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(54) **PORTABLE DRILL PIPE HANDLING APPARATUS FOR USE WITH OIL AND GAS WELL DRILLING RIGS**

**Publication Classification**

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(52) **U.S. Cl.** ..... 414/22.61  
(57) **ABSTRACT**

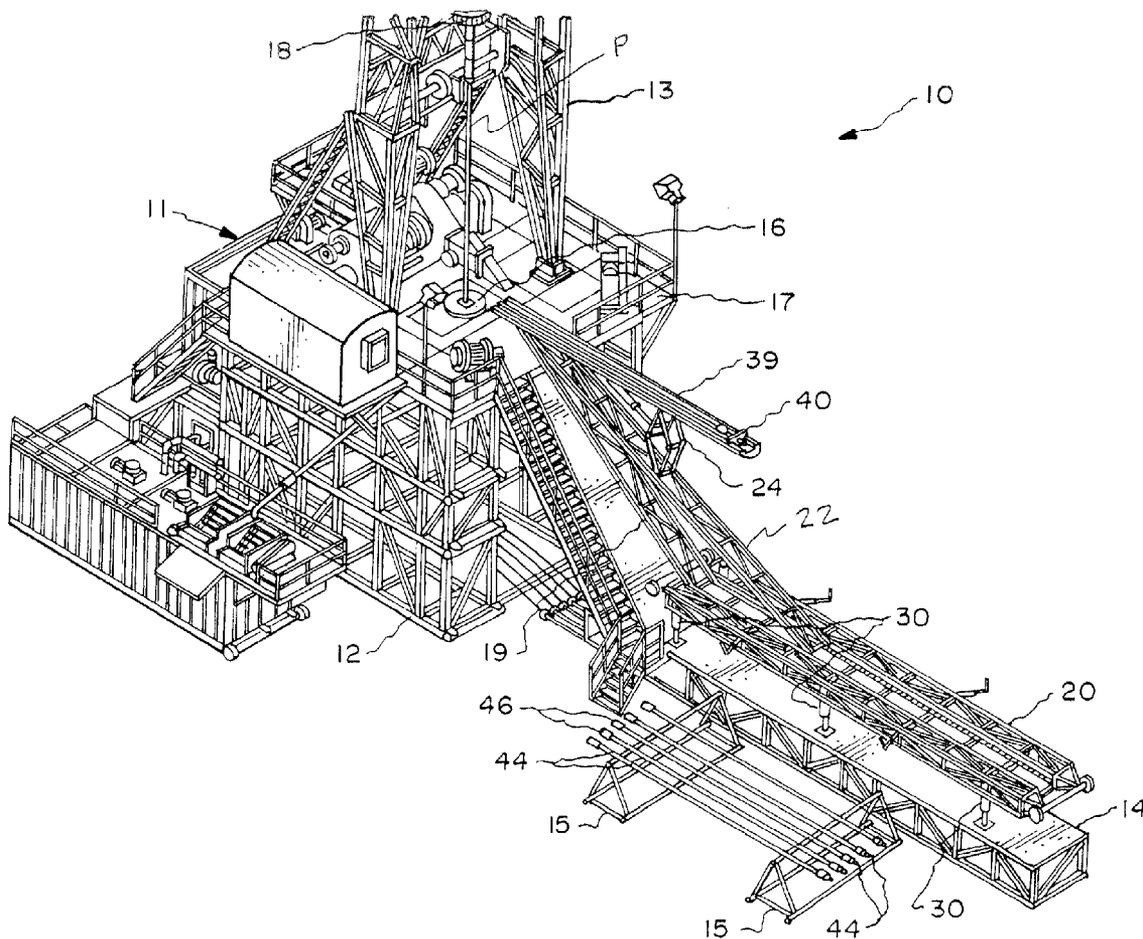
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A pipe handling apparatus transfers successive lengths of drill pipe that are stored in a generally horizontal position on a pipe rack, to an elevated position on the rig deck of an oil and gas well drill rig. An elongated frame includes a base section with a folding section that can be inclined. Both the base and folding sections provide toothed racks. A trestle section travels from the base section toward the inclined section. Pinion gears at opposed end portions of the trestle section engage the toothed racks of the base and folding sections. The trestle section gradually increases in inclination as its front end portion travels toward and up hoisting rails of the inclined folding section. While the rear end of the trestle section remains on the base section, the front end portion of the trestle section climbs the toothed racks of the inclined rails.

(21) Appl. No.: **12/193,309**  
(22) Filed: **Aug. 18, 2008**

**Related U.S. Application Data**

(60) Provisional application No. 60/956,815, filed on Aug. 20, 2007.



