

Jan. 10, 1956

A. L. STONE

2,730,246

APPARATUS FOR HANDLING PIPE IN A DERRICK

Filed Nov. 3, 1951

5 Sheets-Sheet 1

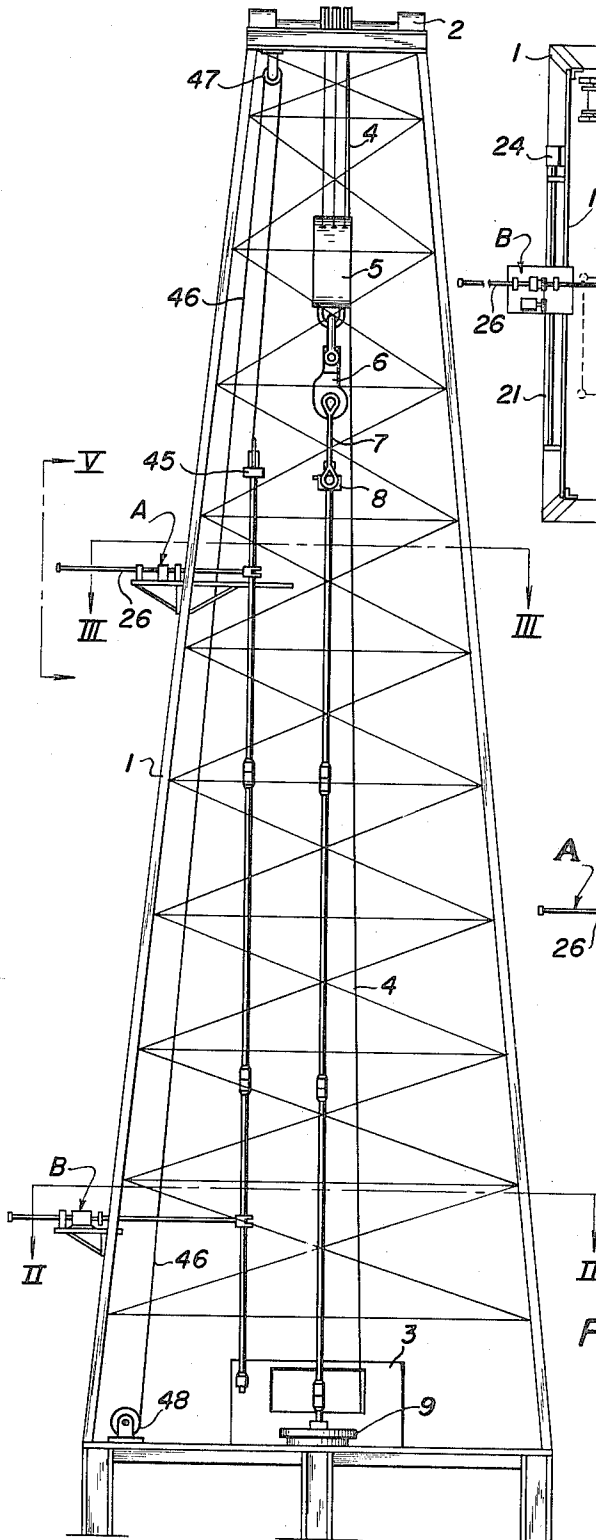
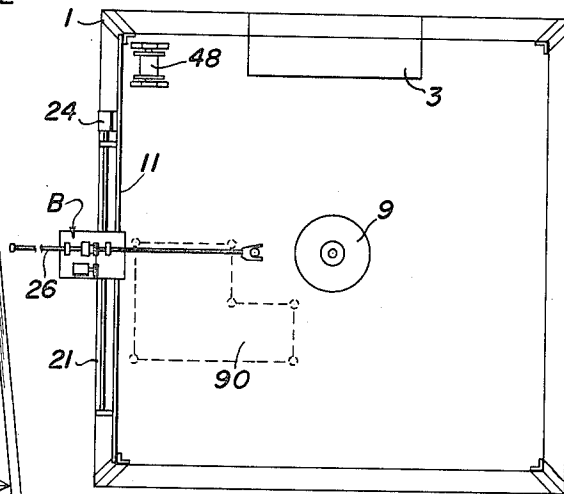


FIG. 2.

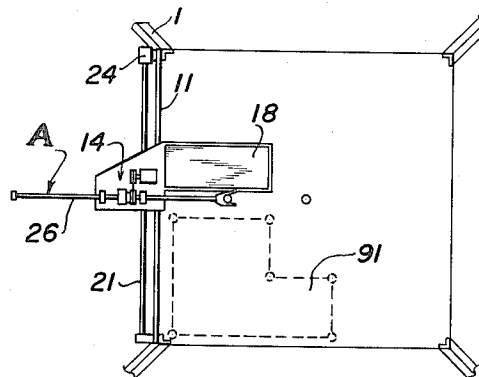


FIG. 3.

FIG. 1.

