United States Patent [19]

Woolslayer et al.

[11] **3,887,086**

[45] **June 3, 1975**

[54] **PIPE RACKER**

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[73] Assignee: **Lee C. Moore Corporation,** Tulsa, Okla.

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[21] Appl. No.: **479,296**

[52] **U.S. Cl.** ..... **214/2.5;** 214/1 P

[51] **Int. Cl.** **E21b 19/14**

[58] **Field of Search** ..... 214/2.5, 1 P, 3.1, 130 R; 175/85

[56] **References Cited**

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1,887,901	11/1932	Dodson	214/2.5 X
3,083,842	4/1963	Bauer et al.	214/2.5
3,655,071	4/1972	Langowski et al.	214/2.5

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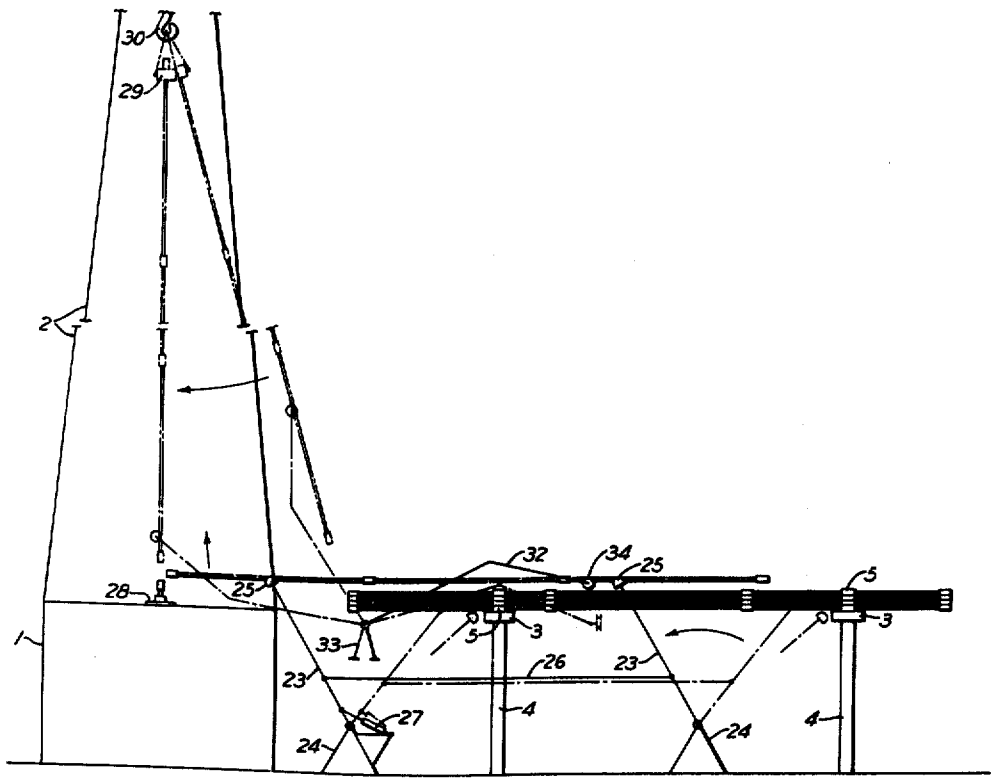
Attorney, Agent, or Firm—Brown, Murray, Flick & Peckham

[57] **ABSTRACT**

At one side of a transfer zone there are laterally spaced elongated members for supporting transversely thereof a plurality of parallel reclining pipestands. Means are provided for indexing the supporting members lengthwise across the transfer zone. At the transfer zone there are means for lifting each successive pipestand from the supporting members and moving it lengthwise to locate its leading end at an elevating position in an oil well derrick. Extending lengthwise of the pipestands adjacent the transfer zone is a steady arm, the end of which nearest the elevating position is pivoted on a horizontal axis. Connected to the other end of the arm are means for engaging the bottom of each lifted pipestand so that when the arm is swung upwardly and over toward the elevating position it can control the trailing end of the engaged pipestand while its leading end is being elevated at the elevating position.

