March 17, 1953 S. J. TUCKER 2,631,741

APPARATUS FOR HANDLING DRILL PIPES

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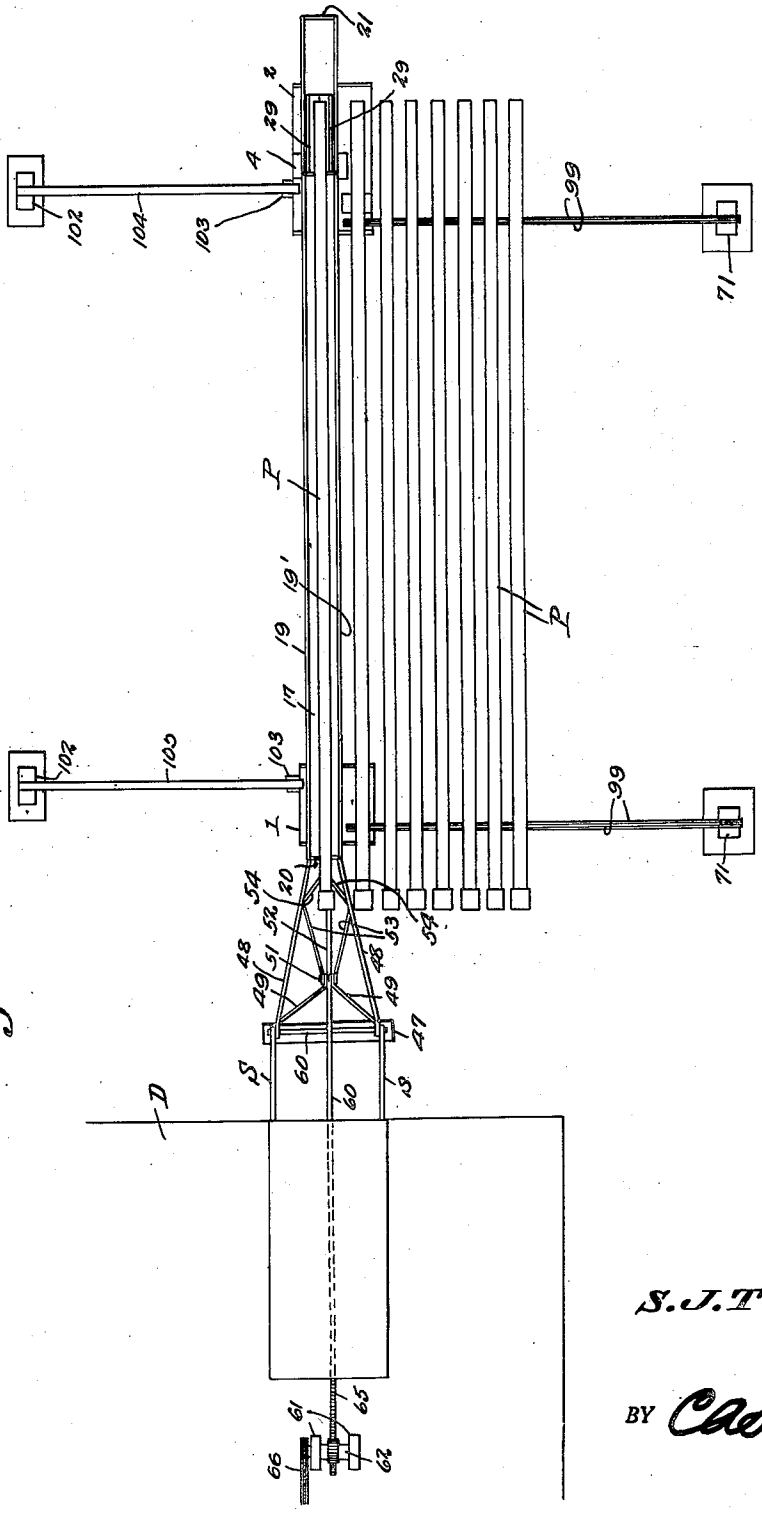

Fig. 1.

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APPARATUS FOR HANDLING DRILL PIPES

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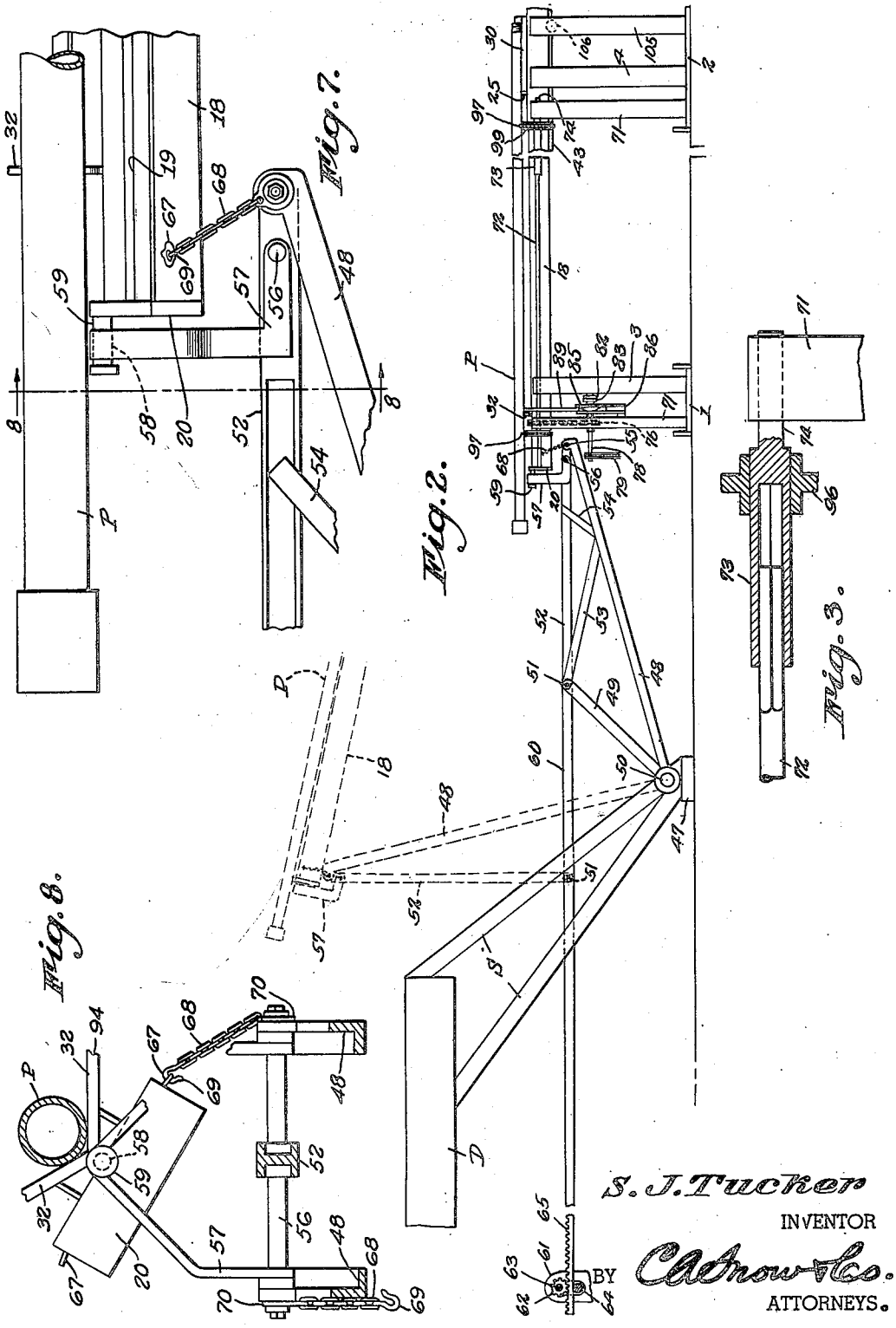

Fig. 7.