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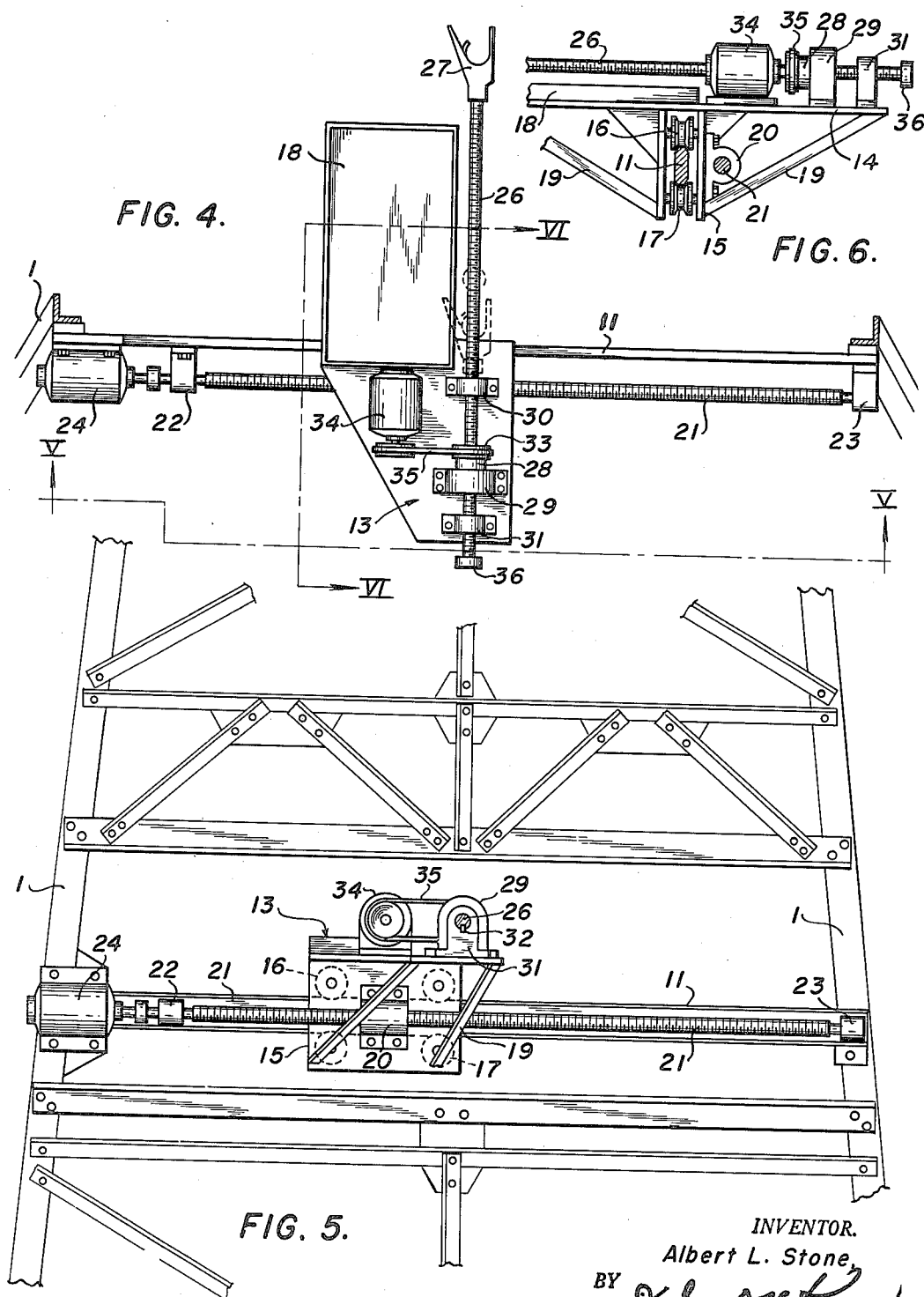
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5 Sheets-Sheet 2



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5 Sheets-Sheet 3

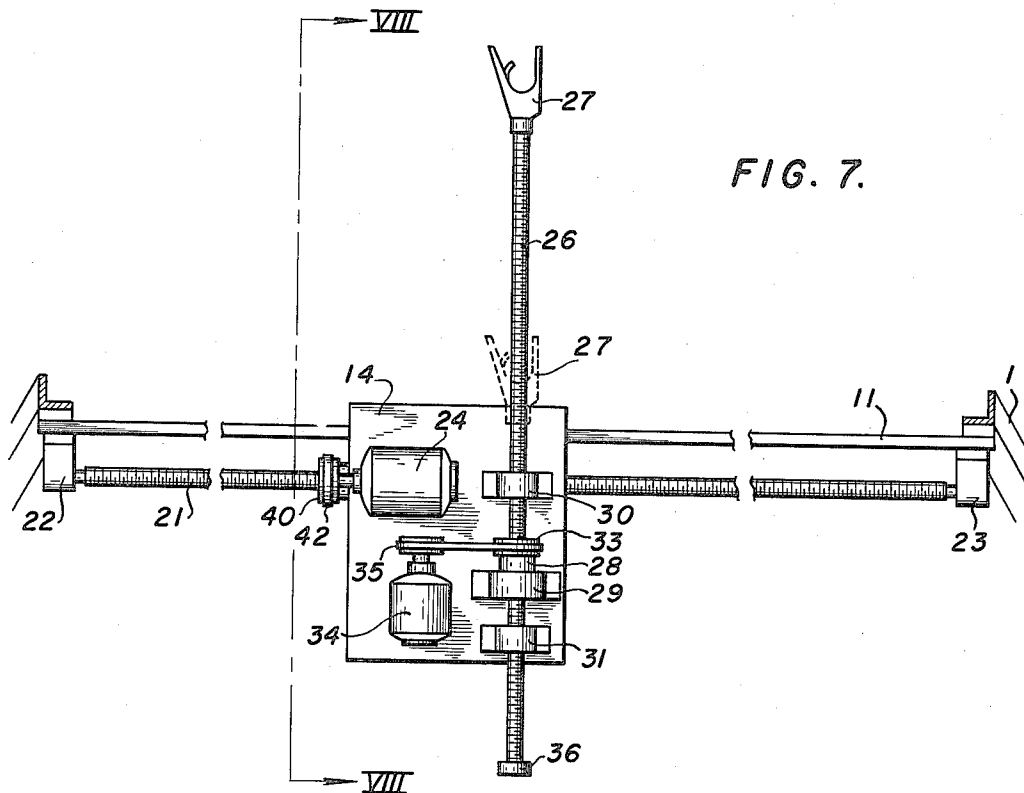


FIG. 7.

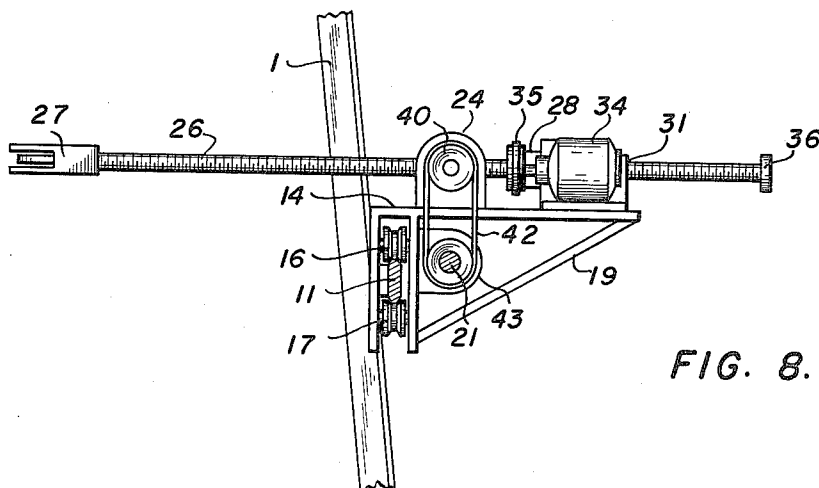


FIG. 8.