9 Claims, 10 Drawing Figures



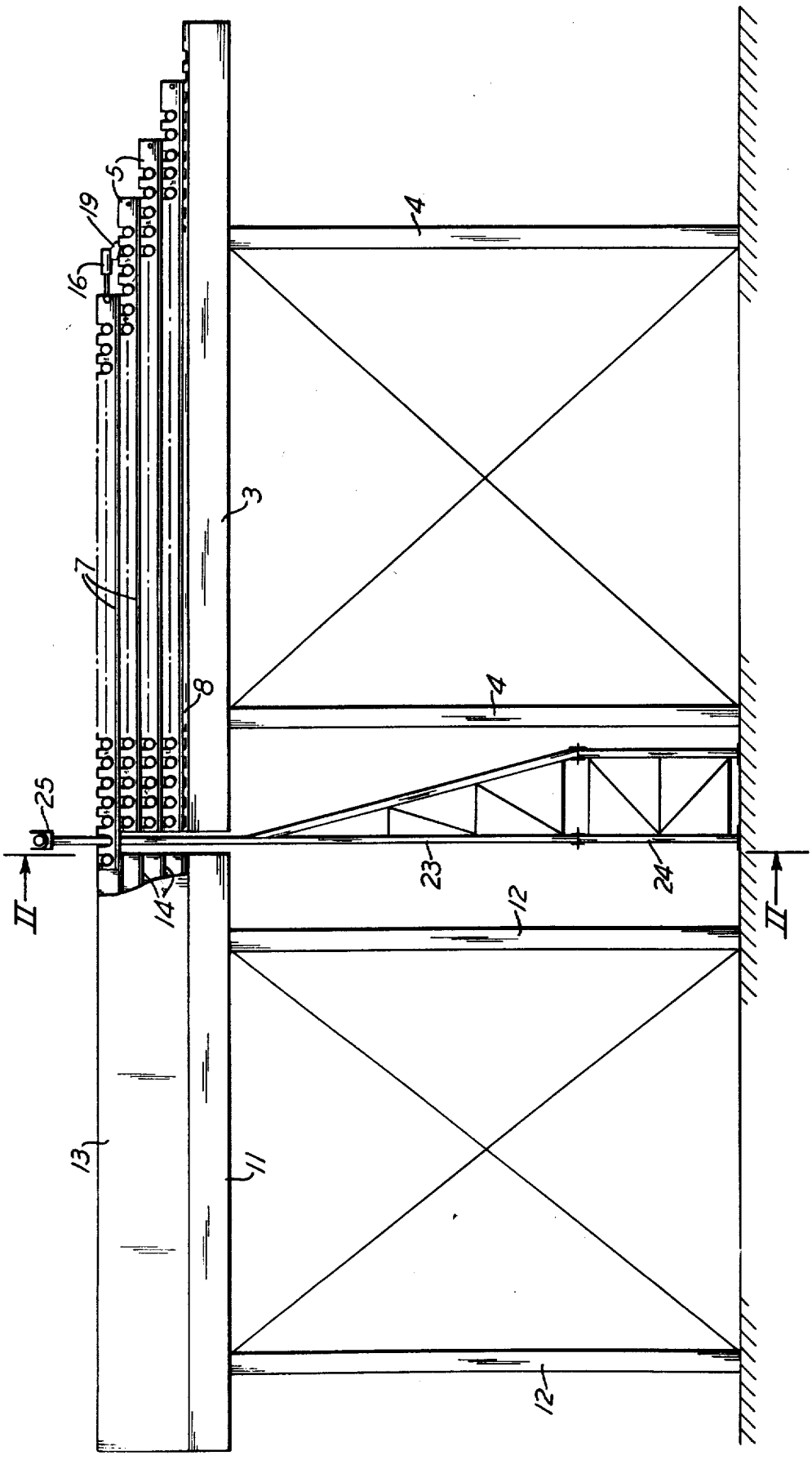


Fig. 1

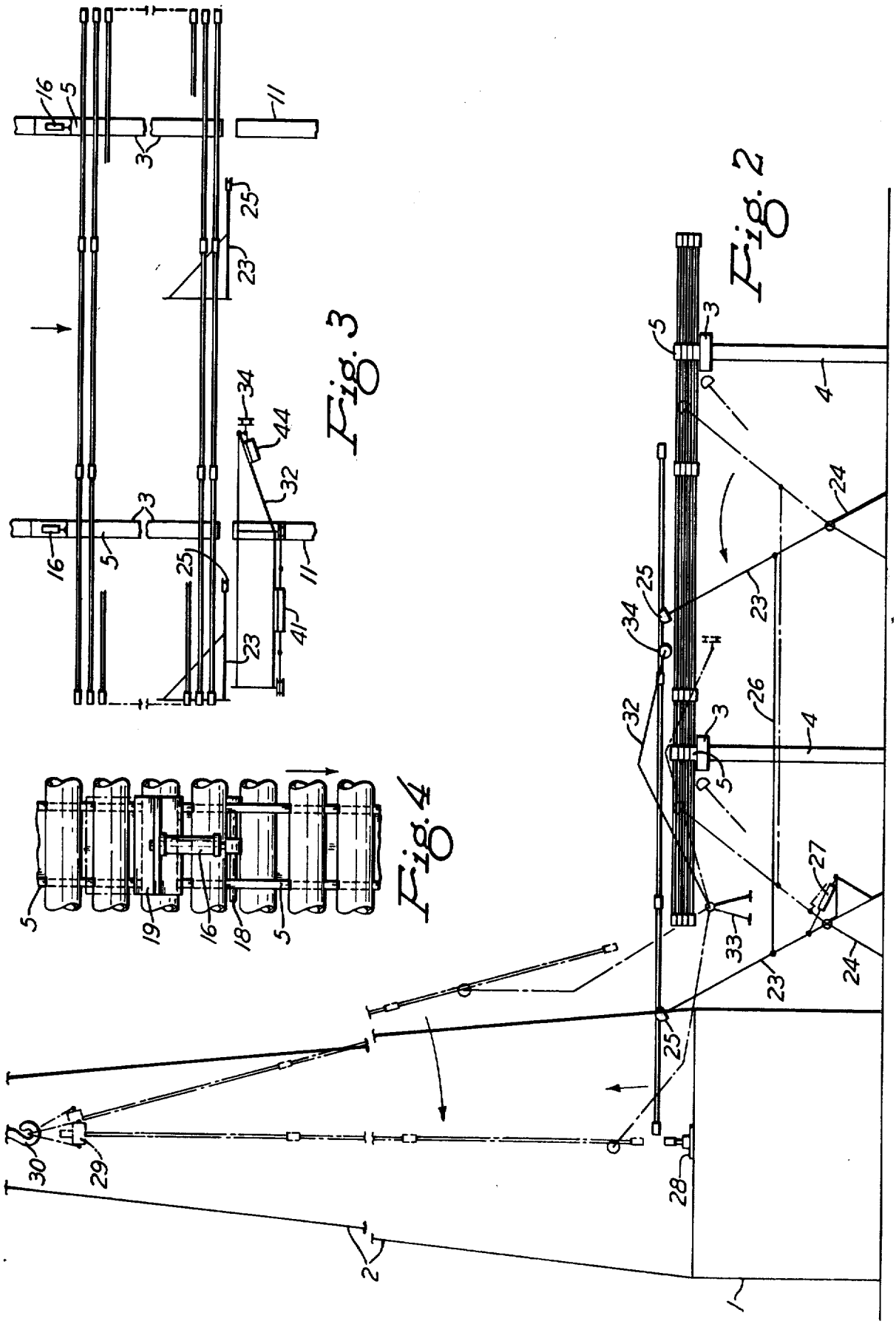


Fig. 2

Fig. 3

Fig. 4

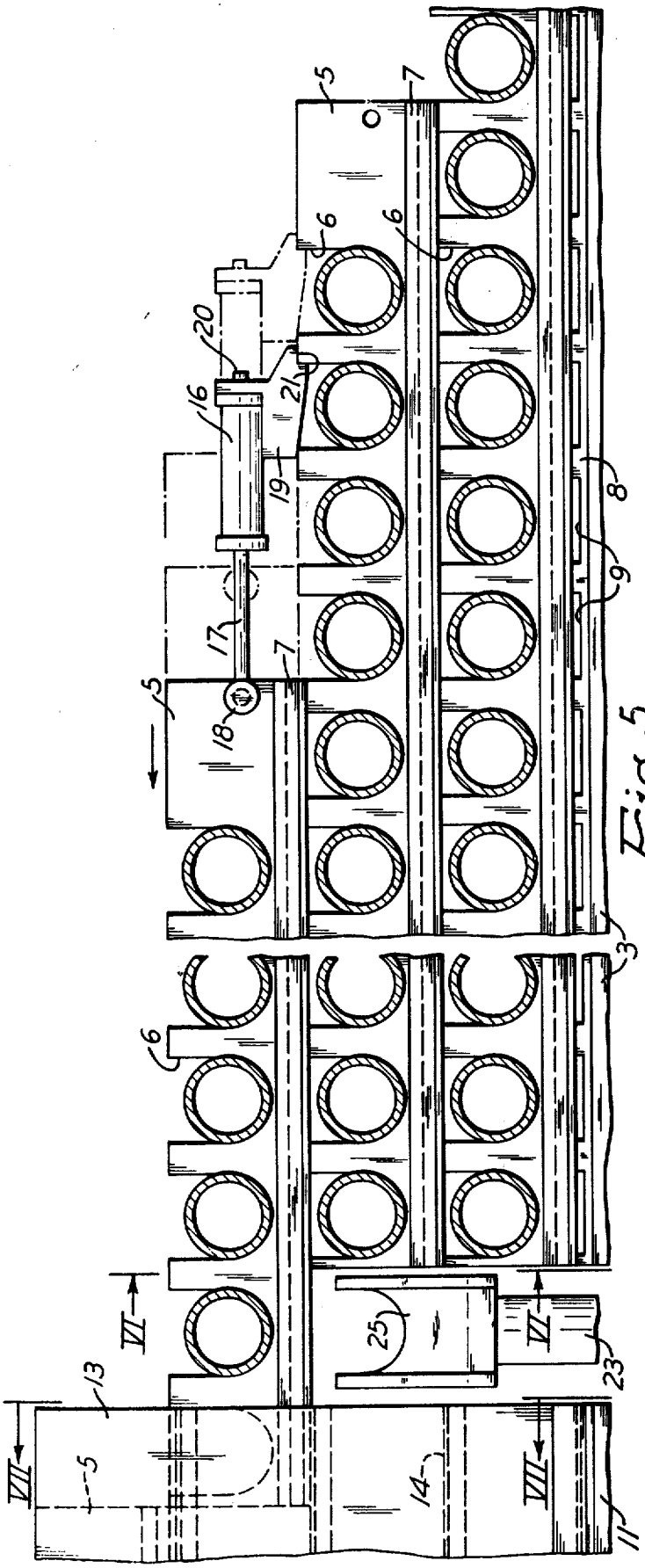


Fig. 5

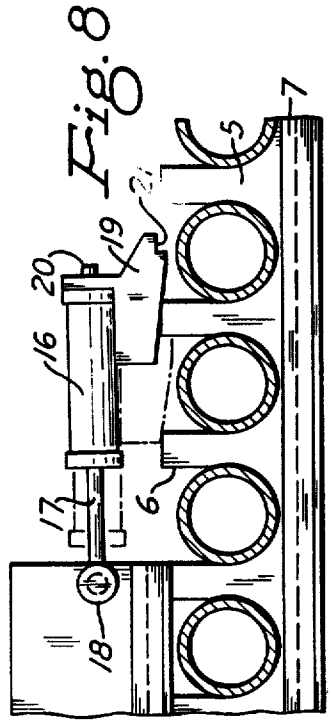


Fig. 8

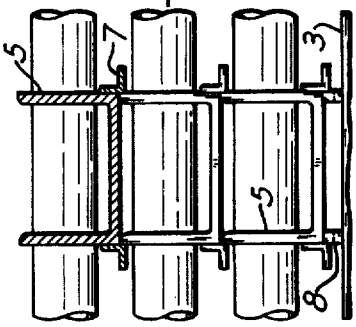


Fig. 6

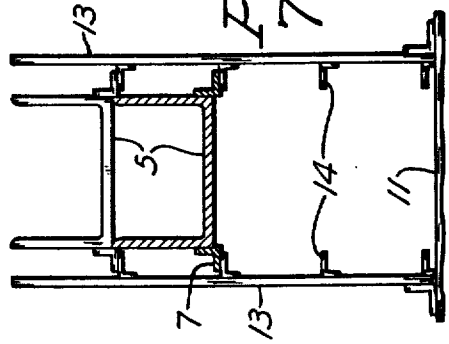


Fig. 7

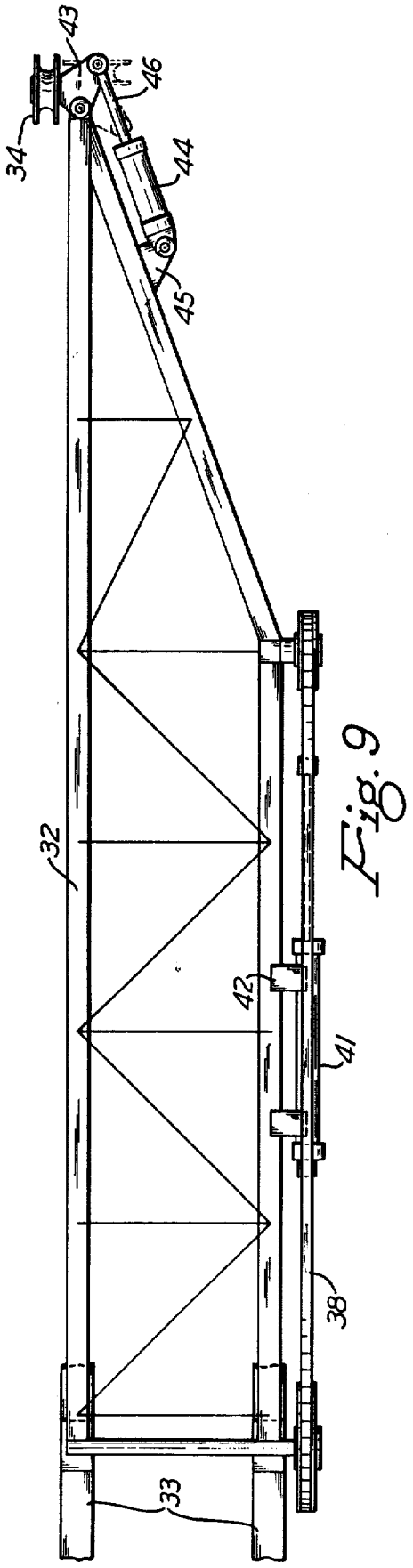


Fig. 9

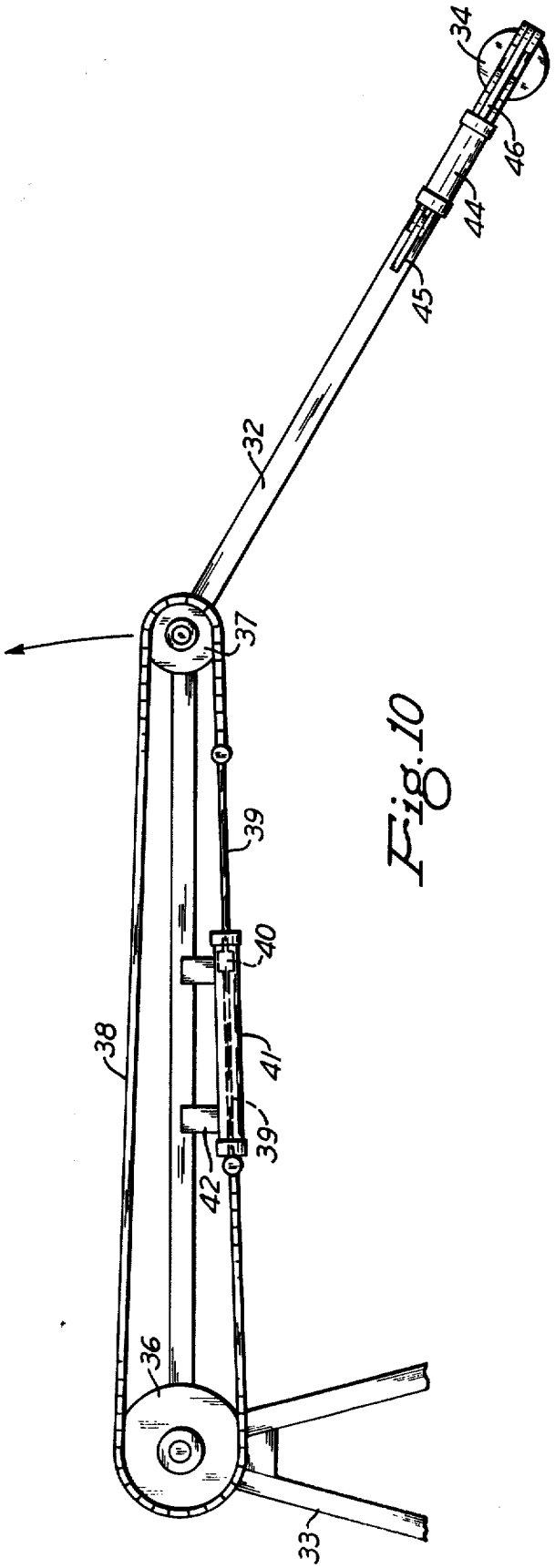


Fig. 10

PIPE RACKER

In U.S. Pat. No. 3,613,905 a boom is shown for swinging pipe up from a horizontal rack to a vertical position in an oil well derrick with the aid of a line hung in the derrick. A strongback pivoted to the outer end of the boom is clamped onto the pipe during the operation and is above the pipe on the rack. U.S. Pat. No. 3,633,771 shows a similar arrangement, but the boom is hinged so that the horizontal pipe held by the strongback can first be lifted from the rack and moved endwise over the derrick floor before the entire boom is swung upwardly. Both systems perform satisfactorily, but it is among the objects of this invention to provide another way of racking pipestands, horizontally beside an oil well mast or derrick, which does not require a strongback, which permits each successive stand to be lifted from below, which controls the position of the trailing or lower end of a pipestand as its leading end is being lifted in the derrick, which can accommodate a large number of pipestands and index each one in succession into position to be moved into the derrick, and which permits pipestands to be quickly laid down on or removed from the rack.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a side view of the pipe rack;