Fig. 2.

Fig. 3.

Fig. 8.

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APPARATUS FOR HANDLING DRILL PIPES

Filed June 29, 1950 5 Sheets-Sheet 3

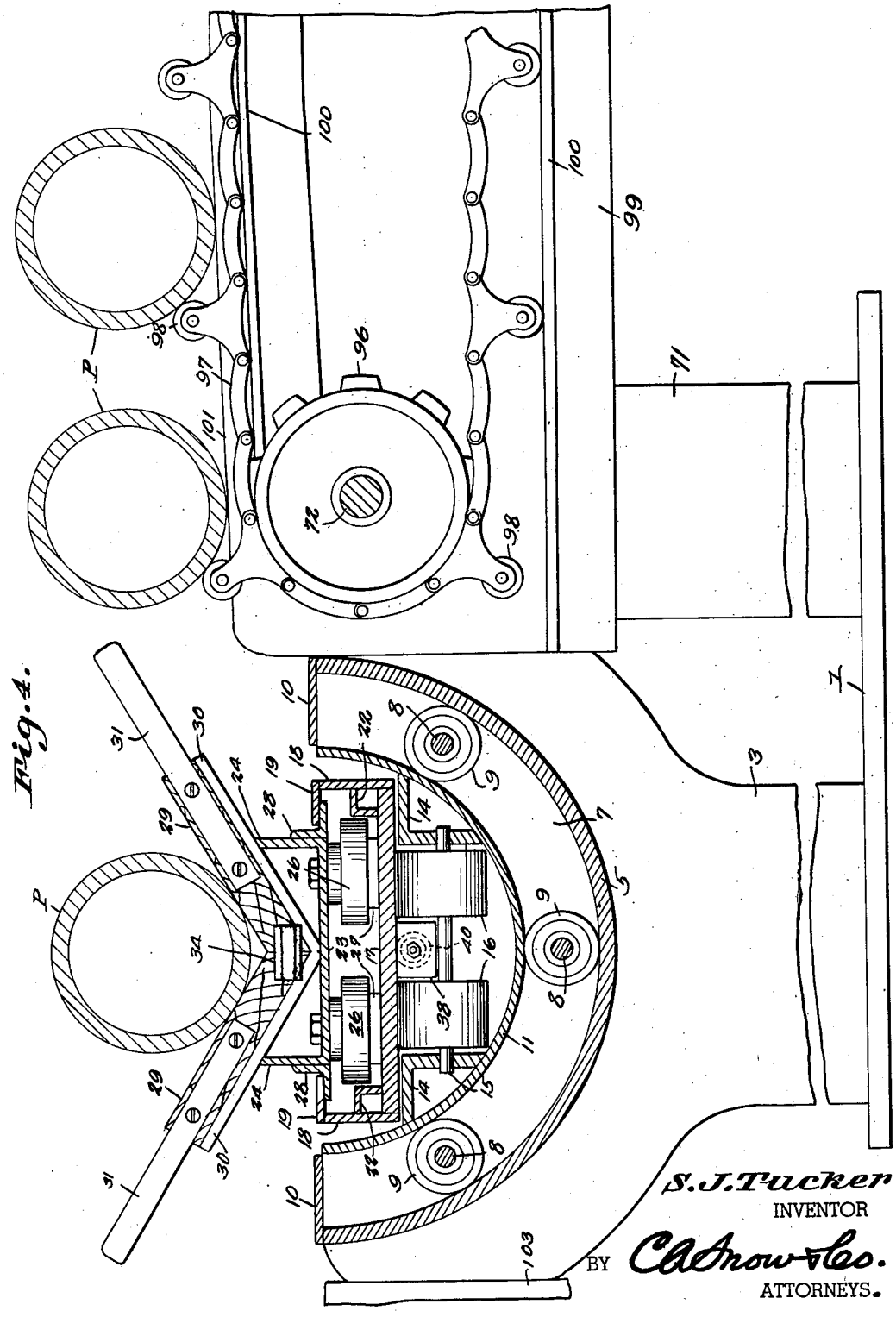

Fig. 4.

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APPARATUS FOR HANDLING DRILL PIPES

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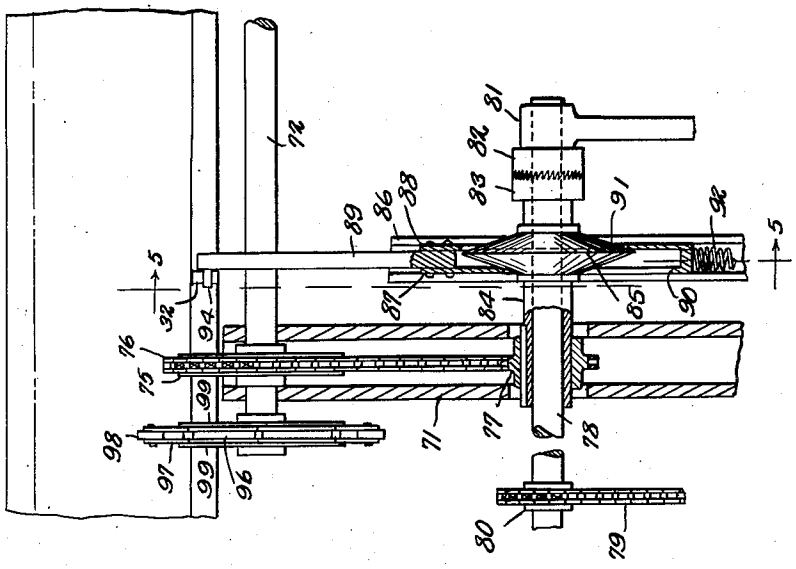