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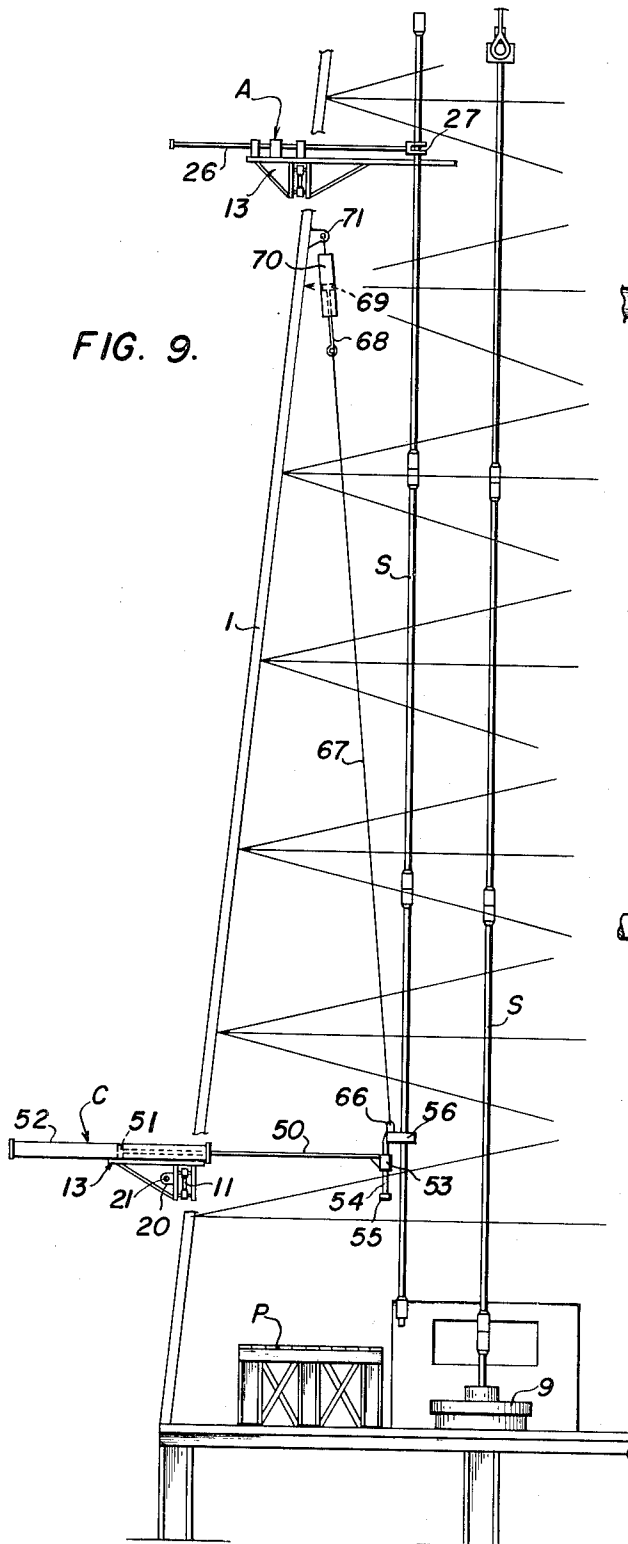
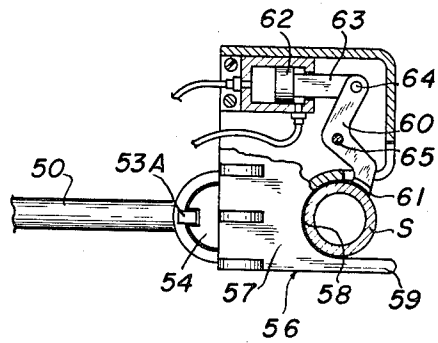
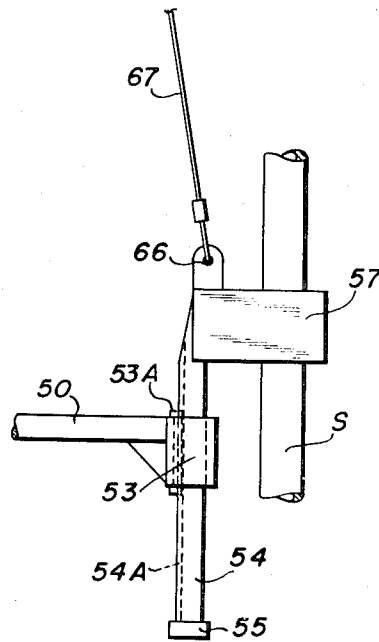
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APPARATUS FOR HANDLING PIPE IN A DERRICK

Filed Nov. 3, 1951

5 Sheets-Sheet 4



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APPARATUS FOR HANDLING PIPE IN A DERRICK

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FIG. 12.