FIG. 2 is a reduced view taken on the line II—II of FIG. 1 and also showing an oil well derrick;

FIG. 3 is a fragmentary plan view of the pipe rack shown in FIG. 2;

FIG. 4 is an enlarged fragmentary plan view;

FIG. 5 is an enlarged fragmentary side view of the rack 15 after the upper row of pipestands has been removed;

FIG. 6 is a fragmentary vertical section taken on the line VI—VI pf FIG. 5;

FIG. 7 is a cross section taken on the line VII—VII of FIG. 5;

FIG. 8 is a fragmentary side view showing the indexing device in an intermediate position;

FIG. 9 is an enlarged plan view of the steady arm shown in FIGS. 2 and 3; and

FIG. 10 is a side view of the steady arm.

Referring to FIGS. 1, 2, and 3 of the drawings, located beside the substructure 1 of an oil well derrick 2 or drilling mast is a pipe rack that includes a pair of spaced parallel beams 3 parallel to the front of the substructure and mounted on top of suitable columns 4. The beams are located at one side of a vertical plane that is perpendicular to the front of the substructure and that pass through the center line of the well. Extending along the top of each beam and supported by it is an elongated tray 5 for supporting horizontally disposed pipestands, which may be single pipes or two or more coupled end to end. As shown in FIGS. 5 and 6, each of these trays preferably is in the form of a channel, the side flanges of which are provided with upwardly opening recesses 6 spaced apart uniformly along the length of the channel. The recesses are wide enough to receive the pipestands that are laid across the trays, and deep enough to maintain the top of the pipes below the top of the trays. With the arrangement shown, the pipestands are supported by two trays and are disposed parallel to one another with spaces between them. In order to provide for racking a large number of pipestands, several of the pipe trays are disposed upon one another, whereby several layers of

pipestands can be supported by the pipe rack. The trays at the different levels are of different lengths; the uppermost trays being the shortest and the bottom trays the lowest, as shown in FIG. 1.

To hold the trays on each beam in vertical alignment, angle bars 7 are welded to their opposite sides and extend downwardly below them to overlap the sides of the underlying trays, as shown in FIG. 6. The angle bars on the bottom tray overlap a pair of laterally spaced bars 8 secured to the underlying beam. The bottom tray rests on bars 8. The upper portions of these two bars are provided with recesses 9 (FIG. 5) directly below the the recesses 6 in the bottom tray. Each tray is movable lengthwise relative to the one supporting it, and the bottom tray is movable along bars 8. This movement is accomplished by indexing means that slide the trays forward across the transfer zone one step at a time as will be described presently.

Spaced a short distance away from the pipe rack across the transfer zone are means for receiving the trays as they are indexed across the transfer zone. As shown in FIGS. 1, 5, and 7, this receiving means may likewise include horizontal parallel beams 11 mounted on top of columns 12, with each beam supporting a pair of laterally spaced side walls 13, the inner surfaces of which are provided with horizontal ledges 14 on which the angle bars 7 on the trays slide as the trays are moved forward between the walls.

In removing pipestands from the rack, the pipes in the upper row are removed first. Therefore, it is the upper pair of trays that are first indexed across the transfer zone and onto the upper ledges 14 of the tray receivers. This indexing can be accomplished in different ways, but preferably by means of a fluid pressure cylinder 16 behind each upper tray and provided with a piston rod 17 extending forward and pivotally mounted on a removeable horizontal pin 18 extending through the rear end of the adjacent tray (FIG. 4). As shown in FIGS. 5 and 8, the rear end of the cylinder is supported by a ratchet block 19 secured to the back of the cylinder by a heavy screw 20. The block has a notch 21 extending across the bottom of its rear end. When the front end of the upper tray is in alignment with the trays below, the ratchet block 19 extends a short distance down into the pipe-receiving recess 6 at the rear end of the underlying tray, which is longer than the upper tray, and the vertical wall of notch 21 engages the rear wall of the recess. By delivering fluid under pressure to the rear end of the cylinder, its piston is moved ahead to cause piston rod 17 to push the upper tray forward. Fluid pressure then is released from the back of the piston and applied in front of it, which causes the cylinder to move forward on the piston rod and drag the ratchet block forward along the underlying tray until the rear wall of the next recess is received in the block notch. When fluid pressure again is applied to the rear end of the cylinder, the upper tray is indexed forward again to bring the first pipestand into the transfer zone. This action of cylinder 16 in moving a tray that is next to the top tray is illustrated in FIGS. 5 and 8, and is continued until the entire tray has been pushed across the transfer zone.