Fig. 6

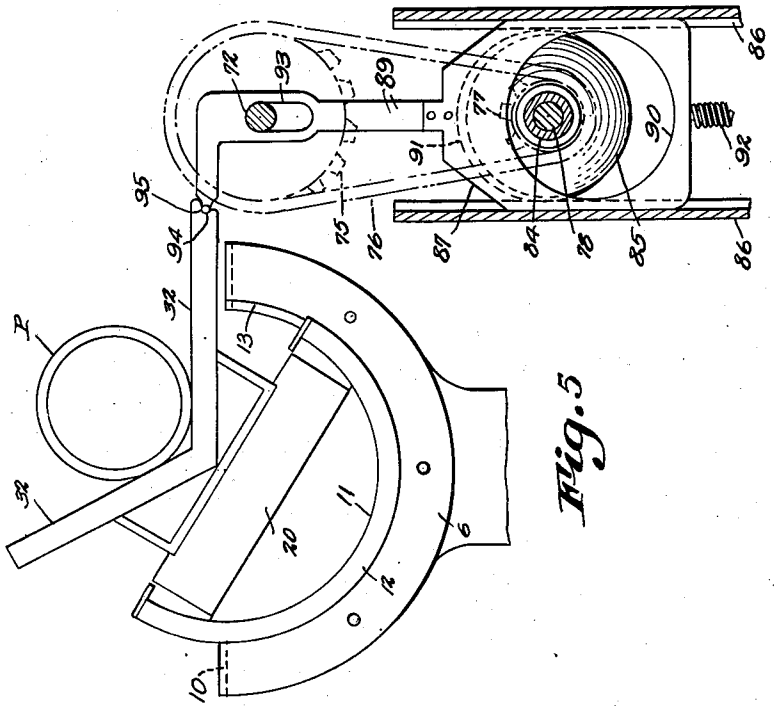

Fig. 5

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APPARATUS FOR HANDLING DRILL PIPES

Filed June 29, 1950 5 Sheets-Sheet 5

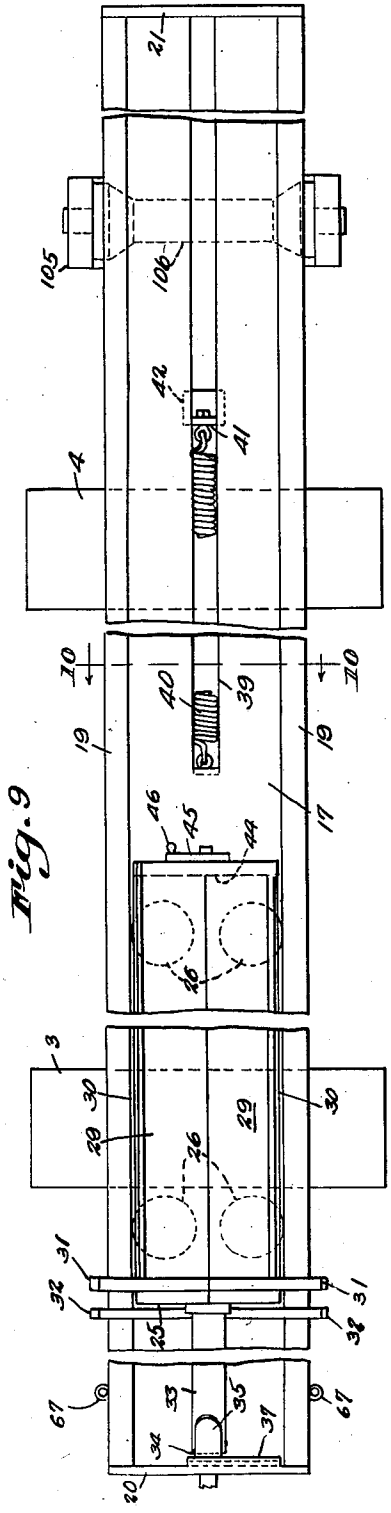

Fig. 9

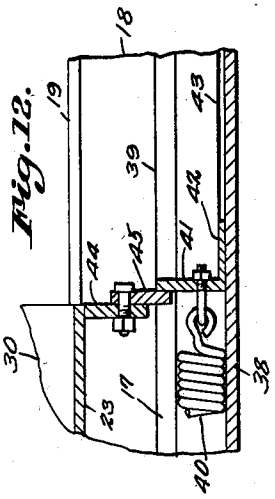

Fig. 12.

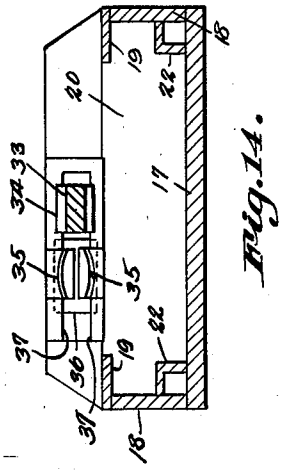

Fig. 14.

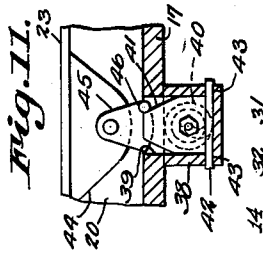

Fig. 11.

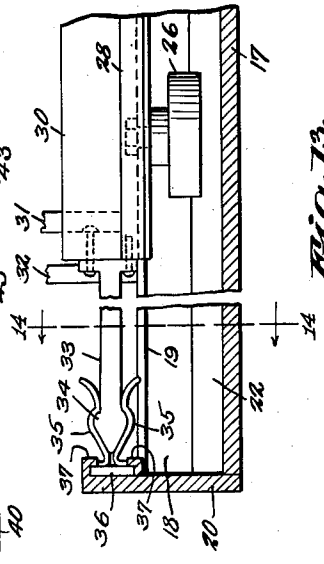

Fig. 13.

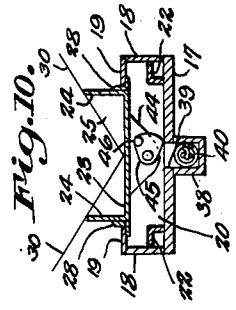

Fig. 10.

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UNITED STATES PATENT OFFICE

2,631,741

APPARATUS FOR HANDLING DRILL PIPES

Samuel Joseph Tucker, Mount Carmel, Ill.

Application June 29, 1950, Serial No. 171,007

10 Claims. (Cl. 214—2.5)

1

This invention relates to apparatus for handling drill pipe such as the pipe sections used in the drilling of oil wells.

Oil well drill pipe sections are of considerable length and the handling of such sections represents a distinct problem in the industry. Such sections are threaded together end to end and lowered into a well, and it will be readily appreciated that the movement of a section between a vertical elevated position in which it is to be threaded to or unthreaded from another section, and a horizontal position some distance away on a pipe rack or the like, involves the attention and the labor of a number of workers both on the ground and on the derrick.

The present invention has as its broad purpose the elimination or the substantial reduction of this problem, through the provision of apparatus specially designed for the automatic movement, with but a minimum of attention by workers, of pipe sections between one position in which they are disposed upon a rack on the ground, and another position in which they are elevated and swung away from said rack to a location over a derrick floor.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts, hereinafter more fully described and pointed out in the claims, it being understood that changes may be made in the construction and arrangement of parts without departing from the spirit of the invention.

Referring to the drawings

Fig. 1 is a top plan view of apparatus formed in accordance with the present invention.

Fig. 2 is a side elevation, the dotted lines indicating the upwardly swung position of the pipe elevating portions of the apparatus.

Fig. 3 is an enlarged fragmentary longitudinal section through one end of a conveyor drive shaft.