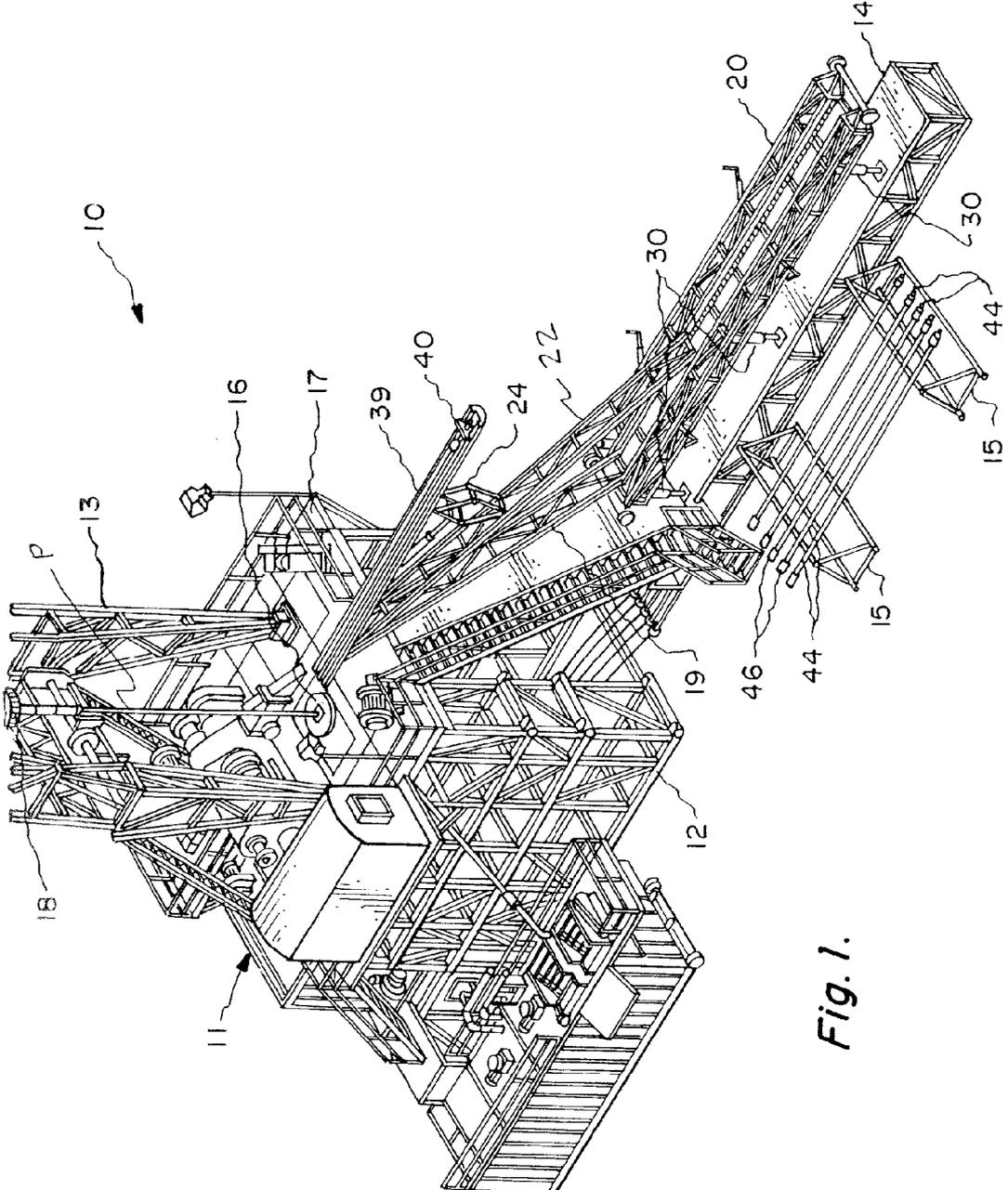


Fig. 1.

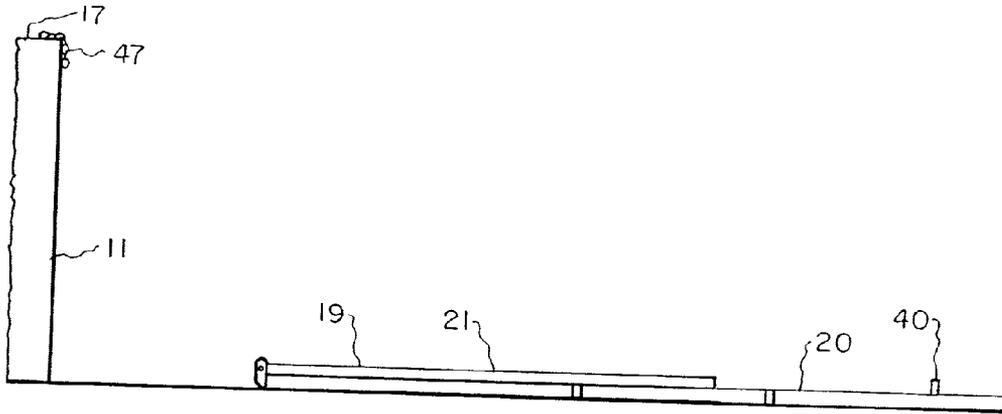


Fig. 2.

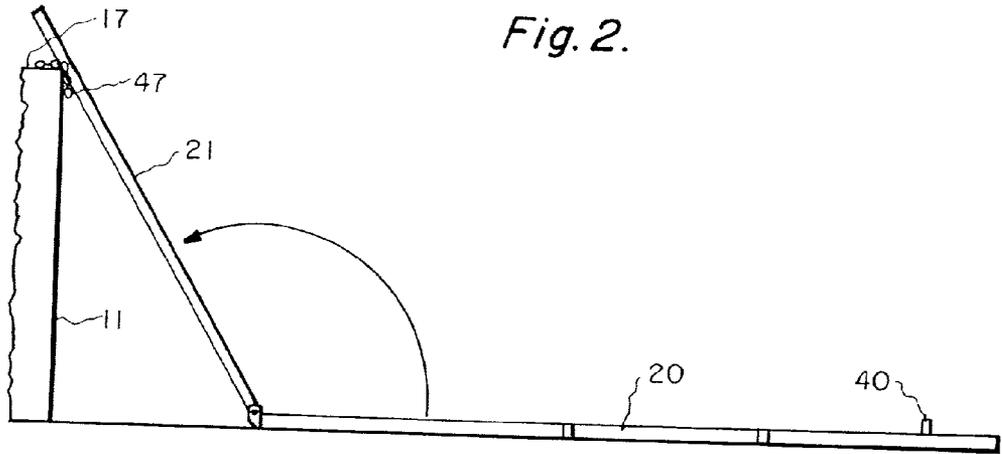


Fig. 3.

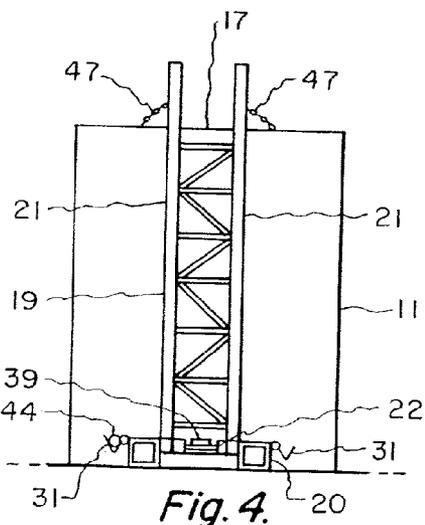


Fig. 4.

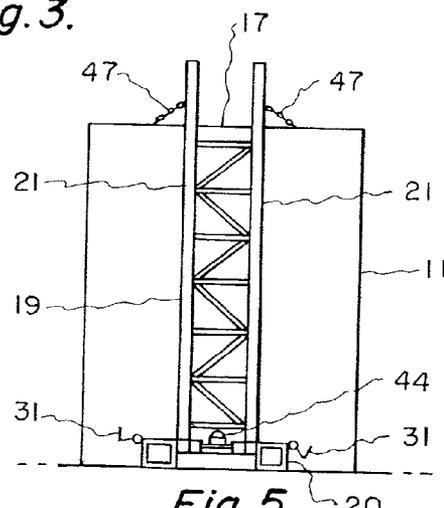


Fig. 5.