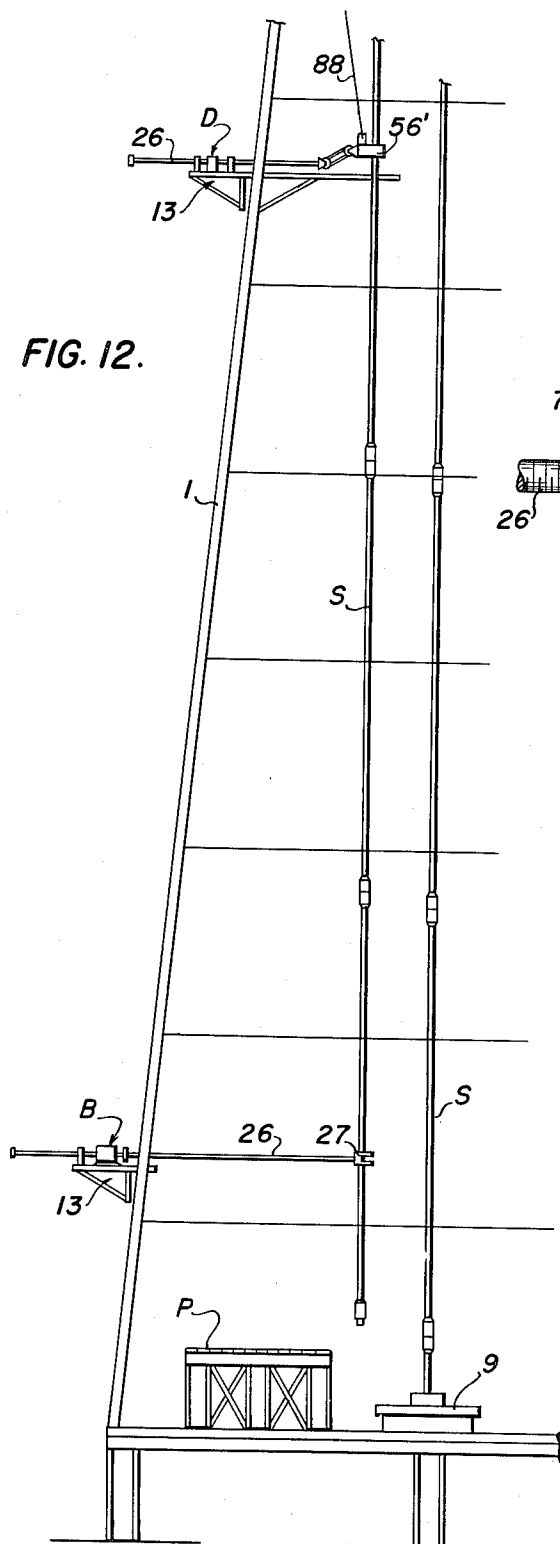


FIG. 13

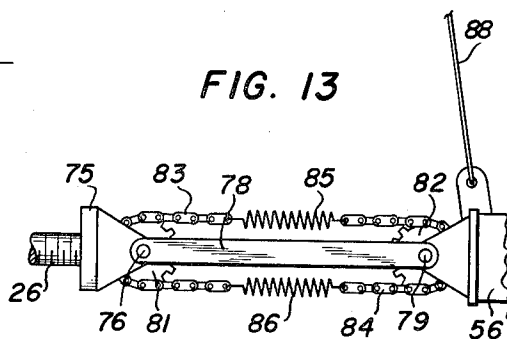
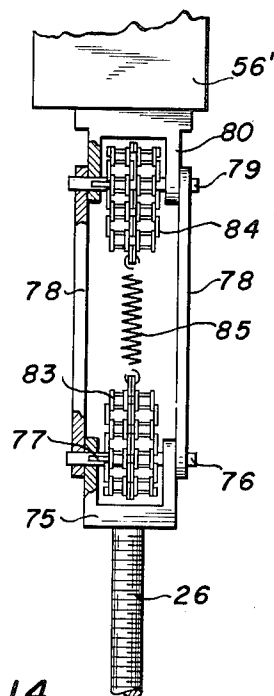


FIG. 14.



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2,730,246

APPARATUS FOR HANDLING PIPE IN A DERRICK

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Application November 3, 1951, Serial No. 254,781

20 Claims. (Cl. 214—2.5)

The present invention relates generally to apparatus for handling substantially vertical sections of pipe in a derrick, and is directed particularly to apparatus for moving disconnected sections of a string of drill pipe between the vertical center-line of the derrick and a laterally offset racking position.

This application is a continuation-in-part of the following copending applications of applicant: Serial No. 692,202, filed August 22, 1946, for Apparatus for Racking Pipe, now abandoned; Serial No. 5,843, filed February 2, 1948, for Apparatus for Racking Pipe in a Derrick, now abandoned; and Serial No. 98,250, filed June 10, 1949, for Pipe Racking Apparatus, now abandoned.

It is a general object of the present invention to provide a system and apparatus for handling vertical stands of drill pipe and the like in a derrick. More particularly, an important object is to mechanize the racking of pipe stands in a derrick, and thus reduce the manual labor and the physical hazards involved, as well as increasing the speed of operation.

One aspect of the present invention embraces the more specific object of providing at least one pipe-racking assembly which is adapted to be mounted in the derrick and which is operable to engage a vertical stand of pipe and move it laterally in a controlled path into or out of racked position.

Another object of the present invention is to provide a pipe-racking assembly comprising components which are movable horizontally and rectilinearly in substantially perpendicular directions, whereby to move a vertical pipe stand in a controlled path which is the resultant of the above-mentioned movements, performed either sequentially or partially or wholly simultaneously.

Still another object of the present invention is to provide a mechanical pipe-racking system embodying upper and lower pipe-racking assemblies adapted respectively to engage and move the upper and lower portions of a vertical stand of pipe in a controlled path between the axis of the well and a laterally offset racked position.

Yet another object of the present invention is to provide, in conjunction with a pipe-racking assembly as characterized above, means for supporting the stand of pipe independently of the conventional main hoisting apparatus. In this connection, a more specific object is to incorporate the pipe-supporting means in a piperacking assembly, whereby to employ the pipe-racking assembly as a means of manipulating the pipe-supporting means into position for grasping stands of pipe disposed in various positions in the derrick.

The foregoing and other objects are attained in accordance with the present invention by apparatus which may be described briefly as follows:

One aspect of the invention may be embodied in apparatus comprising a linear trackway adapted to be mounted substantially horizontally across one side of a derrick, a carriage movable along the trackway, an arm mounted on the carriage with its longitudinal axis sub-

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stantially horizontal and extending substantially perpendicular to the trackway, and a pipe-engaging member on the arm, the arm being movable longitudinally to move a pipe stand toward and away from the vertical center-line of the derrick and the side thereof on which the trackway is mounted, and the arm partaking of the movement of the carriage to move the pipe stand in a direction transverse to the longitudinal axis of the arm. Power means may, if desired, be provided for moving either the carriage or the arm, or both.

According to another aspect of the invention, a pair of pipe-racking assemblies are mounted in the derrick, one above the other, to move the upper and lower portions of a stand of pipe in corresponding controlled paths. During such movement the stand may be supported by means independent of the main hoisting apparatus. Such auxiliary supporting means may be a separate auxiliary supporting device or, according to another aspect of the invention, it may be incorporated in a pipe racking assembly.

According to still another aspect of the invention, the derrick is provided with an elevated setback platform on which the stands of pipe are supported, the platform being disposed at approximately the level at which the stands are connected to and disconnected from the drill string. In this manner the extent of vertical movement of the disconnected stands is reduced to a minimum.

The manner in which the foregoing and other objects of the invention may be attained will be understood from the following detailed description of several embodiments thereof, reference being had to the accompanying drawings wherein:

Fig. 1 is a view in side elevation of a derrick, showing one embodiment of the invention installed therein;

Fig. 2 is a horizontal sectional view taken on line II—II of Fig. 1;

Fig. 3 is a horizontal sectional view taken on line III—III of Fig. 1;

Fig. 4 is an enlarged top plan view of the upper pipe-racking assembly of Fig. 1;

Fig. 5 is a view in side elevation of the assembly shown in Fig. 4, taken on line V—V of that figure;

Fig. 6 is a transverse sectional view taken on line VI—VI of Fig. 4;

Fig. 7 is a top plan view of a modified form of pipe-racking assembly;

Fig. 8 is a transverse view taken on line VIII—VIII of Fig. 7;

Fig. 9 is a view in side elevation of a part of a derrick, showing another embodiment of the invention;

Fig. 10 is an enlarged fragmentary view in side elevation of a part of the lower pipe-racking assembly of Fig. 9;

Fig. 11 is a top plan view, with parts broken away, of the apparatus shown in Fig. 10;

Fig. 12 is a view in side elevation showing a part of a derrick incorporating still another embodiment of the invention;

Fig. 13 is an enlarged fragmentary view in side elevation of a part of the upper pipe-racking assembly of Fig. 12; and

Fig. 14 is a top plan view, with parts broken away, of the apparatus shown in Fig. 13.