Fig. 4 is an enlarged transverse sectional view through the front portion of the carriage frame, carriage, and conveyor.

Fig. 5 is a transverse section through a clutch conveyor control mechanism taken on line 5—5 of Fig. 6.

Fig. 6 is a longitudinal vertical section through said conveyor control mechanism.

Fig. 7 is a fragmentary side elevation of the hoist and carriage in the lowered positions thereof.

Fig. 8 is a transverse section through said hoist taken on line 8—8 of Fig. 7.

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Fig. 9 is a top plan view, portions being broken away, of said carriage and carrier.

Fig. 10 is a section on line 10—10 of Fig. 9, and illustrating a carrier return mechanism in an inoperative position.

Fig. 11 is a fragmentary section across the carriage showing said carrier return mechanism in engaged or operative position.

Fig. 12 is a fragmentary longitudinal section through said engaged carrier return mechanism.

Fig. 13 is a longitudinal section through the front end of the carriage and illustrating a carrier latch.

Fig. 14 is a section on line 14—14 of Fig. 13.

Referring to the drawings in detail, the entire apparatus comprises three cooperating sections. One of these is the carriage section. This supports a piece of pipe during its travel to or from its elevated and its racked positions respectively. A second section is the hoist section which moves the carriage section and a supported pipe during said travel. The third section is the carriage loading and unloading section, used to position a pipe on the carriage section or unload it from said carriage section.

Each of these three sections breaks down into a number of component assemblies. On the carriage section these comprise a frame, a bed, a carriage, a carrier, a front end latch, and a carrier return assembly.

The hoist section comprises a boom, and a boom operator assembly.

The loading section comprises a carriage tilt, a conveyor drive, a conveyor clutch control, a conveyor, and an off loader assembly.

Each of these sections and its component assemblies will be described in turn.

Carriage section

Considering first the frame, this assembly supports all the other parts of the carriage section and includes a plurality of spaced apart flat anchored bases or pedestals. In the present instance two of these are illustrated and are designated 1 and 2 respectively. It may be noted, in this connection, that the frame construction is perhaps best illustrated in Figs. 2 and 4.

Each of the pedestals supports an upstanding standard 3 and 4 the upper ends of which are formed as arcuate U-shaped yokes, as best seen from Fig. 4.

The standards are rigidly mounted on the pedestals in any suitable manner, with the yokes of said standards being aligned longitudinally of the carriage section.

Considering now the bed assembly, the purpose of this assembly is to support a long pipe carriage in a horizontal position for transverse tilting or rocking, and also for movement longitudinally of the frame. Accordingly, I provide on each standard an arcuately depressed plate 5, and to the longitudinal edges of each of these plates I rigidly secure vertical arcuately depressed bearing plates 6 and 7 (see Figs. 4 and 5).

Continuing with the bed assembly, a plurality of rollers is provided, the opposite ends of each roller being journaled in the respective plates 6 and 7. To this end, each roller is provided at opposite ends with gudgeons 8 journaled in suitable bearing openings formed in said bearing plates, the rollers being designated 9. Again, it is believed that this construction is best seen from Fig. 4.

The opposite ends of the area of U-shaped cross section in which said rollers are journaled are closed by end plates 10.

Continuing further with the bed assembly, on each set of rollers such as those shown in Fig. 4, an arcuately depressed cradle 11 is mounted for rocking movement transversely of the frame and bed. To hold each cradle in its assigned path during said rocking movement, a longitudinal depending flange 12 (Fig. 5) is formed on each of the opposite longitudinal edges of each cradle, this engaging under and being in slidable contact with an outturned longitudinal flange 13 formed on the top edge of each of the bearing plates 6 and 7.

Referring now to Fig. 4, on each cradle 11 I provide angular bearing brackets 14 spaced transversely of the frame and bed assemblies, these having registering bearing openings receiving the opposite ends of axles 15 on which are rotatable rollers 16.

Considering now the carriage assembly, this is supported upon the longitudinally spaced pairs of rollers 16 of the bed, and thus rolls in the direction of its own length, that is, longitudinally of the frame and bed, on said rollers. At the same time this carriage assembly is mounted for transverse tilting or rocking, this being by reason of the transversely rockable cradles 11 which bodily tilt transversely of the bed said pairs of rollers 16.

The carriage assembly includes an elongated bottom plate 17 rollably supported upon said pairs of rollers 16. It may be noted, in this connection, that the construction of the carriage is perhaps best illustrated in detail in Figs. 5 and 9, while overall views thereof are believed best provided in Figs. 1 and 2.

The length of a carriage may vary, but normally, a piece of oil well drill pipe P is roughly 30 feet long and the carriage would be of proportionate length.

In any event, rigidly secured to and upstanding from the opposite longitudinal edges of the bottom plate 17 are the carriage side plates 18, imparting to the carriage throughout its length a U-shaped cross sectional shape. Inturned longitudinal flanges 19 are provided on the upper edges of said side plates 18 to provide guides for a carrier to be described hereafter, and which is shiftable longitudinally of the carriage.

The front end of the carriage is closed by a front end plate 20, while the rear end, that is the right hand end in Fig. 1 is closed by a rear end plate 21.

Extending from end to end of the carriage and also constituting guides for keeping the carrier in line, are the angle irons 22 mounted rigidly at opposite sides of the carriage, below the respective guide flanges 19.

Considering now the carrier, this is for the purpose of supporting the rear end, that is the right hand end as seen in Figs. 1 and 2, of a piece of pipe P positioned upon the carriage. As will be apparent hereinafter, the front end of said pipe is supported directly upon the front portion of the carriage. When, however, the front end of the pipe is lifted off the front end of the carriage, the rear end has to be supported for movement longitudinally of the carriage either from front to rear of the carriage or from rear to front, depending on whether the pipe is being loaded upon or being unloaded from said carriage.

The carrier is a relatively short rollably mounted assembly resembling a dolly in general appearance and characteristics, and is believed best seen from Figs. 4 and 9. It comprises a flat bottom plate 23 rigid with upstanding side plates 24 so that the bottom portion of the carrier is of U-shaped cross-sectional shape. The front end of this bottom portion is closed by a front end plate 25. The back end can be left open.

Mounted upon the underside of the bottom plate 23 are horizontally rotatable rollers 26 these being arranged in pairs spaced longitudinally of said carrier and being rollable upon the angles 22.

The carrier also has other pairs of rollers 27 mounted upon the underside of said bottom plate 23, these being mounted for vertical rotation so as to roll upon the bottom plate 17 of the carriage. Both pairs of rollers 26 and 27 cooperate to mount the carrier for rolling movement from end to end of the elongated carriage, and cooperate with engaged portions of the carriage to hold the carrier against undesirable transverse shifting of the carriage during said longitudinal rolling movement.

The carrier has longitudinal outwardly extended guide flanges 28 engaging under the guide flanges 19 of the carriage (see Fig. 4), and these prevent the carrier from lifting off the carriage.