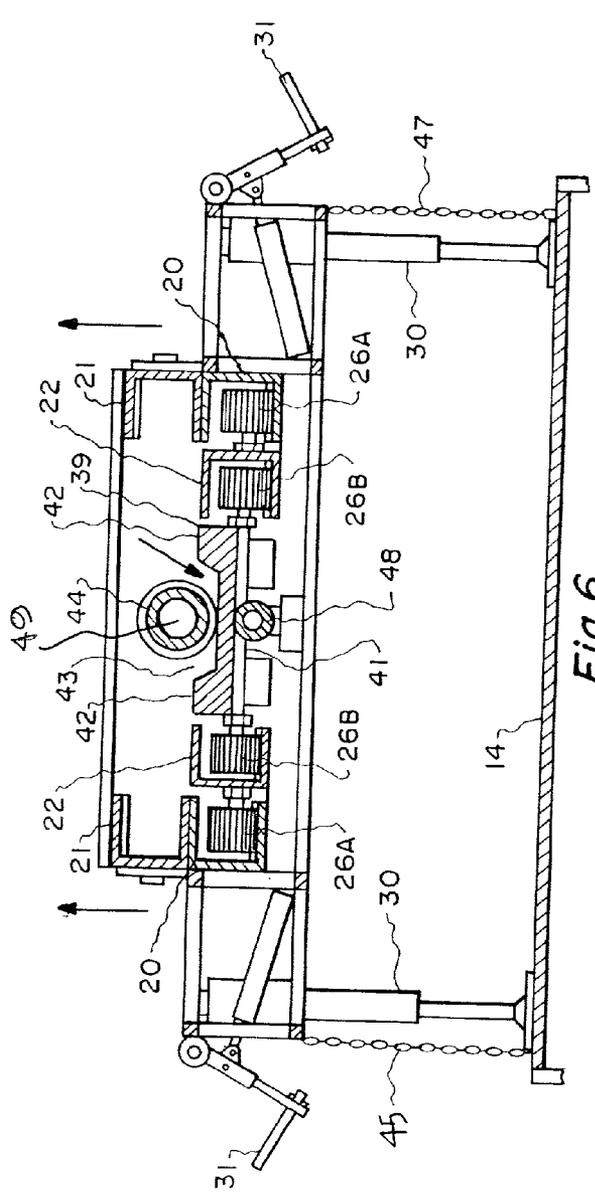


Fig. 6.

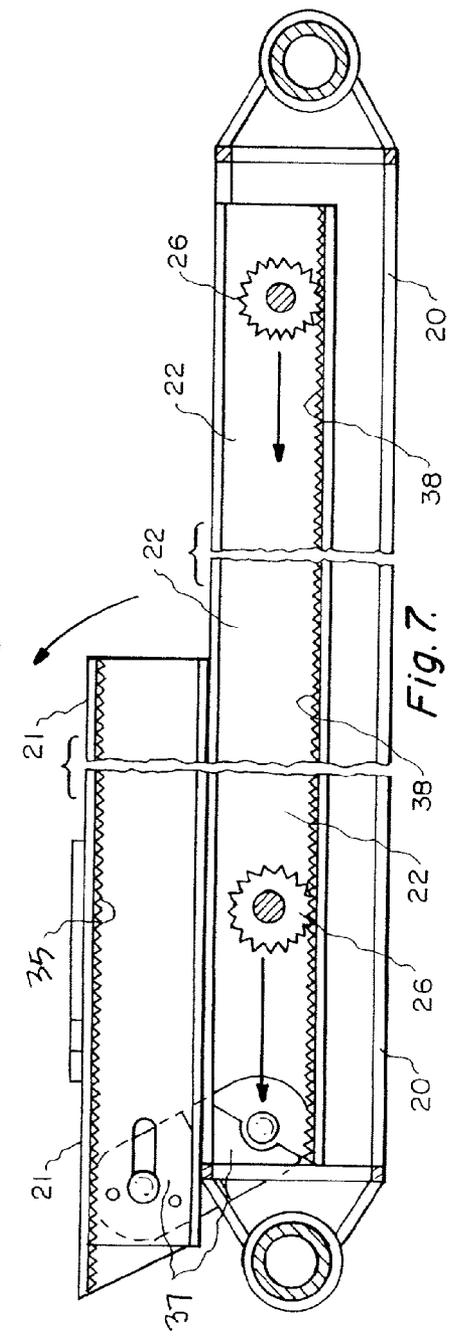


Fig. 7.



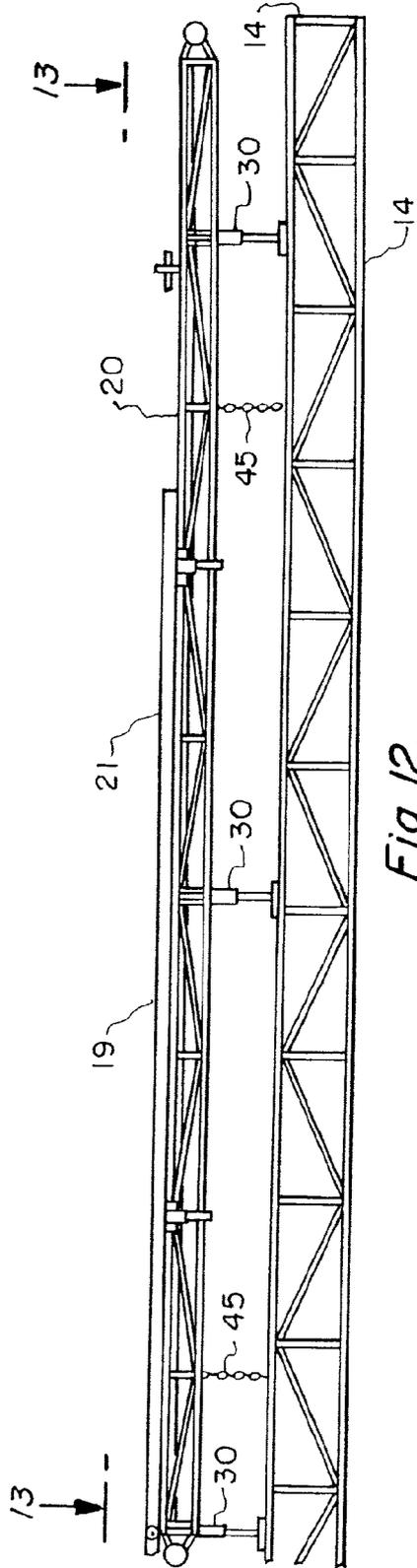


Fig. 12.

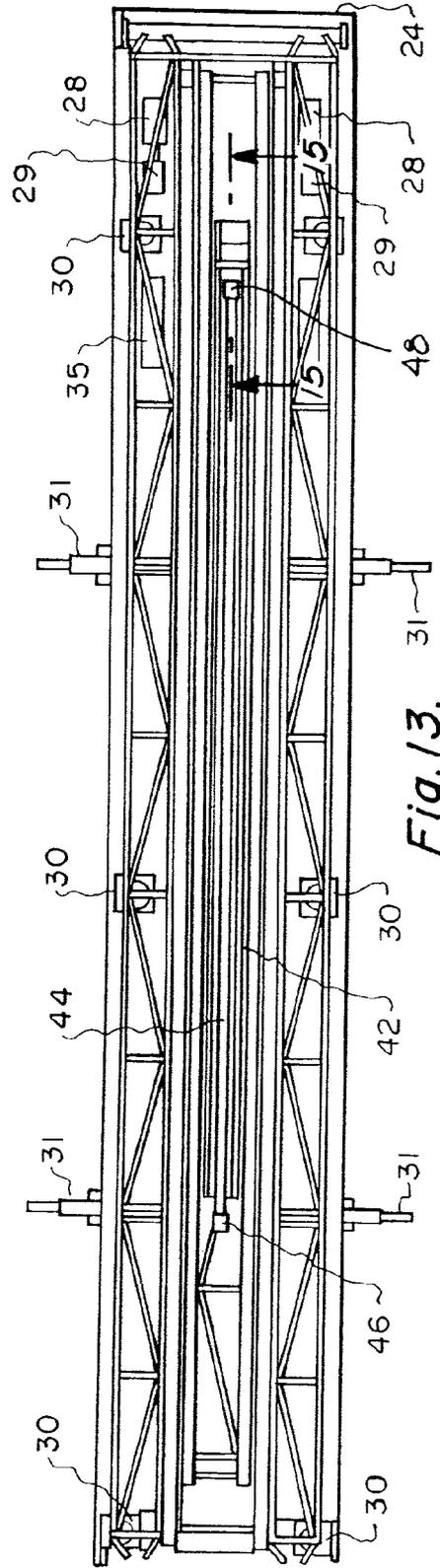


Fig. 13.