Referring first to Figs. 1, 2 and 3, there is shown a conventional well-drilling derrick 1 equipped with the usual crown block 2, drawworks 3, drilling line 4, traveling block 5, hook 6, elevator links 7, elevator 8, and rotary table 9. In this embodiment of the invention an upper pipe-handling assembly, generally designated A, is mounted in the upper portion of the derrick and a generally similar lower pipe-handling assembly, generally designated B, is mounted in the lower portion of the der-

rick. These pipe-handling assemblies are, as shown in Fig. 1, adapted to engage the upper and lower portions of each stand of pipe and move it laterally in a controlled path between the vertical center-line of the derrick and a laterally offset racked position. Both assemblies and their manner of mounting in the derrick are substantially identical, and so a detailed description of the upper assembly will suffice for both.

As shown in Figs. 3, 4, 5 and 6, a linear trackway 11 extends horizontally across one side of the derrick and serves as a supporting track for a carriage 13. The carriage comprises an upper plate 14 secured to the upper edges of a pair of spaced vertical plates 15, 15 between which are journaled upper and lower pairs of grooved rollers 16, 16 and 17, 17. As shown in Figs. 5 and 6, these rollers embrace the upper and lower edges of the trackway 11. The plate 14 may, if desired, extend inwardly of the trackway 11 toward the vertical center-line of the derrick to provide a personnel platform 18. Suitable braces 19 may be provided to impart rigidity to the structure.

The carriage 13 may be moved along the trackway 11 by any suitable means, and for purpose of illustration a motor-driven screw and nut mechanism is shown. A bracket 20 having a threaded bore, and constituting a nut, is secured to one of the vertical plates 15 and threadably engages an elongated feed screw 21 extending parallel to the trackway 11, the ends of the feed screw being journaled in bearings 22 and 23 secured to the trackway. A reversible motor 24 is mounted on the trackway and is connected in driving relation with the screw 21. Thus upon energization of the motor to rotate the screw in the desired direction, the carriage 13 may be moved along the trackway 11 in either direction to any desired position, it being apparent that the screw and nut mechanism is self-locking to hold the carriage stationary upon de-energization of the motor.

The carriage serves as a movable support for a racker arm 26 which is mounted on the carriage with its longitudinal axis at right angles to the trackway 11. The arm 26 carries at its inner end a forked pipe-engaging member 27 adapted partially to embrace a stand of pipe and cause it to move laterally with the arm. The pipe-engaging member 27 may be such as that disclosed in applicant's U. S. Patent No. 2,537,607 dated January 9, 1951.

In addition to movement of the arm 26 and the pipe-engaging member 27 with the carriage back and forth parallel to that side of the derrick on which the carriage is mounted, the arm 26 is mounted on the carriage for movement relative to the carriage back and forth along the longitudinal axis of the arm. Here again for purpose of illustration, a screw and nut mechanism is shown as the means for moving the arm relative to the carriage. The arm is externally threaded throughout its length, and threadably engages a nut 28 journaled in a bearing housing 29. Bearings 30 and 31 support the arm 26 at axially spaced points, one of these bearings having a key 32 (Fig. 5) which engages a keyway in the arm 26 to restrain the arm against rotation. A driving member which may be a belt pulley 33 is secured to the nut 28 and is driven by a motor 34 mounted on the carriage, through a driving belt 35. A stop member 36 is provided on the outer end of the arm 26 to limit its inward movement by engagement with the bearing 31.

Lower assembly B is constructed in the same way as upper assembly A except that it does not have a personnel platform 18. In this connection, it may be noted that if desirable the personnel platform 18 may be omitted from the upper assembly A; when this is done more room is left in the derrick for racking pipe. It will be understood that the provision of power means for moving the carriage and racker arm and for actuating the pipe engaging member into or out of engagement with each pipe stand makes possible remote control of all manipulations

of either or both the upper and lower pipe handling assemblies by an operator located at any convenient point from which the operations can be observed and controlled.

From the foregoing description of the pipe handling assemblies A and B, it will be apparent that each of the pipe-engaging members 27 may be moved horizontally in the derrick in two rectangularly related directions, either sequentially or simultaneously by suitable control of the motors 24 and 34. It will also be apparent that during such movements the pipe-engaging members are always maintained facing in the same direction. This is an important advantage in that it facilitates the stabbing of the pipe-engaging member onto each racked stand of pipe without interference by other stands.

Figs. 2 and 3 illustrate a suitable pattern for racking the stands of pipe in the derrick. In Fig. 2, 90 shows the pattern of the lower ends of stands of pipe as they rest on the derrick floor or mat, and in Fig. 3, 91 shows the pattern of the upper ends of the stands. As will be seen by comparing the relation of patterns 90 and 91 with the axis of the derrick, the stands of pipe resting on the derrick floor lean in two directions in the derrick; they lean away from that side of the derrick on which assemblies A and B are mounted (or to the right as seen in Figs. 2 and 3) and they lean away from that side of the derrick where drawworks are located (or downwardly as seen in Figs. 2 and 3).

The patterns 90 and 91 show that the available area in the derrick for racking pipe is used effectively. A conventional drilling derrick tapers toward the top with the sides making a 5 degree angle with the perpendicular and because of this taper the space in the upper part of the derrick is the limiting factor in racking the pipe. As seen in Fig. 3, the lower row of stands of pipe in pattern 91 is in close proximity to the adjacent side of the derrick and the left row of stands of pipe is in close proximity to the side of the derrick on which assembly A (as well as assembly B) is mounted. Because the side of the derrick slants inwardly, the upper ends of the left row of stands of pipe in pattern 91 of Fig. 3 rest against the girt of the derrick which is immediately above assembly A.

A section of pipe being handled by assemblies A and B must be supported or suspended by suitable means to keep the pipe's lower end off the derrick floor or pipe mat so that it is free to move laterally under the lateral forces exerted by the pipe handling assemblies A and B. In Fig. 1 the means shown which will be discussed more fully hereafter is an auxiliary pipe supporting means with elevator 45 suspended from cable 46.