To support the rear end of the pipe P upon the carrier, I provide a V-shaped pipe support on the carrier comprising a plate 30 bent along its longitudinal center line into the shape of a wide V, there being rigidly secured to said plate wooden liners 29. The wooden liners are provided to prevent scarring or mutilation of the threads provided on the rear end of the pipe P.

So as to preclude the possibility of the pipe slipping laterally from the carrier, extension arms 31 are secured to the members 29.

At this point, and reverting for the moment to the carriage assembly previously described, extension arms 32 disposed in a V arrangement are provided at the front of said carriage to hold the front end of the pipe P against lateral shifting off the carriage and also for operating a conveyor control in a manner to be made apparent.

Referring now to the front end latch assembly this is shown in Figs. 9, 13 and 14. This is an assembly that releasably engages the carrier at the front end of the carriage, for releasably holding the carrier at said front end of the carriage on occasions when pipe is being taken off a derrick D. The front end latch is not, however, used when pipe is being oppositely handled, that is, when it is being moved from a rack up to the derrick.

Considering the construction of the front end latch, a forwardly extended nose pin 33 is fixedly secured to the front plate 25, and at its free end is formed with an enlargement 34. A pair

of spring arms 35 are secured to a slide 36, slidably mounted between guide flanges 37 mounted upon the inner surface of the front end plate 20 of the carriage. This permits the spring arms 35 to be slidably adjusted to one position in which they releasably grip the enlargement 34, this position being seen in Fig. 9. Alternatively, the slide and the spring arms can be shifted to another position, seen in Fig. 14, in which they cannot under any circumstances engage the nose pin.

When pipe is being loaded from the rack to the derrick, the spring arms will have previously been adjusted to the position of Fig. 14. Therefore, when the pipe is lifted off the carriage, the rear end of the pipe pulls the carrier to the front end of the carriage, seen as the left hand end in Fig. 9. When the pipe is completely removed, it is desirable that the carrier gravitate to the right hand end of the carriage seen in Fig. 9, so that it will be in position to receive the rear or right hand end of the next piece of pipe to be loaded to the derrick. For this reason, the latch and nose pin are kept from engaging during this particular operation.

When, however, the pipe is to be loaded from the derrick to the rack, the carrier should be at the front end of the carriage at the time the pipe is dropped from the derrick toward the carriage. Thus, the rear end of the pipe will automatically be supported upon the carrier.

It is during this particular operation that the spring arms are positioned where they will engage the nose pin 33, so as to hold the carrier against gravitation from the elevated carriage.

However, again referring to the operation of loading pipe from the derrick to the rack, it is necessary to provide a means for positioning the carrier at the front or left hand end of the carriage preparatory to receiving pipe that is being loaded from the derrick. To this end, I provide a carrier return assembly which will act to return automatically the carrier from the right to the left hand end of the carriage as seen in Fig. 9, each time a piece of pipe is unloaded from the carriage and the carriage is to be returned for another piece of pipe to be taken off the derrick.

To this end, the carrier return assembly is provided and it is believed that this is best illustrated in Figs. 9 through 12. This assembly includes an elongated spring housing 38 mounted upon the underside of the bottom plate 17 of the carriage and extending from the rear or right hand end of the carriage as seen in Fig. 9 toward the other end of the carriage, but terminating a substantial distance from said other end. The spring housing 38 communicates with a slot 39 extending longitudinally and centrally of the bottom plate 17, and positioned within the spring housing under said slot is an elongated spring 40. One end of the spring is connected to an upstanding tongue 41 formed upon a slide 42, the side edges of which project through longitudinal slots 43 formed in the housing 38. The other end of the spring is anchored to the closed front end wall of the spring housing.

Rigid with the rear end of the carrier is a depending lip 44 and pivotally mounted on said lip in a pivoted wing 45 capable of being manually swung between an inoperative position seen in Fig. 10 and an operative position seen in Figs. 11 and 12. A knob 46 is provided that engages the tongue 41 when the wing is swung in one direction, as seen in Fig. 11 to limit swinging movement in said direction. The knob also comprises a handle which can be manually grasped for the purpose of adjusting the pivoted wing 45 between its respective positions.

When pipe is being loaded from the rack to the derrick the wing 45 is adjusted to inoperative position seen in Fig. 10. When pipe is to be loaded from the derrick to the rack, the wing is adjusted to the position of Figs. 11 and 12 and in this position constitutes an abutment on the rear end of the carrier which will strike the tongue 41 of the slide 42 when the carrier moves rearwardly along the carriage, that is, to the right hand end of the carriage as seen in Fig. 9.

Thus, when pipe is being loaded from the rack to the derrick, there is nothing to interfere with free gravitational movement of the carrier to the right hand end of the carriage, and nothing to cause the carrier to leave said right hand end during the time it is awaiting a new piece of pipe P to be loaded from the rack to the derrick. When, however, pipe is to be loaded from the derrick to the rack, it is desired as previously noted that the carrier be sent up to the left hand end of the carriage to await a piece of pipe coming from the derrick. For this reason the carrier is caused to engage the right hand end of the spring 40 in the manner shown in Figs. 11 and 12. In other words, as pipe is being loaded from the derrick to the rack, the pipe will force the carrier from left to right in Fig. 9. After the carrier has moved a certain distance along the carriage, toward the right hand end of the carriage, it engages the right hand end of the spring and places the spring under tension. As a result, when the pipe is finally taken off the carriage and deposited upon an unloading rack, the carrier, now freed of the pipe's weight, will be impelled with great force by the contracting spring back to the left hand end of the carriage, causing the spring arms 35 to engage over the enlargement 34 and thus retain the carrier at said left hand end of the carriage awaiting another pipe to be loaded from the derrick for ultimate deposit upon the off loading conveyor or rack.

Hoist section

This section of the apparatus, considered generally, is seen in Figs. 1 and 2, and detail views thereof are seen in Figs. 7 and 8. The overall purpose of this section is to swing the carriage from a position as seen in full lines in Figs. 2 and 7, to a position as seen in dotted lines in Fig. 2. The hoist section swings the carriage section from said full line to said dotted line positions when pipe is being loaded from the rack to the derrick. It swings said carriage section from the dotted line position to the full line position when pipe is being unloaded from the derrick for deposit back on the rack.

Considering the hoist section more specifically, this comprises a boom assembly and a boom operating or driving mechanism. Each will be described in turn.

As to the boom assembly, a base 47 is provided on which the boom swings between its respective extreme positions. The boom, in this connection, comprises a pair of converging long arms 48 the inner or left hand ends of which register with short converging arms 49, a pivot shaft 50 mounted upon said base passing through said ends of the arms 48 and 49. A pin 51 connects to the other ends of the short arms 49 one end of a center arm 52, and said pin also serves to connect to the arms 49 and center arm 52 one end of a pair of diverging arms or braces 53 rigidly connected

at their other ends to the respective arms 48. Short braces 54 are also rigidly connected to the arms 48 and at their other ends to the center arm 52. Connecting the right hand ends of the arms 48 and center arm 52 is a cross pin 55.