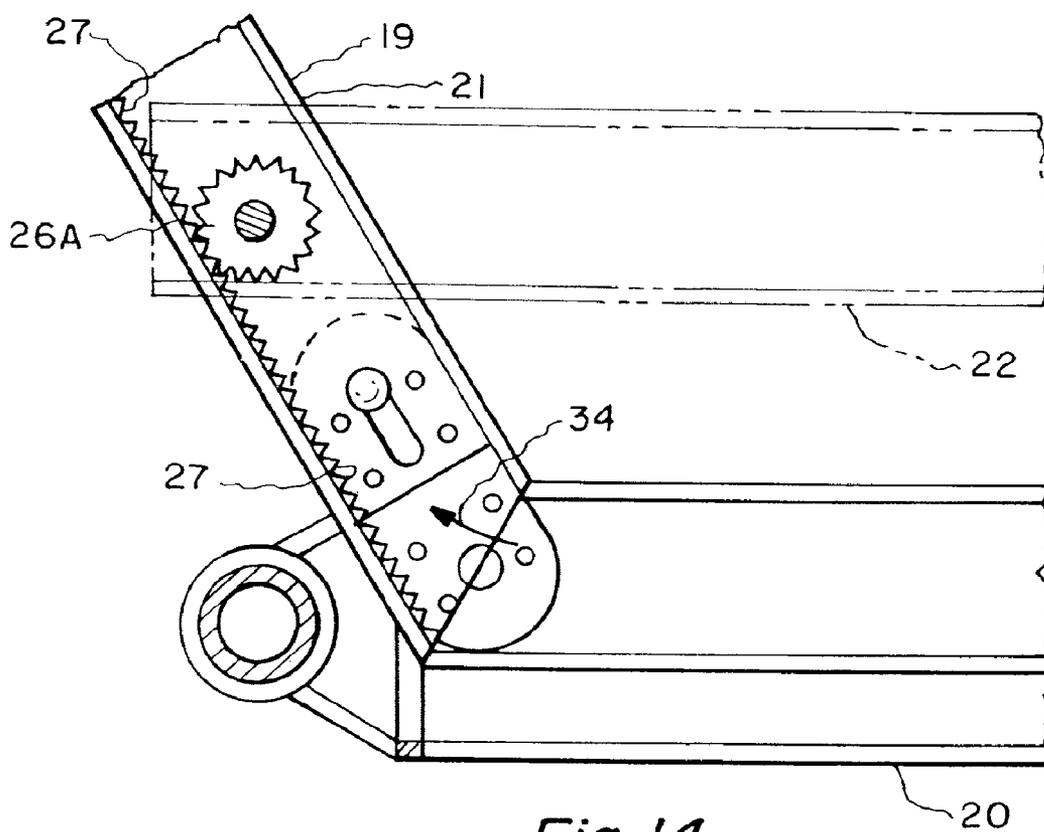


Fig. 14.

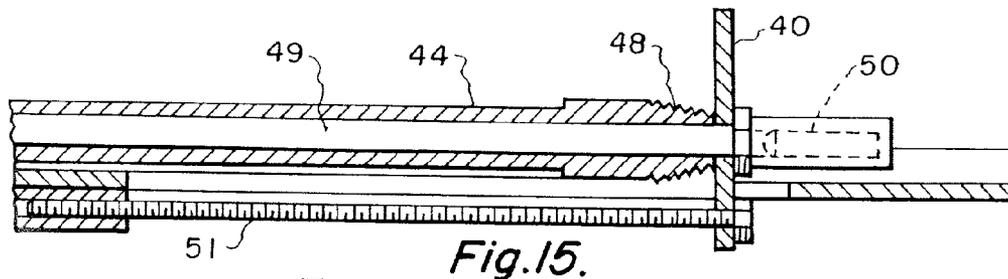


Fig. 15.

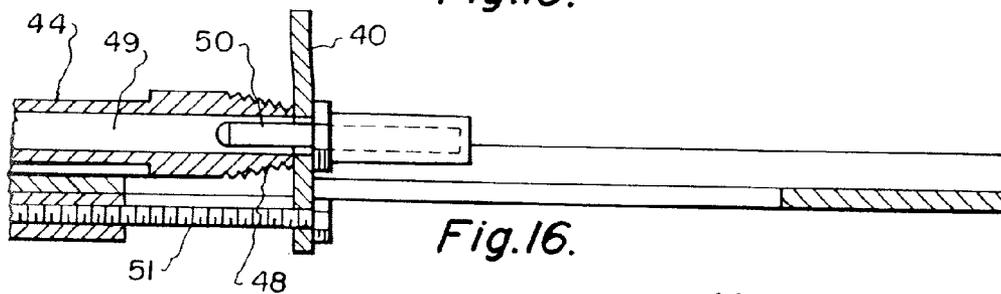


Fig. 16.

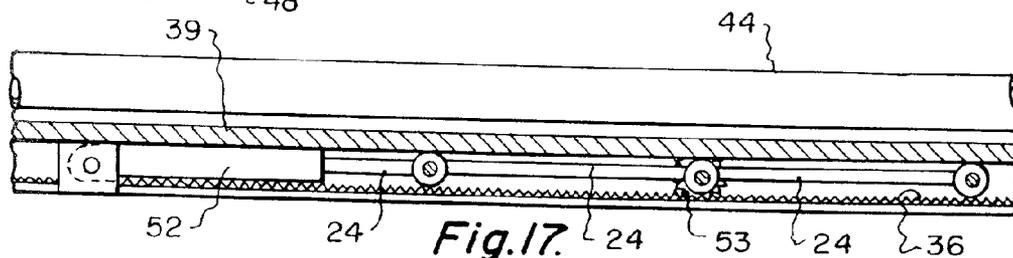


Fig. 17.

