 are mounted

6

in the derrick or drill rig 10, as suggested in Figures 1 through 3 inclusive and when it is desired to extract a stand of pipe from a well hole, the elevator A is lowered as illustrated in Figure 3, so that the clamp 92 or an equivalent coupling such as those illustrated in Figures 9 and 10 may be connected to the upper end of the string of pipe in the well hole. In this position of course, the carriages 36 and 72 are advanced toward the axis of the well hole, and upon operating the motor 96 to wind the cable 94 on the drum 95, the two alignment means 88 of the elevator A will move upwardly along the elevator guide cables 56, respectively as the elevator carries the string of pipe upward. When a sufficient amount of pipe has been extracted from the well hole, the stabilizer 128 is swung into a position partially to embrace the pipe string near its upper end as suggested in Figures 1 and 2, and the coupling 92 is disengaged from the pipe. In this position, the lengths of pipe which have been extracted from the well will be held in vertical alignment with the pipe string remaining in the well, and the uppermost lengths of pipe may be uncoupled from the pipe string within the well adjacent the floor of the derrick or rig. The carriage 140 is next moved to bring the clamp 148 carried by the cable 146 into engagement with the upper end of the stand of pipe which has been or is to be uncoupled from the string remaining in the well, and upon lifting the pipe stand, and reversing the motor 142, it will be evident that the uncoupled stand of pipe may be moved to the side of the drill rig or derrick 10 remote from the elevator guide 56. Obviously, during the period that the pipe stand is being uncoupled from the string of pipe which remains in the well, and the transfer of the stand of pipe to the rack is taking place, the cranes 12 and 70 are moved laterally away from the axis of the well hole and the elevator A is moved downwardly, so that by the time the first stand of pipe has been uncoupled and transferred to the pipe rack, the elevator A and the attendant pipe engagement mechanism may be lowered ready for engagement of the coupling 92 with the pipe string. In this way, much time is saved in extracting well or drill pipe from a well hole. Obviously, in entering the pipe in the well hole, the clamp 148 or equivalent pipe engaging means such as shown in Figs. 9 and 10 is engaged with a stand of pipe standing in the pipe rack and the carriage 140 on the crane 136 then advances the pipe toward the axis of the well hole, after which the stabilizer 128 is moved to engage the pipe stand and hold it in alignment with the well hole while it is being coupled to a string of pipe that has already been entered into the well hole. The clamp 148 is disengaged from the stand of pipe, and the elevator A is then moved laterally toward the axis of the well hole by the lateral movement in unison of the upper carriage 36 and the lower carriage 72 so that the clamp 92 may be engaged with the stand of pipe adjacent its upper end. The elevator A is held in alignment with the two carriages during this lateral movement by engagement of the two alignment means 88 with the two runs of the guide cable extending vertically between the two carriages. The stabilizer 128 is then moved out of engagement with the stand of pipe and the latter is lowered into the well hole by moving the elevator carriage A downwardly. The guide pulley 56 will serve to hold the elevator A and the clamp 92 in proper position throughout both the raising and lower-

ing of the pipe stand with relation to the well hole and owing to the fact that the elevator is guided throughout its entire length of travel, it is obvious that it may be raised or lowered without in any way interfering with the coupling or uncoupling of the stand of pipe and its transfer to or from the pipe rack.

While in the foregoing there has been shown and described the preferred embodiment of this invention it is to be understood that minor changes in the details of construction, combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as claimed.

Having described the invention what is claimed as new is:

1. In apparatus for handling pipe at a well hole, the combination of: an elevator to raise and lower the pipe; means to shift said elevator laterally into and out of alignment with the well hole so that the elevator may operate in a cycle having two stages, in one of which stages the elevator moves in one vertical direction in engagement with pipe extending into the well hole, in the other of which stages the elevator moves in the other vertical direction out of alignment with the well hole and free from the pipe; a stabilizer to temporarily engage a stand of pipe above the well hole to maintain the stand of pipe upright in alignment with the hole; and a transfer crane to reciprocate between the upright position of the pipe in alignment with the hole and a pipe storage zone out of alignment with the hole, whereby the elevator and crane may operate simultaneously in engagement with successive stands of pipe with the elevator and crane alternately moving into alignment with the hole and with said stabilizer maintaining the successive stands of pipe upright in alignment with the hole in the periods between engagement of the pipe by the elevator and engagement of the pipe by the crane.

2. An apparatus for handling pipe as set forth in claim 1 which includes means to guide said elevator in the two stages of its operating cycle.

3. An apparatus for handling pipe as set forth in claim 2 in which said guide means extend substantially vertically and is moved laterally by said shifting means.

4. In apparatus for handling pipe at a well hole, the combination of: a pair of vertically spaced carriages movable horizontally; a vertical guide means connected at its opposite ends to said carriages respectively for movement therewith; means to move said two carriages synchronously to shift said guide means laterally; and a pipe elevator in guiding engagement with said guide means.

5. Apparatus for handling pipe as set forth in claim 4 in which said elevator is supported by said upper carriage.

6. Apparatus for handling pipe as set forth in claim 5 in which said guide means comprises a pair of spaced parallel cables in guiding engagement with two spaced points on said pipe elevator.

7. In apparatus for handling pipe at a well hole, the combination of: an elevator to raise and lower the pipe; an upper laterally movable carriage supporting said elevator; means to shift said carriage to move said elevator laterally into and out of alignment with the well hole so that the elevator may operate in a cycle having two stages, in one of which stages the elevator moves in one vertical direction in engagement with the pipe extending into the well hole, in the other of which stages the elevator moves in the other vertical direction out of alignment with the well hole and free from the pipe; means carried by said carriage to guide said elevator in the two stages of its operating cycle, said guide means being substantially vertical; and a transfer crane to reciprocate between the upright position of the pipe in alignment with the hole and a pipe storage zone out of alignment with the hole, whereby the elevator and crane may operate simultaneously in engagement with successive stands of pipe, with the elevator and crane alternately moving into alignment with the hole and with said stabilizer maintaining the successive stands of pipe upright in alignment with the hole in the periods between engagement of the pipe by the elevator and engagement of the pipe by the crane.

8. An apparatus for handling pipe as set forth in claim 7 which includes a lower laterally removable carriage synchronized with said upper carriage and connected to the lower end of said guide means.

9. An apparatus for handling pipe as set forth in claim 8 in which said guide means comprises two spaced parallel guide members engaged by the elevator.

FRANK D. DE JARNETT.

References Cited in the file of this patent UNITED STATES PATENTS

Number	Name	Date
Re. 9,790	Winkless	July 5, 1881
1,083,341	Sousae et al.	Jan. 6, 1914
1,138,322	Santrock	May 4, 1915
1,540,245	Bergsten	June 2, 1925
1,634,859	Tibbetts	July 5, 1927
1,956,147	Carpenter	Apr. 24, 1934
2,096,600	Vandervoort	Oct. 19, 1937
2,187,392	Chappell	Jan. 16, 1940
2,226,947	Sheldon	Dec. 31, 1940
2,416,815	Calhoun	Mar. 4, 1947