It will be evident that the pipe handling assemblies A and B are constructed and arranged to provide an uninterrupted path of movement of a pipe section embraced by the pipe engaging members (when supported or suspended by suitable means), said path extending into close proximity of the side of the derrick on which said assemblies are mounted. Actually, the assemblies allow a stand (when supported or suspended by suitable means), to be moved until its upper end touches the derrick girt immediately above the upper pipe engaging assembly and it is to be understood that hereafter when in the specification and claims mention is made of a pipe engaging assembly capable of embracing a stand of pipe and moving it in a path extending into close proximity to the side of the derrick upon which the assembly is mounted, this language is intended to refer to an assembly capable of laterally moving a stand of pipe (which is suspended or supported by suitable means so that its lower end does not rest on the derrick floor or pipe mat) until its upper end touches the derrick girt immediately above said assembly.

In Figs. 7 and 8 there is shown a modified form of pipe-handling assembly which differs from the assembly A principally in that both motors 24 and 34 are mounted on the carriage 13 and in that it does not have

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the personnel platform 18 of assembly A. In this form of the invention the motor 24 is mounted on the top plate 14 of the carriage and is connected, as by pulleys 40 and 41 and transmission belt 42, with a nut 43 journaled in a bracket mounted on one of the vertical plates 15 of the carriage. The nut 43 is in threaded engagement with the feed screw 21, which in this instance is non-rotatably mounted on the trackway 11 by the brackets 22 and 23. Accordingly, upon energization of the motor 24 the nut 43 is rotated and is caused to travel along the stationary feed screw 21, thus moving the carriage along the trackway 11.

As previously mentioned, another important aspect of the instant invention is the provision, in conjunction either with both upper and lower pipe-handling assemblies A and B or with a single pipe-handling assembly, of means for supporting each disconnected stand of pipe independently of the main hoisting apparatus. It will be obvious that such an arrangement not only saves considerable time but also reduces the horizontal load on the upper pipe-handling assembly by rendering it unnecessary, when coming out of the hole, for the pipe-handling assembly to deflect the massive traveling block, hooks, links and elevator laterally out of their path of free suspension at the vertical center-line of the derrick. The provision of auxiliary pipe-supporting means also obviates the necessity, when going in the hole, of moving the main elevator laterally into engagement with each racked stand of pipe to raise it off the pipe-racking platform.

The auxiliary pipe-supporting means may assume various forms, three different embodiments being disclosed herein for purpose of illustration. In Fig. 1 an auxiliary elevator 45 is suspended from a cable 46 which is trained over a sheave 47 mounted at the top of the derrick, the cable in this instance extending downwardly to an auxiliary hoist 48 mounted on the derrick floor. This form of auxiliary pipe-supporting means is simple and relatively inexpensive, but requires manipulation of the auxiliary elevator 45 into engagement with each pipe stand independently of the manipulation of the pipe-handling assemblies A and B. This disadvantage has been overcome in the two forms of auxiliary pipe-supporting means shown in Figs. 9, 10, and 11 and Figs. 12, 13, and 14. In each of these embodiments the pipe-engaging member of one of the pipe-handling assemblies serves the dual purpose of moving the pipe stand laterally and also of supporting the pipe stand and raising and lowering it. Inasmuch as the racker arm 26 of each pipe-handling assembly is constrained to movement in a single horizontal plane, these embodiments include means whereby the pipe-engaging member which functions also as a pipe-supporting member is mounted on its racker arm for vertical movement relative to the arm. Although it is possible to provide motive means acting between the arm and the pipe-supporting member for moving the latter vertically relative to the arm, this would impose the weight of the pipe stand on the arm. It is therefore preferred to provide separate hoist means for supporting, raising and lowering the pipe-supporting member independently of the arm.

Referring to Figs. 9, 10 and 11, the upper pipe-handling assembly A may be identical with assembly A shown in Figs. 1 and 3. However, in the embodiment of Figs. 9, 10 and 11 the hoist cylinder 70 for lower assembly C is attached to the derrick at a point below carriage 13. The lower pipe-handling assembly, designated C, incorporates a pipe-supporting member mounted on the inner end of the racker arm for vertical movement relative thereto. Also, solely for illustrative purposes, the racker arm and its actuating means are of a form different from that disclosed in the previously described embodiments. In so far as concerns the carriage 13, its mounting on the trackway 11, and the means for moving the carriage along the trackway, 75

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these may be identical with the construction shown in Figs. 4, 5, and 6 or in Figs. 7 and 8. The racker arm is in the form of a piston rod 50 connected to a piston 51 reciprocable by fluid pressure in a cylinder 52 mounted on the carriage 13.

A vertically extending guide member 53 is secured to the free end of the piston rod 50 and is bored to slidably receive a guide rod 54. Guide member 53 is provided with a key 53A fitting slidably in a keyway 54A milled in rod 54. Rod 54 has a collar 55 at its lower end to limit its upward movement. Secured to the upper portion of the rod 54 is a pipe-supporting member, generally designated 56, comprising a body 57 having a vertical pipe-receiving recess 58 therein bounded at one side by a finger 59 and its opposite side by a hollow body portion. A pipe-gripping jaw 60 is mounted in the hollow body portion and is adapted to be projected therefrom into the pipe recess 58 or withdrawn from the recess to permit insertion and removal of a pipe stand S into and out of the recess. The jaw 60 may be provided with a pipe-gripping die 61 to cause it firmly to grip the pipe stand. Any suitable means may be provided for actuating the jaw between its gripping and inactive positions and for applying the necessary pressure thereto to cause it to grip the stand. As shown, a cylinder 62 is mounted in the hollow portion of the body 57, in which is slidable a plunger 63 having its free end pivotally connected at 64 to the inner end of the jaw 60. The jaw is pivoted in the body 57 at 65 intermediate its ends, it being noted that the pivot 65 is so located as to cause the die 61 to exert radially inward pressure on the pipe stand.

In order to support the member 56 independently of the piston rod 50 and move it vertically relative thereto, the body 57 is provided with a clevis 66 to which is attached the lower end of a supporting cable 67. The upper end of the cable is secured to the free end of a piston rod 68 connected to a piston 69 reciprocable in a hoist cylinder 70 suspended from a bracket 71 secured to the upper portion of the derrick.

From the foregoing description it will be apparent that the pipe-supporting member 56 may be manipulated, by suitable actuation of the carriage 13 and the piston rod 50 of assembly C, into position to engage a stand of pipe S either at the vertical center-line of the derrick or at any racked position. Upon admitting pressure fluid to the cylinder 62 the jaw 60 is caused to grip the stand, whereupon pressure fluid is admitted to the hoist cylinder 70 to lift the stand by raising the member 56 relative to the piston rod 50, the rod 54 sliding through the guide member 53 during such movement. With the pipe stand thus supported, its lower end may be moved laterally in the derrick by movements of the carriage 13 and piston rod 50, of assembly C, while its upper end is moved laterally in the derrick by movements of carriage 13 and arm 26 of assembly A.