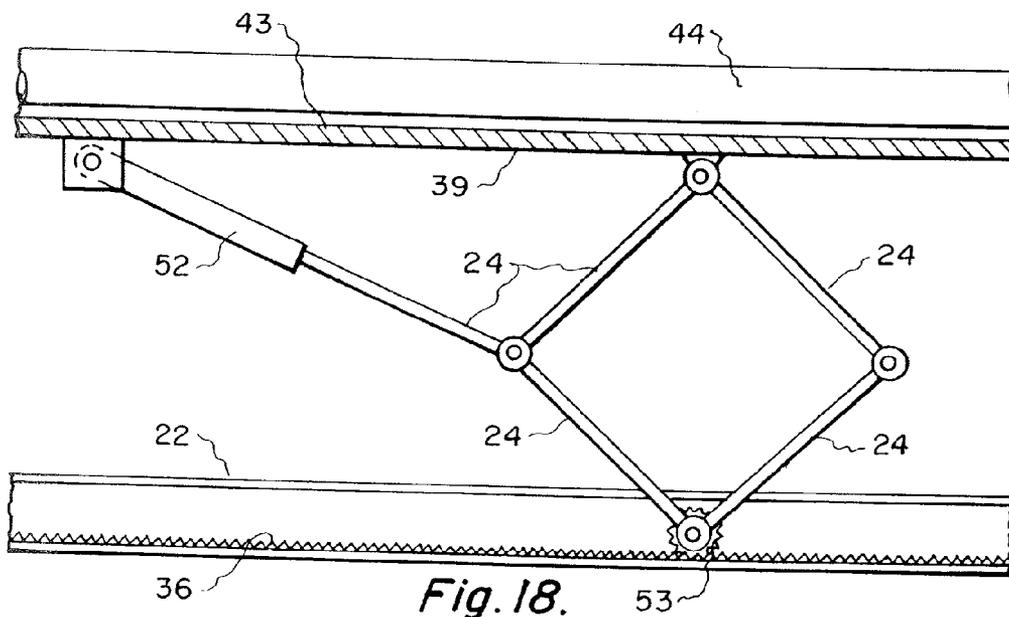


Fig. 18.

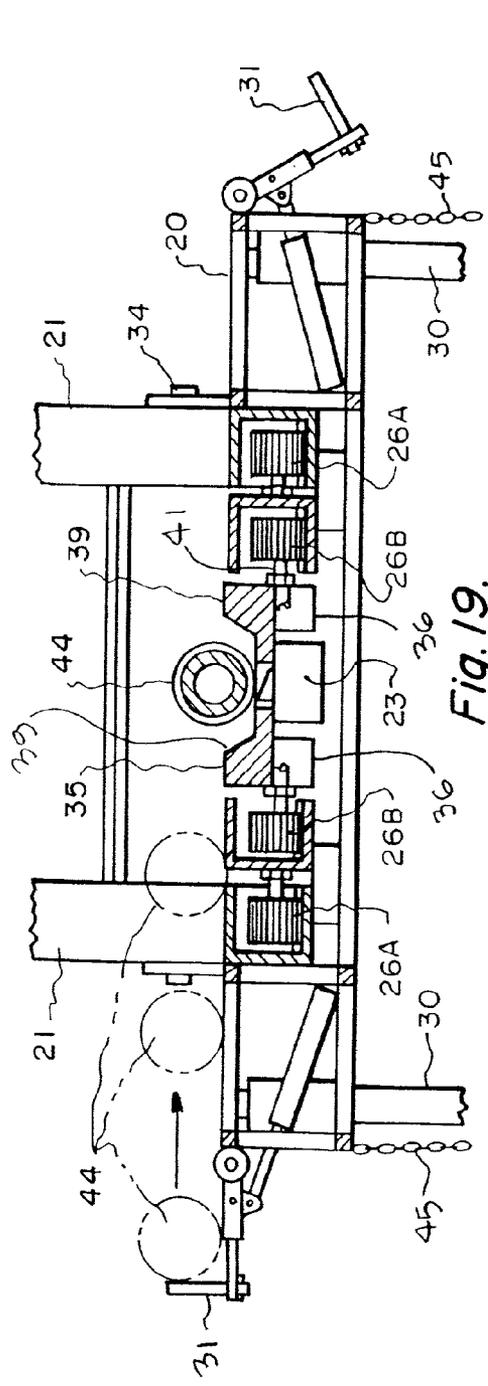


Fig. 19.

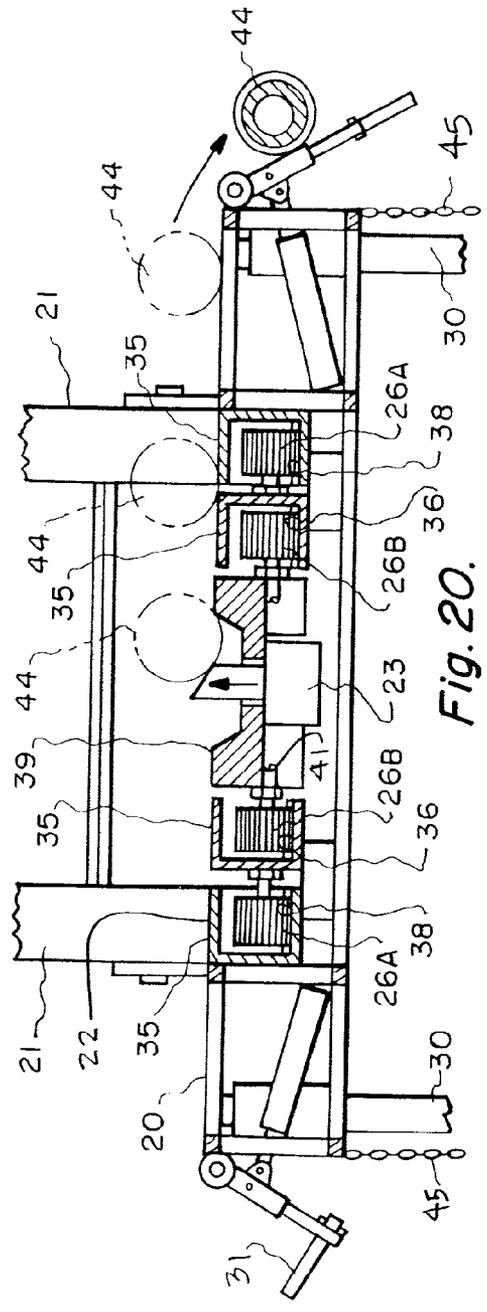


Fig. 20.