As soon as the pipestand arrives at its transfer zone, as shown in FIG. 1, it is lifted out of its supporting trays and moved forward until its leading end is more of less above the well in the derrick as shown in FIG. 2. This movement is accomplished by a pair of parallel transfer

arms **23**, the lower ends of which are pivotally mounted on parallel axes on suitable supports **24** below the transfer zone. The two arms extend up into the space between the pipe rack and the tray receivers and normally are inclined away from the derrick as shown in dotted lines in FIG. **2**. The upper end of each arm supports a shoe **25** provided with an arcuate groove for accommodating a pipestand. The two arms are connected together by a long link **26** pivotally connected to them so that when one of the arms is swung toward the derrick by a fluid pressure cylinder **27**, the other arm will move with it. This swinging of the transfer arms moves their shoes up into engagement with the bottom of the pipestand in the transfer zone and lifts it from its trays and then carries it forward until its leading end is above the rotary table **28** in the derrick. That position of the leading end is referred to herein as the elevating position because, while supported in that position, the usual elevators **29** hanging from the traveling block **30** in the derrick are connected with the underlying end of the pipestand and then are drawn upwardly in the derrick to lift the pipe from the arm closet to the derrick.

At about the same time as the transfer arms lift the pipestand from its trays, a steady arm **32** is engaged with the pipestand to control the movement of its trailing or lower end as its upper end is elevated in the derrick. As shown in FIG. **2**, the steady arm has one end pivoted on a horizontal axis on a support **33** adjacent the substructure. The arm normally extends from this support towards the opposite end of the pipes on the rack. That is, the arm is inclined upwardly past the pipes and over the nearest tray receiver and then slopes downwardly toward the outer transfer arm. The outer end of the steady arm is provided with means **34** for engaging the bottom of the pipestand supported by the transfer arms so that swinging of the lower end portion of the pipestand toward the center of the derrick is controlled by the steady arm as the latter is slowly swung upwardly and then down to its dotted line position over the substructure. This movement of the steady arm can be accomplished as shown in FIGS. **9** and **10**, by mounting a stationary sprocket **36** at its pivoted end and mounting a rotary sprocket **37** at the point where the two sections of the arm meet at an angle. A chain **38** extends around the two sprockets and has its opposite ends connected to the outer ends of a pair of piston rods **39** secured to the opposite ends of a piston **40** in a fluid pressure cylinder **41** supported by brackets **42** attached to the steady arm. When fluid pressure is admitted to the right-hand end of this cylinder, the cylinder will tend to move to the right relative to the piston and this action will cause the arm to swing upwardly and over and down toward the substructure. Reversing the fluid pressure in the cylinder will return the steady arm to its original position.

In order to permit the steady arm to engage and disengage the pipestand, the means **34** by which it engages the pipe is a vertical wheel rotatably mounted on a bracket **43** that is pivoted to the outer end of the steady arm so that the wheel can be swung from a position where its axis is at right angles to the arm as shown in full lines in FIG. **9**, to a position 90° away as shown in dotted lines. This swinging of the bracket is accomplished by a fluid pressure cylinder **44**, one end of which is pivotally connected to a bracket **45** secured to the arm. The outer end of the piston rod **46** projecting from the cylinder is pivotally connected to the bracket **43**. As the piston rod is moved in and out of the cylinder, the bracket and wheel will be moved from one position to the other.

After the two top trays have been moved completely across the transfer zone and into the tray receivers, the indexing cylinders are disconnected from the top trays and attached to the rear ends of the trays in the next layer, which then support the top layer of pipestands.

This second layer of trays then is indexed across the transfer zone as each successive pipestand is lifted from it by the transfer arms **23**. When the indexing cylinders are finally attached to the lowest pair of trays, the ratchet blocks **19** on the cylinders engage the rear walls of the recesses **9** in bars **8** that support those trays, so that the bottom trays can be indexed across the transfer zone in the same manner as the other trays.