All these parts together form a rigid elongated boom pivotally mounted to swing around a center comprising the pivot shaft 50, so that said boom swings between positions respectively shown by the full lines and dotted lines in Fig. 2.

Continuing with the boom assembly, a clevis 57 is of right angled formation when seen in side elevation as in Figs. 7 and 8, this clevis being formed as an inverted U-shaped yoke having arms 57 spaced from opposite sides of the center arm 52 and pivotally mounted upon a cross bar 56 extending through said center arm 52.

The middle portion of the clevis has an opening 58 through which extends a stud 59 rigidly secured to the front end plate 20 of the carriage. By reason of this arrangement, it will be observed that when the boom is in the full line position seen in Fig. 2, the carriage section will be horizontally supported in position either to receive a piece of pipe P from a loading conveyor seen at the right in Fig. 4, or discharge a piece of pipe P to an unloading rack seen fragmentarily to the left of the frame in Fig. 4. When swung to the dotted line position, the boom tilts the front end of the carriage up and swings it to the dotted line position of the carriage seen in Fig. 2. In this position the carriage is positioned either to receive a piece of pipe from the derrick or permit the unloading of a piece of pipe for stacking of the pipe upon the derrick floor D.

Referring now to the boom operating mechanism whereby the boom is swung between said respective extreme positions, I provide the reciprocable elongated shaft 60 one end of which is connected to the boom by the connecting pin 51 of the boom. The other end of the shaft extends between a pair of standards 61, rotatably mounted between which is the pinion 62 rotatable with the drive shaft 63 journaled in the standards. A support bar 64 extends under the shaft 60, and that portion of the shaft 60 that extends between the support bar and the pinion is formed as a rack 65 in mesh with said pinion.

Shaft 63 is driven by chain and sprocket 66 extending from a suitable source of power, not shown.

It will be seen that when the shaft 63 is driven in one direction, the elongated reciprocable shaft 60 will be shifted to the left in Fig. 2, and will pull the boom to the dotted line position seen in that figure. On reversal of the boom drive, the boom is swung back to the full line position of Fig. 2.

Carriage loading and unloading section

This section includes the components of the apparatus that cause a piece of pipe P to be either deposited upon the carriage or taken off the carriage, when the carriage is in the full line position seen in Fig. 2.

These components comprise a means for tilting the carriage laterally or transversely to position it to receive or discharge the pipe, said pipe moving onto or off the carriage laterally of the carriage. This section also includes a means for driving a loading conveyor, a clutch control that engages said drive only at times when pipe is to be actually deposited upon the carriage, this clutch control being actuated by the tilting of the carriage. This section also includes the conveyor itself used for loading pipe upon the carriage, and finally, the section includes an off loading rack used to receive pipe discharged by the carriage during the operation of taking a pipe from the derrick, as distinguished from the operation whereby the piece of pipe is sent up to the derrick.

Considering first the carriage tilt assembly, as previously noted the carriage section is mounted to rock transversely upon the bed, and the carriage tilt assembly provided controls this movement of the carriage. This includes a ring 67 secured to and extending laterally from each of the opposite side walls 18 of the carriage section. Chains 68 have hooks 69 at one end adapted to engage in the rings 67. The other ends of the chains have rings 70 attached to the respective ends of the connecting cross bar 55 of the boom.

Whenever one of the chains is to be hooked in a ring 67, the other is to be left unhooked. This may be noted in Fig. 8 in which one of the chains is allowed to dangle in an inoperative position. Only the right hand chain 68 is engaged with the carriage section, this being the chain that will be engaged whenever the carriage is to be positioned for receiving a pipe P from the loading conveyor. In this arrangement of the parts the carriage tilts in a clockwise direction. This is the arrangement used when pipe is to be loaded from the rack to the derrick. If pipe is to be loaded from the derrick to the rack, the right hand chain 68 is disengaged from its associated ring 67 and the left hand chain 68 is engaged with its associated ring. This causes tilting of the carriage in a counterclockwise direction, so as to tilt it toward the off loading rack.

The tilting is caused by reason of the chain being of such a length that when the carriage is moving toward its horizontal position, the chain will become taut and will exert pull upon one side of the carriage to tilt it. This is caused, in the final analysis, by the particular connection of the front end of the carriage to the boom formed by the yoke 57. When the yoke 57 is in the position seen in Fig. 7 it swings the ring 67 a distance from the pin 55 greater than the length of the chain so as to cause the chain to pull upon and tilt the carriage. When, however, the boom is swinging away from its horizontal position to its vertical position, the distances between the ring 67 and cross bar 55 becomes shorter and the carriage is permitted to swing back to its middle position. This movement of the carriage section back to its middle position sets in almost immediately as the carriage moves away from the horizontal position shown in full lines in Fig. 2. Conversely, when the carriage is being returned from the dotted line position of Fig. 2 to the full line position there shown, as the carriage approaches the end of its travel the chain begins to tilt it more and more until it is finally in the fully tilted position seen in Fig. 8.

Referring now to the conveyor drive mechanism or assembly, this is best shown in Figs. 2 and 6. It may be noted at this point that this conveyor drive assembly is for the purpose of operating a pair of spaced apart chain conveyors that support opposite ends of a plurality of pipes P extending therebetween as best seen in Figs. 1 and 4. These conveyors thus constitute in effect a loading rack to which reference has hereinbefore been made in discussing the loading of pipe from the rack to the derrick or from the derrick to the rack.

In any event, the opposite ends of these respective conveyors are supported upon upstanding posts 71, and those posts 71 located close to the carriage section end portions serve as bearings for an elongated shaft 72 (see Fig. 2) extending longitudinally of the carriage section and parallel thereto. This shaft constitutes means for simultaneously driving both of the spaced conveyors, which conveyors will be described in greater detail hereinafter. In any event, the shaft 72 is actually a spline shaft in the preferred form of the invention, having a solid end portion journaled in one of the posts 71, the other end portion being formed as a sleeve end 73 (see Fig. 3), journaled in the other post 71. The sleeve end 73 has a stub shaft or spindle 74 rotatable in the bearing that is defined by said post.

The purpose of utilizing a spline shaft at this location is to permit adjustable spacing of the posts 71 in setting up the apparatus and during operation of the apparatus there is no relative sliding movement between the opposite ends of said spline shaft.

For the purpose of driving the shaft 72, a sprocket 75 is made rigid with the shaft at one end thereof, chain 76 passing around and driving said sprocket. Chain 76 is driven from a smaller sprocket 77. The sprocket 77 is to be driven only intermittently, being controlled by a clutch mechanism to be described.

Considering this clutch mechanism the driving of a jack shaft 78 is provided for by means of a drive chain 79 passing around sprocket 80 secured to said jack shaft, the chain 79 taking its power from a suitable source of power, not shown. The jack shaft 78 is driven continuously, and has one end journaled in a bearing 81. Rigid with this end of the jack shaft is a clutch member 82, adapted to be engaged with or disengaged from a cooperating clutch member 83 that is rigid with one end of a sleeve 84 in which the shaft 78 is rotatable. Sleeve 84 has the sprocket 77 keyed to it, and thus it will be seen that only when the clutch members are engaged as in Fig. 6 will the sleeve 84 and shaft 78 be engaged in direct drive.