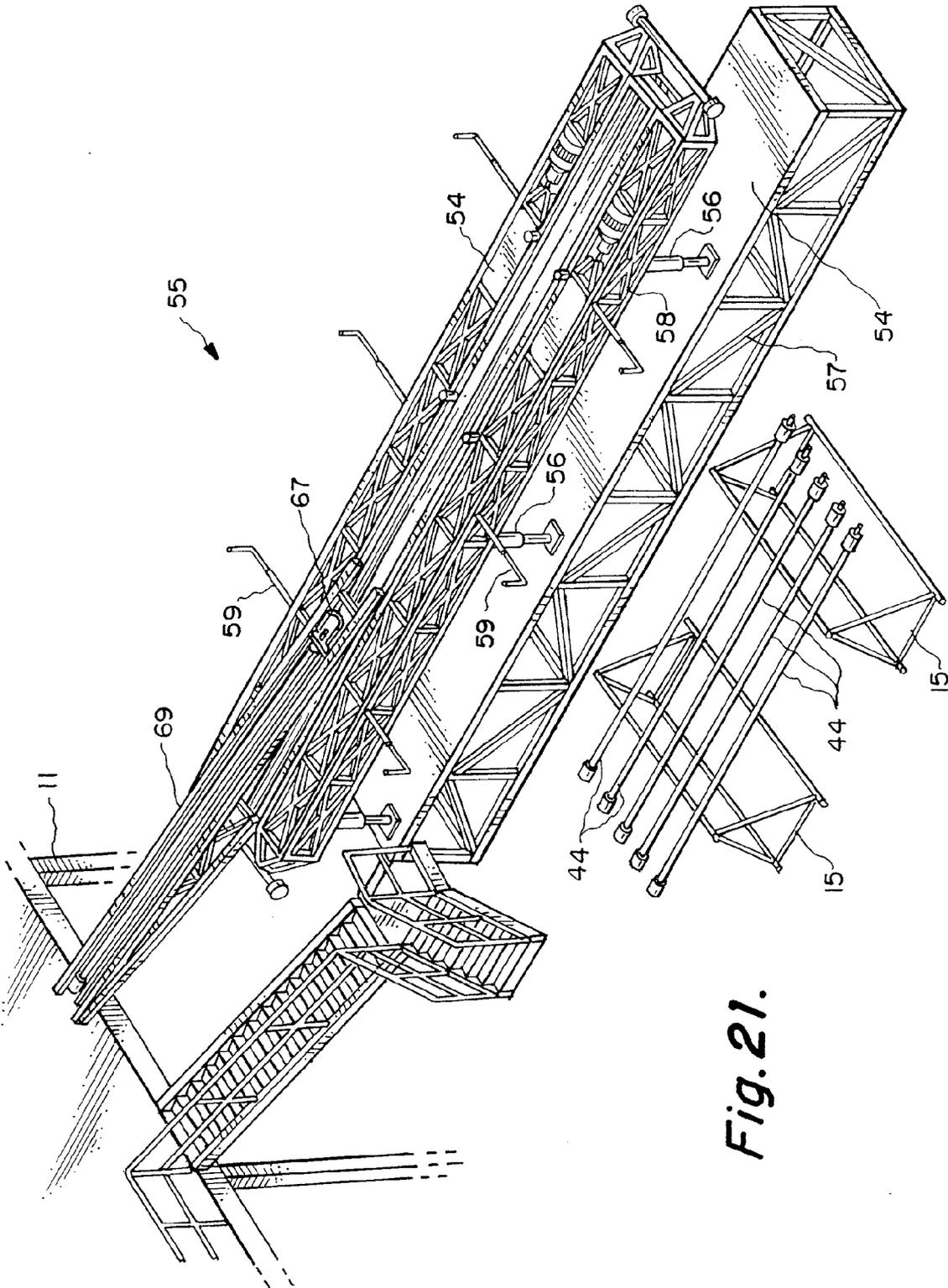
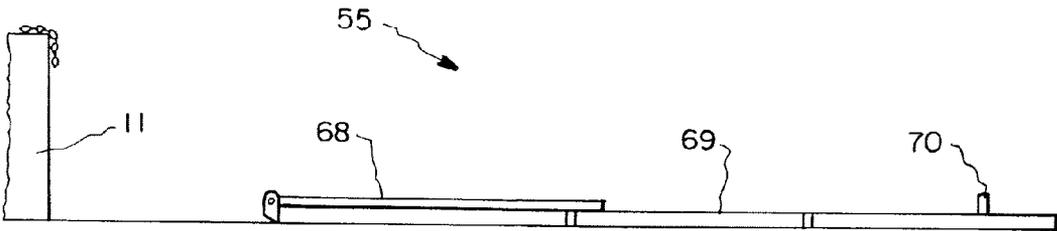
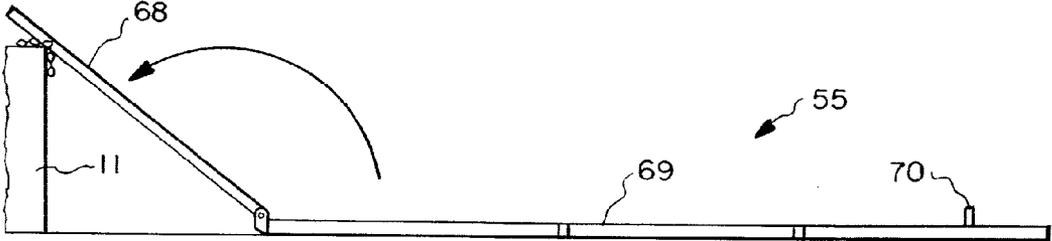


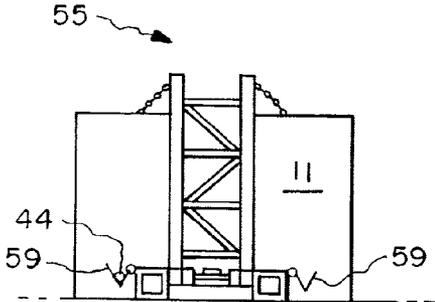
Fig. 21.