In the operation of coming out of the hole, the pipestands are first laid down on the lowest pair of trays, followed by each successive overlying pair. To receive the pipestands, the bottom trays must be indexed out of the receivers and onto bars **8** on the pipe rack beams. Before this can be done, the ratchet blocks on the indexing cylinders **16** are removed and turned around and then reattached to the cylinders by screws **20** so that when fluid under pressure is delivered to the rod ends of the cylinders the blocks will be pulled into engagement with the front walls of the underlying recesses **9** and then the piston rods will pull the trays a step at a time out of the tray receivers. After each step a pipestand is laid down in the tray recesses that are at the transfer zone. This is done by swinging the steady arm over the substructure and then swinging its retracted wheel **34** out behind the pipestand that is suspended from the traveling block. The steady arm then is swung slowly toward the pipe rack as the upper end of the suspended pipestand is lowered. This movement continues until the pipestand reaches a horizontal position resting on the shoes **25** on the upper ends of the transfer arms. After the wheel of the steady arm has been swung away from the pipestand and the latter has been disconnected from the elevators, the transfer arms are swung away from the substructure to carry the reclining pipestand out away from substructure and lower it into a pair of recesses **6** in the trays that are waiting to receive it. These trays are then indexed a step over the pipe rack and the operation is repeated with the next pipestand, and this is continued until all of the pipestands have been laid down on the trays.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A pipe racker comprising laterally spaced elongated trays for supporting transversely thereof a plurality of parallel reclining pipestands at one side of a transfer zone, means for indexing said trays lengthwise across said transfer zone, transfer means for lifting each successive pipestand at said transfer zone from said members and moving it lengthwise a predetermined distance to locate its leading end at an elevating position in an oil well derrick, a steady arm normally extending lengthwise of the pipestands adjacent said transfer zone, means pivoting the end of said arm that

is nearest said elevating position on a transverse horizontal axis, means connected to the other end of the arm for engaging the bottom of each lifted pipestand, and means for then swinging said arm upwardly and over toward said elevating position to control the trailing end of the engaged pipestand while its leading end is being elevated at said elevating position.

2. A pipe racker according to claim 1, including actuating means carried by said steady arm for moving said pipe-engaging means laterally away from a pipestand after said leading end has been elevated to suspend the pipestand in substantially vertical position, whereby the arm can be returned to its original position.

3. A pipe racker according to claim 1, in which said pipe-engaging means is a grooved wheel, and said actuating means include a bracket supporting the wheel and pivoted to said steady arm, and a fluid pressure cylinder and piston connected with the arm and said bracket to swing said wheel laterally away from a pipestand after the stand has been suspended in vertical position.

4. A pipe racker according to claim 1, in which said arm-swinging means include a stationary vertical sprocket at said arm pivoting means, a rotatable vertical sprocket mounted on the steady arm between said stationary sprocket and said other end of the arm, a chain extending around said sprockets, and means mounted on the steady arm and connected with the chain for pulling on it to swing the arm upwardly.

5. A pipe racker according to claim 1, in which said transfer means include a pair of normally inclined parallel arms spaced lengthwise of a pipestand at said transfer zone, means pivotally supporting the lower ends of the transfer arms on parallel axes, means at the upper ends of said transfer arms for engaging the bottom of a pipestand, and means for swinging the transfer arms in unison toward and away from said elevating position.

6. A pipe racker according to claim 1, in which said indexing means include a fluid pressure cylinder and piston rod pivotally connected to the trailing end of each tray and provided with stop means for preventing backward movement of the indexing means when the piston rod is extended from the cylinder, whereby the tray is pushed forward across said transfer zone.

7. A pipe racker according to claim 6, in which there is a plurality of superimposed pipe-supporting trays each of which is provided with longitudinally spaced open-top recesses for receiving pipestands, and said stop means of the indexing means attached to the upper tray projects down into successive recesses in the underlying trays to push against the latter in order to push the upper trays forward.

8. A pipe racker according to claim 1, in which there is a plurality of superimposed pipe-supporting trays slidable along one another, the racker including means for receiving and supporting said trays at the side of said transfer zone opposite said indexing means.

9. A pipe racker according to claim 1, including means for receiving said trays at the side of said transfer zone opposite said indexing means, and said indexing means being reversible for pulling the trays away from said receiving means and back across said transfer zone for receiving at said zone each successive pipestand lowered onto the trays by said transfer means.

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