Continuing with the description of the clutch mechanism, I control the engagement of the clutch faces 82 and 83 by means of a cam disc 85 having opposed frusto-conical faces. This disc is rigid with the sleeve 84, and thus, if the disc is urged to the right in Fig. 6 it will cause the clutch faces to be engaged, so that the sprocket 77 which is splined to the sleeve 84 will be driven. When, however, the cam disc is shifted to the left in Fig. 6 the opposite effect will be had, the clutch faces now being out of engagement and the conveyor being now stationary.

The cam disc is positioned between a pair of upstanding channeled guides 86 constituting a slideway for a pair of cam plates 87 and 88 rigidly connected in close spaced relationship to a vertically reciprocable rod 89. The plate 87 has formed in it an opening 90 which, as seen best from Fig. 6, is close to the lower end of the plate 87. The plate 88 has an opening 91 which is close to its upper end, so that said openings are fully out of register.

By reason of this arrangement, it will be seen that when the rod 89 is forced downwardly, the edge of the upper end of the opening 90 will engage one face of the cam disc, urging the cam disc to the right in Fig. 6 and causing the clutch faces 82 and 83 to engage. When the rod 89 is elevated, the lower portion of the opening 91 engages the other face of the cam disc so as to urge the cam disc to the left in Fig. 6, thus causing the clutch faces to disengage.

The normal position of the rigidly connected cam plates is their up position, and to cause the plates to assume this position whenever they are not forced to their down position, I provide the push spring 92 pressing upwardly against the lower end of said fixedly connected plates.

The upward or downward movement of the cam slide comprising the two fixedly connected plates can be limited by the provision of an oblong slot 93 near the upper end of the rod 89, the shaft 72 extending through this slot and constituting a stop limiting said up and down movement of the vertically reciprocable rod 89. Above this slot, the rod 89 is formed with a laterally extended upper end, this being extended in the direction of the carriage section.

In this connection, one of the members 32 of the carriage has formed in it a notch 94, adapted to engage a finger 95 formed on said laterally extended upper end of the operating rod 89.

From this, it will be observed that assuming that the apparatus is to be used for loading pipe from the rack to the derrick, the right hand chain 68 seen in Fig. 8 is engaged with the carriage section and will tilt the carriage section counterclockwise, that is, toward the operating rod 89 of the clutch. As the tilted carriage section arrives at its horizontal normal position ready for another piece of pipe, the result will be that the notch will engage the finger 95, causing the reciprocable rod 89 to be depressed against the action of the spring 92. This will cause the cam slide to move downwardly, urging the cam disc to the right in Fig. 6 and engaging the clutch faces 82 and 83 so as to cause the conveyor to be driven. Then, as soon as the hoist section is operated to swing the carriage section upwardly, the rod 89 is released for upward movement and moving upwardly, will cause the clutch faces to be disengaged so that the conveyor is halted awaiting the next cycle of operation.

Referring now to the construction of the driven conveyor assembly, at opposite ends of the spline shaft there are provided conveyor drive wheels 96 rotatable with the spline shaft so as to be driven when said shaft is driven. Around these wheels pass the conveyor chains 97 having the roller type cleats 98 at spaced intervals for regular spacing and carrying of the pipes P.

The conveyor chains are held against slacking by plates 99 between which each conveyor chain passes, the plates being mounted upon the respective ends of the spline shaft and being also supported by the posts 71. To hold the conveyor chains against slackening, the plates are equipped with the angles 100. The construction of the conveyor is perhaps best seen from Figs. 4 and 6.

The top edges of the respective plates 99 are inclined downwardly toward the carriage section as best seen from Fig. 4. As a result, the pipes P will normally tend to gravitate toward the carriage section, being prevented from doing so only by the rollers 98. Each time the conveyor drive mechanism is engaged, however, one of the rollers will pass out of pipe-retaining position and the pipe nearest the carriage section will be allowed to roll upon the tilted carriage section to be carried up to the derrick floor when the hoist assembly is next operated to provide for this movement.

Referring now to the off loading rack seen at the left in Fig. 4, and also seen in Fig. 1, outer posts 102 and inner posts 103 support spaced

rack members 104. This off loading rack is used when pipe is being loaded from the derrick to the rack, and when this operation is to take place, the left hand chain shown in Fig. 8 or 11 is hooked upon its associated ring and the other chain disengaged.

Considered properly a part of the carriage tilt assembly is a post 105 (see Figs. 2 and 9). This post is disposed a short distance from the rear end or right hand end of the carriage and carried at the upper end of the post is a guide roller 106 which, as seen from Fig. 9, has a depressed center and enlarged inclined end portions.

The purpose of this arrangement is to cause the carriage to be returned from the tilted position seen in Fig. 8 to the middle position when the carriage is elevated to the dotted line position seen in Fig. 2. Normally when the carriage is in the horizontal position of Fig. 2, it does not engage this guide roller. However, as the boom begins to pull the carriage up, the carriage rolls forwardly upon the rollers 16 of the bed, at the same time dropping at its back end, by reason of the upward pull upon its front end. The dropping of the back end of the carriage causes the downwardly tilted bottom corner of the carriage to engage one or the other of the inclined end portions of the guide roller, and this cams the carriage back to untilted position.

Operation

The apparatus is adapted, as touched upon hereinbefore, for operation in either of two ways. In one of these the apparatus permits pipe to be loaded from a ground rack up to a derrick floor, where it is pulled by a team of men operating suitable equipment to stacked position in the derrick, preparatory to threading of the pipe sections during drilling of the hole. In the other instance the apparatus is adapted for reverse operation, as where pipe is being pulled out of a drilled hole and is to be loaded from the derrick back onto a rack. Each of these will be summarized in turn.

Considering first the loading of pipe from the rack to the derrick, chains 68 are engaged at the right of the carriage section as seen in Fig. 8. Spring arms 35 are positioned as in Fig. 14, where they will not grip the nose pin 33 of the carrier. Pivoted wing 45 is swung upwardly to the position of Fig. 10 where it will not engage the spring slide.

The apparatus is now placed in operation, and will generally require the services of no more than a hoist section operator who will swing the hoist from the full line to the dotted line position whenever a pipe P is automatically deposited upon the carriage section. The hoist when swung to the dotted line position of Fig. 2 positions the front end of the pipe where it can be held thereafter by a team working on the derrick floor for stacking of the pipe on the derrick. As the pipe P is pulled off the elevated carriage section, the rear end of the pipe will of course travel from the right to the left end of the carriage section as seen in Fig. 2, and carrier supporting the rear end of said pipe during said movement. When the pipe is fully pulled off the carriage section, the carrier will be free to gravitate toward the back end of the carriage section and will be properly positioned when the next piece of pipe is deposited thereon.

Continuing, the carriage section is now returned to the full line position in Fig. 2 by dropping of the boom. As it arrives, it is tilted in the position of Fig. 8 or 5, and this engages the conveyor drive to cause another piece of pipe to be deposited on the carriage section. The cycle of operation is now repeated.