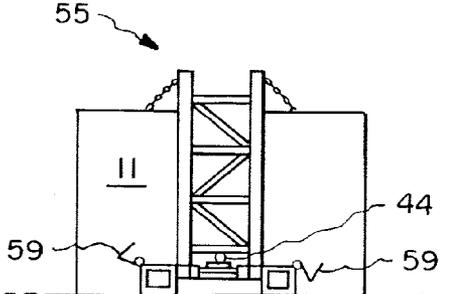
*Fig. 22.*



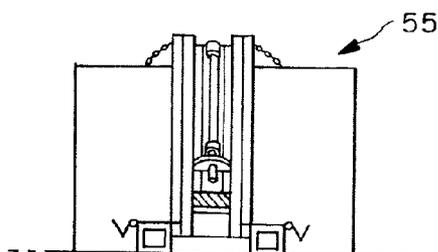
*Fig. 23.*



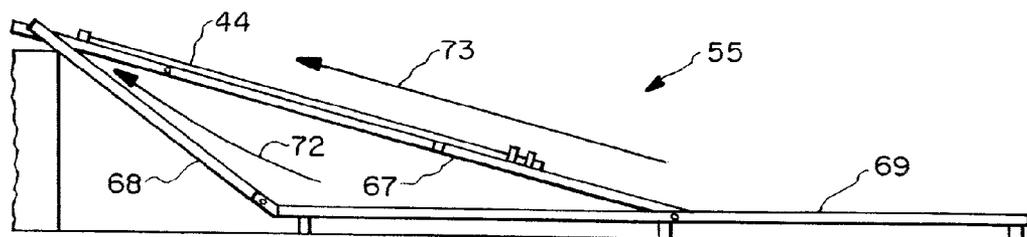
*Fig. 24.*



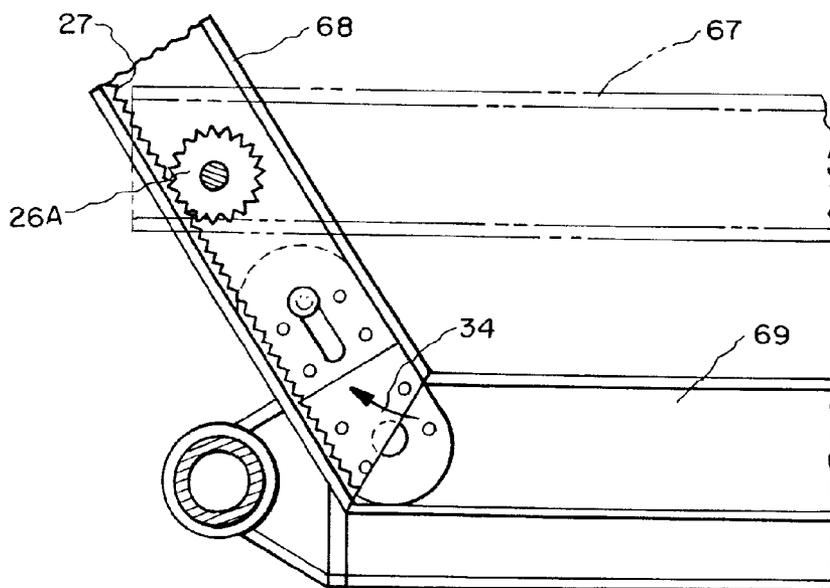
*Fig. 25.*



**Fig. 26.**



**Fig. 27.**



**Fig. 28.**

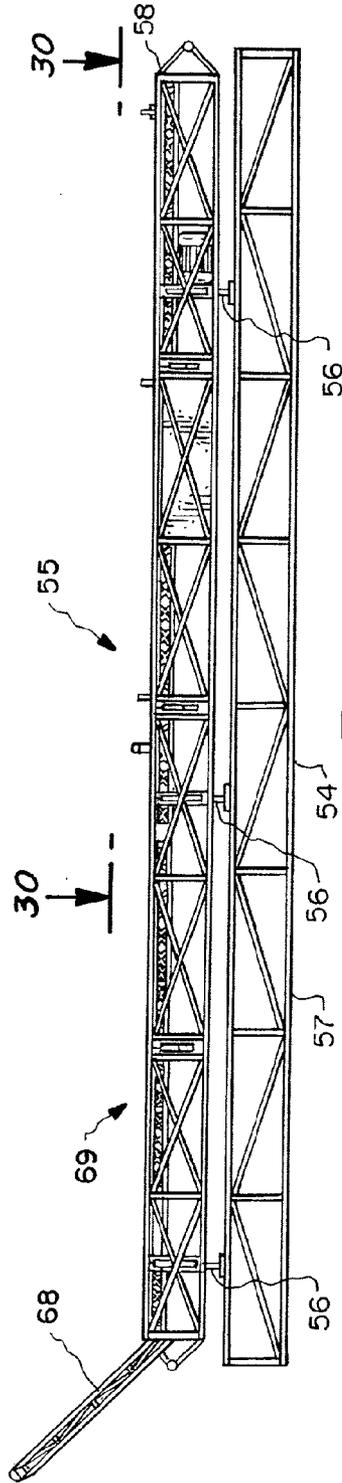


Fig. 29.

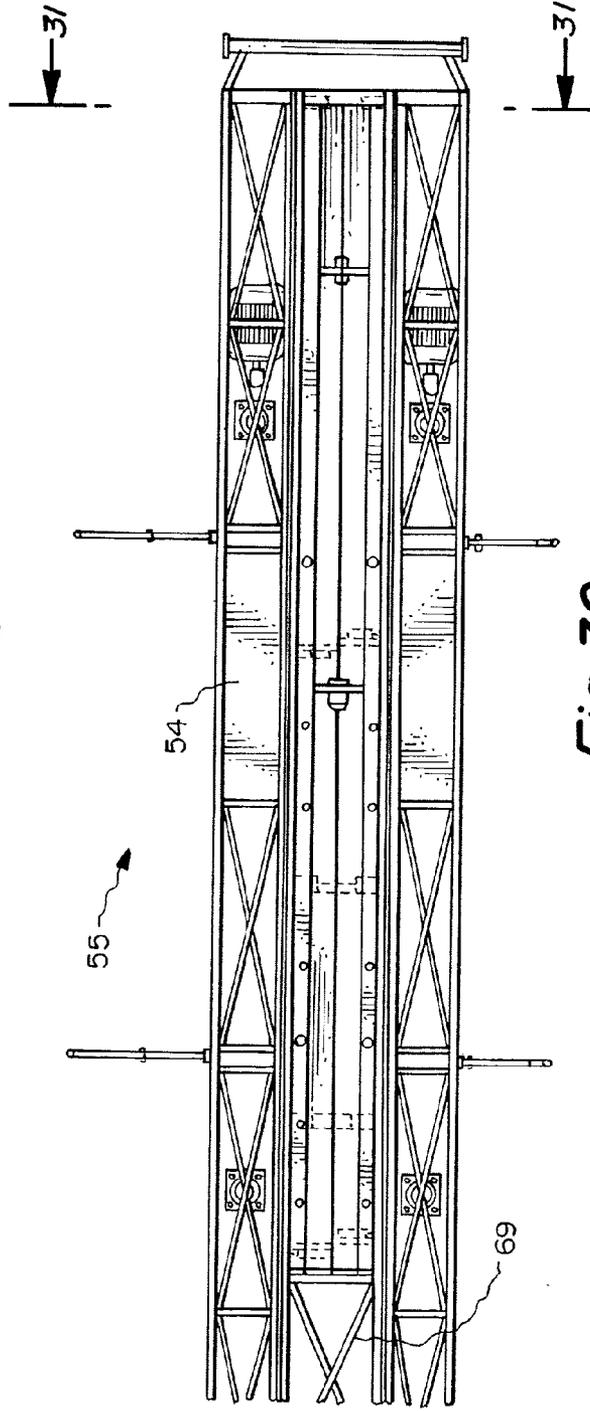


Fig. 30.