It will be observed by reference to Fig. 9 that the derrick is provided with an elevated setback platform P on which the stands of pipe are supported in racked position. It will be noted in particular that the upper surface of the platform is disposed at approximately the level at which the joint between each pipe stand and the drill string is made up or broken out. This arrangement reduces to a minimum the extent of required vertical movement of the disconnected pipe stands, thus correspondingly reducing the extent of vertical movement of the pipe-supporting member relative to its racker arm, as well as minimizing the required length of stroke of the auxiliary hoist means. This reduction in extent of vertical movement also effects a substantial economy in expenditure of power, it being apparent that the saving in power for each stroke is multiplied by twice the number of stands in the drill string for each "round trip" out of and back into the hole.

It will be understood that the provision of the elevated setback platform in conjunction with one or both pipe-handling assemblies is optional, it being apparent that any of the disclosed types of pipe-handling assemblies may be adapted to move the pipe stands into and out of racked positions wherein they are supported directly on the derrick floor or on a setback platform of less height than that shown, merely by providing for the increased extent of vertical movement of the stands.

It is within the purview of the invention that a pipe-supporting member may be associated with either the upper or the lower pipe-handling assembly, the latter arrangement being disclosed in the embodiment shown in Figs. 9, 10 and 11, just described. An example of the former arrangement is shown in Figs. 12, 13 and 14, wherein the lower pipe-handling assembly B may be similar in all respects to the lower pipe-handling assembly of Figs. 1 and 2. The upper pipe-handling assembly, designated D, differs from the upper pipe-handling assembly A of Figs. 1 and 3 only in the provision of a pipe-supporting member 56', which may be similar to the member 56 of Fig. 11 and which is mounted on the inner end of the racker arm 26 for vertical movement relative thereto. For purpose of illustration, Figs. 13 and 14 show a modified form of mounting for the pipe-supporting member 56' on the racker arm. A forked trunnion member 75 is secured to the end of the racker arm 26 and is provided with a pair of aligned horizontal bores in which a shaft 76 is non-rotatably secured as by keys 77. A pair of spaced parallel links 78, 78 are pivotally mounted at one end on the extended ends of the shaft 76, the other ends of the links being similarly pivotally mounted on a horizontal shaft 79 non-rotatably secured to a pair of ears 80, 80 formed on the pipe-supporting member 56'. Sprockets 81 and 82 are non-rotatably secured to the shafts 76 and 79, respectively, and are engaged by chain sections 83 and 84, the ends of which are interconnected by springs 85 and 86.

This construction permits the pipe-supporting member to be moved vertically relative to the arm 26, the links 78, 78 restraining it against lateral movement and against lateral tilting relative to the arm. The chain and spring interconnection between the non-rotatable sprockets 81, 82 normally maintains the axis of the pipe recess in the member 56' vertical; however, the springs 85, 86 are adapted to yield to permit slight tilting of the member 56' to adjust itself to tilting of the stand of pipe supported thereby.

The member 56' may be supported, raised and lowered by means similar to that provided for the member 56 of Figs. 9, 10 and 11. A cable 88 is shown attached to the member 56' and extends upwardly to a hoist cylinder-piston structure which may be similar to the structure 68, 69, 70 of Fig. 9.

It will be observed with reference to Fig. 12 that an elevated setback platform is provided in conjunction with this form of the invention. It will be understood that this is optional.

From the foregoing detailed description of various aspects and embodiments of the invention, it will be apparent that I have provided means whereby the handling of disconnected pipe stands may be completely mechanized. It will be understood, however, that it may not be necessary or desirable in all instances to employ a complete combination of upper and lower pipe-handling assemblies and auxiliary pipe-supporting means, inasmuch as a single pipe-handling assembly such as A of Fig. 1, C of Fig. 9, or D of Fig. 12, may be employed alone to advantage as an upper pipe-handling assembly.

It will be understood that while I have disclosed several preferred embodiments of the invention, various changes in structure and arrangement of parts, and substitution of equivalent means for those shown, may be made without departing from the spirit of the invention or the scope of the appended claims.

Having fully described and illustrated preferred embodiments of the invention, what I desire to claim as new and useful and to secure by Letters Patent is:

1. Apparatus for handling pipe in a derrick having at least one side, comprising: a linear trackway adapted to be mounted substantially horizontally in the derrick substantially parallel to a side of the derrick; a carriage mounted on said trackway for movement therealong; an arm having a pipe-engaging member thereon, said pipe-engaging member having means adapted to embrace a pipe and being constrained to move horizontally in unison with said arm; means mounting said arm on said carriage with its longitudinal axis substantially horizontal and in fixed substantially perpendicular relation to said trackway, said arm being movable longitudinally thereof relative to said mounting means to move said pipe-engaging member toward and away from the vertical centerline of the derrick and the side of the derrick on which said trackway is mounted; means for moving said carriage along said trackway; and means for moving said arm relative to its mounting means.

2. Apparatus as set forth in claim 1, wherein said carriage and said arm-mounting means are constructed and arranged to provide an uninterrupted path of movement of a pipe section embraced by said pipe-engaging member, said path extending into close proximity to the side of the derrick on which said trackway is mounted.

3. Apparatus as set forth in claim 1, wherein said carriage includes a portion having an inner side which intersects a vertical plane through the longitudinal axis of said arm, said inner side being adapted to be disposed closely adjacent the side of the derrick on which said trackway is mounted, whereby to provide sufficient outward retraction of said arm to permit said pipe-engaging member to move a section of pipe into close proximity to said side of the derrick.

4. Apparatus as set forth in claim 1, wherein said trackway is adapted to extend across the outer side of the derrick, and wherein the major portion of said arm-mounting means is disposed outwardly of said trackway, whereby to provide sufficient outward retraction of said arm to permit said pipe-engaging member to move a section of pipe into close proximity to said side of the derrick.

5. Apparatus as set forth in claim 1, wherein said carriage includes a substantially horizontally extending personnel platform disposed alongside the path of movement of said pipe-engaging member relative to said carriage.

6. Apparatus as set forth in claim 1, including power means for actuating said means for moving said carriage and said arm.

7. Apparatus as set forth in claim 1, including a motor mounted on said carriage and operatively connected to said arm-moving means.

8. Apparatus as set forth in claim 1, including a first motor mounted on said carriage and operatively connected to said arm-moving means, and a second motor mounted on said carriage and operatively connected to said carriage-moving means.