Referring now to the use of the apparatus in unloading pipe from a derrick to a rack, the left hand chain in Fig. 8 is engaged to cause the carriage to tilt counter-clockwise, that is, toward the off loading rack.

The spring arms 35 are positioned as in Fig. 9 and the pivoted wing 45 is positioned as in Figs. 11 and 12. The empty carriage section is now swung up to the dotted line position in Fig. 2, with the carrier releasably latched at the front end of said carriage section. A piece of pipe is lowered upon the front end of the carriage section, the rear end of the pipe engaging and being supported upon the carrier. Initially the carrier will be forced to the rear end of the carriage, placing the spring 40 under tension during this movement. When it arrives at the rear end of the carriage section, the pipe will be fully supported upon the carriage section and the boom assembly is now lowered. As the carriage section arrives at its full line normal position, it is tilted by the chain toward the off loading rack, and the pipe is discharged to said off loading rack. As soon as the pipe rolls off the tilted carriage, the spring 40 is now free to contract, and catapults the carrier to the front end of the carriage, causing it to be releasably gripped by the spring arms 35 and thus properly positioned to receive the next pipe when the carriage is elevated once again at the beginning of the next cycle.

What is claimed is:

1. Apparatus for handling drill pipe comprising a supporting frame; a carriage mounted upon said frame for movement longitudinally of the frame and for rocking transversely of the frame; a boom assembly connected to one end of the carriage and adapted for swinging said end of the carriage upwardly off the supporting frame while shifting the carriage longitudinally of the frame; a loading conveyor mounted adjacent said carriage; drive mechanism for said conveyor; a clutch included in said drive mechanism for actuating the conveyor intermittently on each return of the carriage to its normally substantially horizontal position; means for rocking the carriage toward the conveyor on movement of the carriage to said normal position; and means actuated by rocking of the carriage for engaging the drive mechanism of the conveyor.

2. Apparatus for handling drill pipe comprising a supporting frame; a bed mounted upon said frame to rock transversely of the frame; a carriage of elongated formation mounted to roll longitudinally of said bed and rockable with the bed; a loading conveyor mounted adjacent said carriage; drive mechanism for said conveyor; a boom assembly for swinging the carriage off the bed to an elevated tilted position; means connecting the boom assembly and carriage for transverse rocking of the carriage when the carriage is supported upon the bed; and a clutch mechanism engaged by the transversely rocked carriage to actuate the conveyor drive mechanism.

3. Apparatus for handling drill pipe comprising a supporting frame; a bed rockable transversely of the frame; a carriage shiftable longitudinally of and elevatable off the bed; a hoist assembly for elevating said carriage off the bed; means connecting the carriage and hoist assembly for transverse rocking of the carriage and

bed when the carriage is in one position; a conveyor for loading a piece of pipe upon the carriage when said conveyor is driven; drive mechanism for the conveyor; and a clutch mechanism engaged by the tilted carriage and adapted to energize said drive mechanism of the conveyor.

4. Apparatus as in claim 3, and including a carrier mounted upon the carriage for movement longitudinally thereof and adapted to support the rear end of a pipe carried upon said carriage.

5. Apparatus for handling drill pipe comprising a supporting frame; a bed mounted upon said frame to rock transversely thereof; a carriage shiftable longitudinally of and elevatable off the bed; a boom assembly for elevating said carriage; a connection between said boom assembly and carriage for tilting the carriage transversely of the frame; an off loading rack to which said carriage is tilted; a carrier for supporting the rear end of a piece of pipe and shiftable longitudinally of the carriage; means releasably latching the carrier at the front end of the carriage; and a return spring on the carriage for propelling the carrier to a position in which it will be releasably engaged by said means whenever pipe is not being supported by the carrier.

6. Apparatus for feeding lengths of tubular conduit in succession to the elevating apparatus of a drill rig comprising an elongated transversely tiltable carriage mounted to move longitudinally from a horizontal position remote from a drill rig to an upwardly inclined position adjacent the drill rig, means mounted between the carriage and the drill rig and connected to the carriage adjacent one end thereof for so moving the carriage, and means connected to the carriage moving means and to the carriage for tilting said carriage to conduit receiving position as it approaches the horizontal.

7. Apparatus for feeding lengths of tubular conduit in succession to the elevating apparatus of a drill rig comprising an elongated transversely tiltable carriage mounted to move longitudinally from a horizontal position remote from a drill rig to an upwardly inclined position adjacent the drill rig, means mounted between the carriage and the drill rig and connected to the carriage adjacent one end thereof for so moving the carriage, means connected to the carriage moving means and to the carriage for tilting said carriage to conduit receiving position as it approaches the horizontal, and a table mounted adjacent the carriage for supporting parallel lengths of tubular conduit in parallel relation to the carriage for transfer to the carriage when it is in its conduit receiving position.

8. Apparatus for feeding lengths of tubular conduit in succession to the elevating apparatus of a drill rig comprising an elongated transversely tiltable carriage mounted to move longitudinally from a horizontal position remote from a drill rig to an upwardly inclined position adjacent the drill rig, means mounted between the carriage and the drill rig and connected to the carriage adjacent one end thereof for so moving the carriage, means connected to the carriage moving means and to the carriage for tilting said carriage to conduit receiving position as it approaches the horizontal, a table mounted adjacent the carriage for supporting parallel lengths of tubular conduit in parallel relation to the carriage for transfer to the carriage when it is in its conduit receiving position, and means carried by the table to advance the parallel lengths of tubular conduit toward the carriage.

9. Apparatus for feeding lengths of tubular conduit in succession to the elevating apparatus of a drill rig comprising an elongated transversely tiltable carriage mounted to move longitudinally from a horizontal position remote from a drill rig to an upwardly inclined position adjacent the drill rig, means mounted between the carriage and the drill rig and connected to the carriage adjacent one end thereof for so moving the carriage, means connected to the carriage moving means and to the carriage for tilting said carriage to conduit receiving position as it approaches the horizontal, a table mounted adjacent the carriage for supporting parallel lengths of tubular conduit in parallel relation to the carriage for transfer to the carriage when it is in its conduit receiving position, an endless chain mounted on the table to move in a closed path perpendicular to the carriage, and lugs carried by the chain and projecting above the top of the table for maintaining separated the parallel lengths of tubular conduit and advancing said lengths of tubular conduit in succession toward the carriage.

10. Apparatus for handling tubular conduit comprising a conduit supporting frame, an elongated trough shaped carriage mounted beside the frame and lying in parallel relation to lengths of conduit supported on said frame, said carriage being adapted to tilt about its longitudinal axis to deliver a length of conduit to the frame or to receive a length of conduit from the frame, means mounted adjacent the frame and connected to the carriage for moving said carriage longitudinally beside the frame into an upwardly inclined position adjacent the frame, and means carried by the frame and connected to the carriage moving means for tilting the carriage toward the frame when it returns to a horizontal position beside the frame.

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