9. Apparatus adapted for moving vertical sections of pipe in a derrick having at least one side, comprising in combination: a pair of linear trackways, one being adapted to be secured substantially horizontally to the upper portion of one side of the derrick and the other trackway being adapted to be similarly secured to the lower portion of the same side of the derrick; and a pair of pipe handling assemblies, one being adapted to be mounted on said upper trackway, and the other being adapted to be mounted on said lower trackway, each assembly comprising: a carriage movable along its respective trackway, an arm movably mounted on the carriage with its longitudinal axis extending substantially horizontally and in fixed substantially perpendicular relation to the track-

way, a pipe-engaging member mounted on said arm and having means adapted to embrace a pipe and being constrained to move horizontally with said arm, said arm being movable along its longitudinal axis relative to its carriage to cause said pipe-engaging member to move a section of pipe toward and away from the vertical centerline of the derrick and said side of the derrick; means for moving each arm relative to its respective carriage; and means for moving each carriage along its respective trackway.

10. Apparatus for supporting and moving vertical sections of pipe in a derrick, comprising in combination: a racker arm; means mounting said arm substantially horizontally in a derrick for movement in angularly related horizontal directions; means for effecting said movement of said arm; a pipe-gripping member having means adapted to grip and support a vertical pipe section at a point intermediate its ends; and means mounting said pipe-gripping member on said arm for bodily vertical movement relative to said arm, said mounting means being operable to constrain said pipe-gripping member to move horizontally with said arm.

11. Apparatus for supporting and moving vertical sections of pipe in a derrick, comprising in combination: a racker arm; means mounting said arm substantially horizontally in a derrick for movement in angularly related horizontal directions; means for effecting said movement of said arm; a pipe-gripping member having means adapted to grip and support a vertical pipe section at a point intermediate its ends; means mounting said pipe-gripping member on said arm for bodily vertical movement relative to said arm, said mounting means being operable to constrain said pipe-gripping member to move horizontally with said arm; and power-operated hoist means operatively connected to said pipe-gripping member for supporting said pipe-gripping member and a pipe section gripped thereby independently of said arm, and for moving them vertically relative to said arm.

12. Apparatus as set forth in claim 10, wherein said means mounting said pipe-gripping member on said arm comprises means providing a substantially vertical guideway on said arm, and an element freely slidable on said guideway, said pipe-gripping member being carried by said element.

13. Apparatus as set forth in claim 10, wherein said pipe-gripping member includes a pipe-receiving recess and wherein said means mounting said pipe-gripping member on said arm comprises a linkage structure pivotally connected at its respective ends to said arm and to said pipe-gripping member, and parallel-motion means associated with said linkage structure and operable to normally maintain the axis of said pipe-receiving recess substantially vertical.

14. Apparatus as set forth in claim 11, wherein said power-operated hoist means comprises a flexible tension element connected in supporting relation to said pipe-gripping member and extending upwardly therefrom in the derrick, and a power-operated hoist operatively connected to said flexible element.

15. Apparatus adapted for supporting and moving vertical pipe sections in a derrick, comprising in combination: a first racker arm; means mounting said arm substantially horizontally in the upper portion of the derrick for movement in angularly related horizontal directions, said arm having a pipe-engaging member mounted thereon and adapted to embrace the upper portion of a pipe section; means for effecting said movement of said arm; a second racker arm; means mounting said second arm substantially horizontally in the lower portion of the derrick, substantially directly below said first arm, for movement in angularly related horizontal directions, said second arm having a pipe-engaging member mounted thereon and adapted to embrace the lower portion of said pipe section; means for effecting said movement of said second arm; said pipe section being freely slidable vertically through

one of said pipe-engaging members and being constrained only against horizontal movement relative thereto; the other of said pipe-engaging members having means for gripping and supporting the weight of said pipe section and being mounted on its respective arm for bodily vertical movement relative to its arm.

16. Apparatus adapted for supporting and moving vertical pipe sections in a derrick, comprising in combination: a first racker arm; means mounting said arm substantially horizontally in the upper portion of the derrick for movement in angularly related horizontal directions, said arm having a pipe-engaging member mounted thereon and adapted to embrace the upper portion of a pipe section; means for effecting said movement of said arm; a second racker arm; means mounting said second arm substantially horizontally in the lower portion of the derrick, substantially directly below said first arm, for movement in angularly related horizontal directions, said second arm having a pipe-engaging member mounted thereon and adapted to embrace the lower portion of said pipe section; means for effecting said movement of said second arm; said pipe section being freely slidable vertically through one of said pipe-engaging members and being constrained only against horizontal movement relative thereto; the other of said pipe-engaging members having means for gripping and supporting the weight of said pipe section and being mounted on its respective arm for bodily vertical movement relative to its arm; and power-operated hoist means operatively connected to said other pipe-engaging member for supporting it and a pipe-section gripped thereby independently of its respective arm, and for moving them vertically relative to the arm.

17. Apparatus as set forth in claim 15, wherein the pipe section is freely slidable through the lower pipe-engaging member and is gripped and supported by the upper pipe-engaging member.

18. Apparatus as set forth in claim 15, wherein the pipe section is freely slidable vertically through the upper pipe-engaging member and is gripped and supported by the lower pipe-engaging member.

19. Apparatus adapted for supporting and moving vertical pipe sections in a well-drilling derrick, comprising in combination: a first racker arm; means mounting said arm substantially horizontally in the upper portion of the derrick for movement in angularly related horizontal directions; a first pipe-engaging member mounted on said arm for bodily vertical movement relative thereto, said first pipe-engaging member having means for gripping and supporting the weight of a pipe section; power-operated hoist means operatively connected to said first pipe-engaging member for supporting it and a pipe section gripped by it and for moving them vertically relative to said arm; a second racker arm; means mounting said second arm substantially horizontally in the derrick, normally substantially directly below said first arm, for movement in angularly related directions; and a second pipe-engaging member mounted on said second arm and having means adapted to loosely embrace the lower portion of the pipe section to constrain it to move horizontally in unison with said arm while permitting it to slide freely vertically through said second pipe-engaging member.

20. Apparatus for supporting and moving vertical sections of pipe in a derrick, comprising in combination: a racker arm; means mounting said arm substantially horizontally in a derrick for movement in angularly related horizontal directions; means for effecting said movement of said arm; a pipe-gripping member having means adapted to grip and support a vertical pipe section at a point intermediate its ends; means mounting said pipe-gripping member on said arm for bodily vertical movement relative to said arm, said mounting means being operable to constrain said pipe-gripping member to move horizontally with said arm; and an elevated setback platform in the derrick on which a plurality of pipe sections

constituting a drill string are adapted to be supported in racked positions, the upper surface of said platform being disposed approximately at the level at which the pipe joints are connected to and disconnected from the drill string.

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