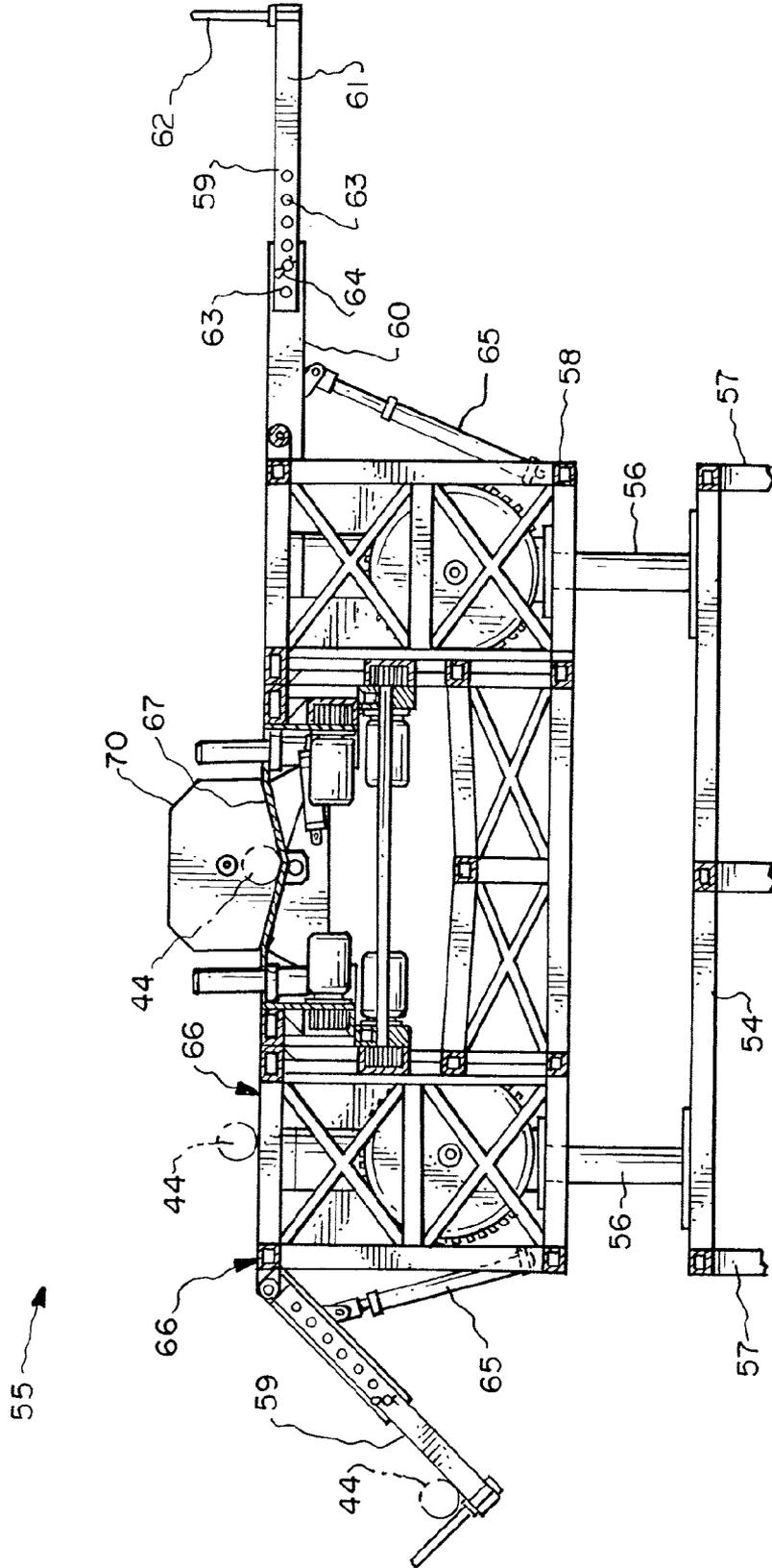


Fig. 31.

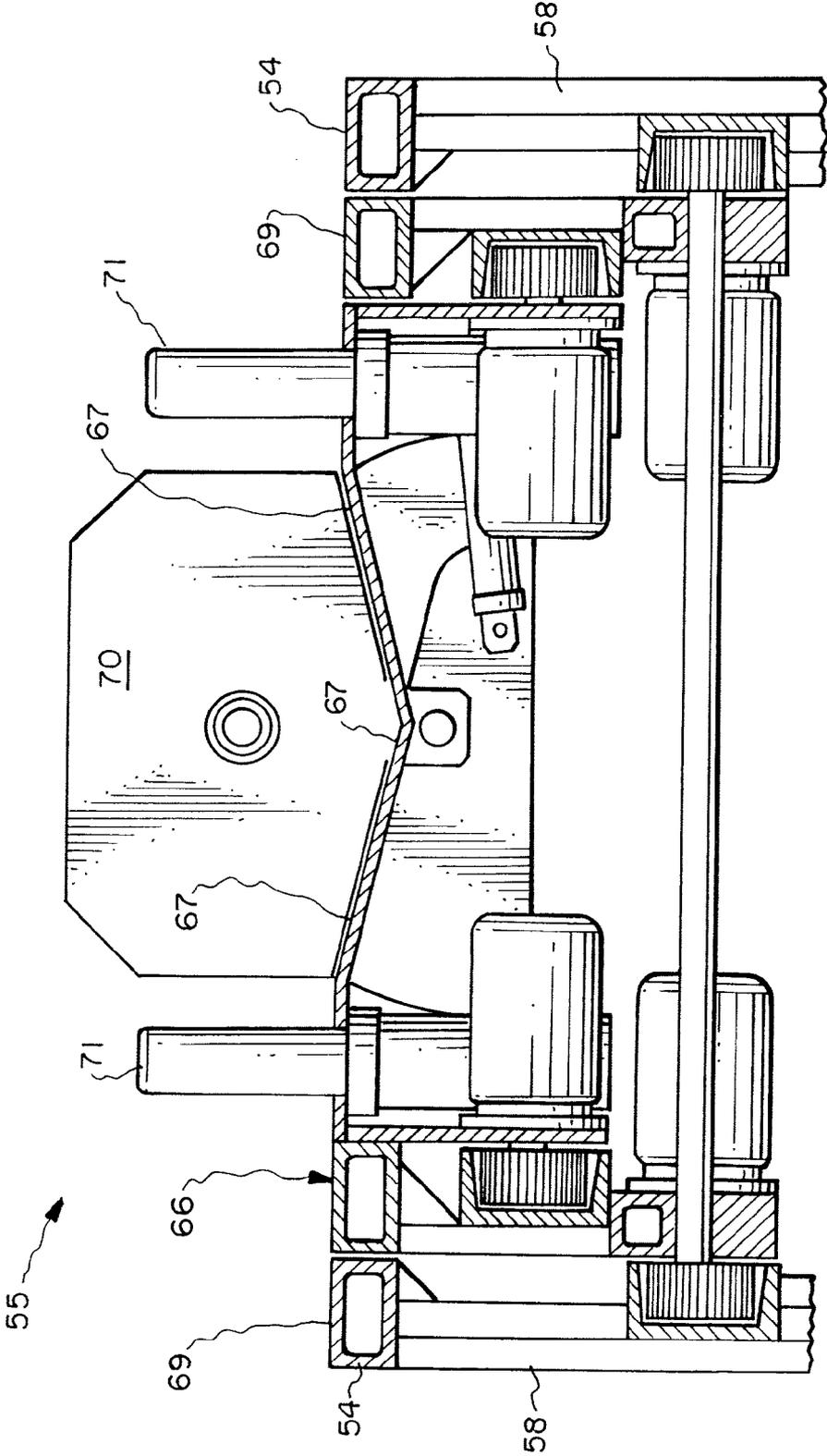


Fig. 32.

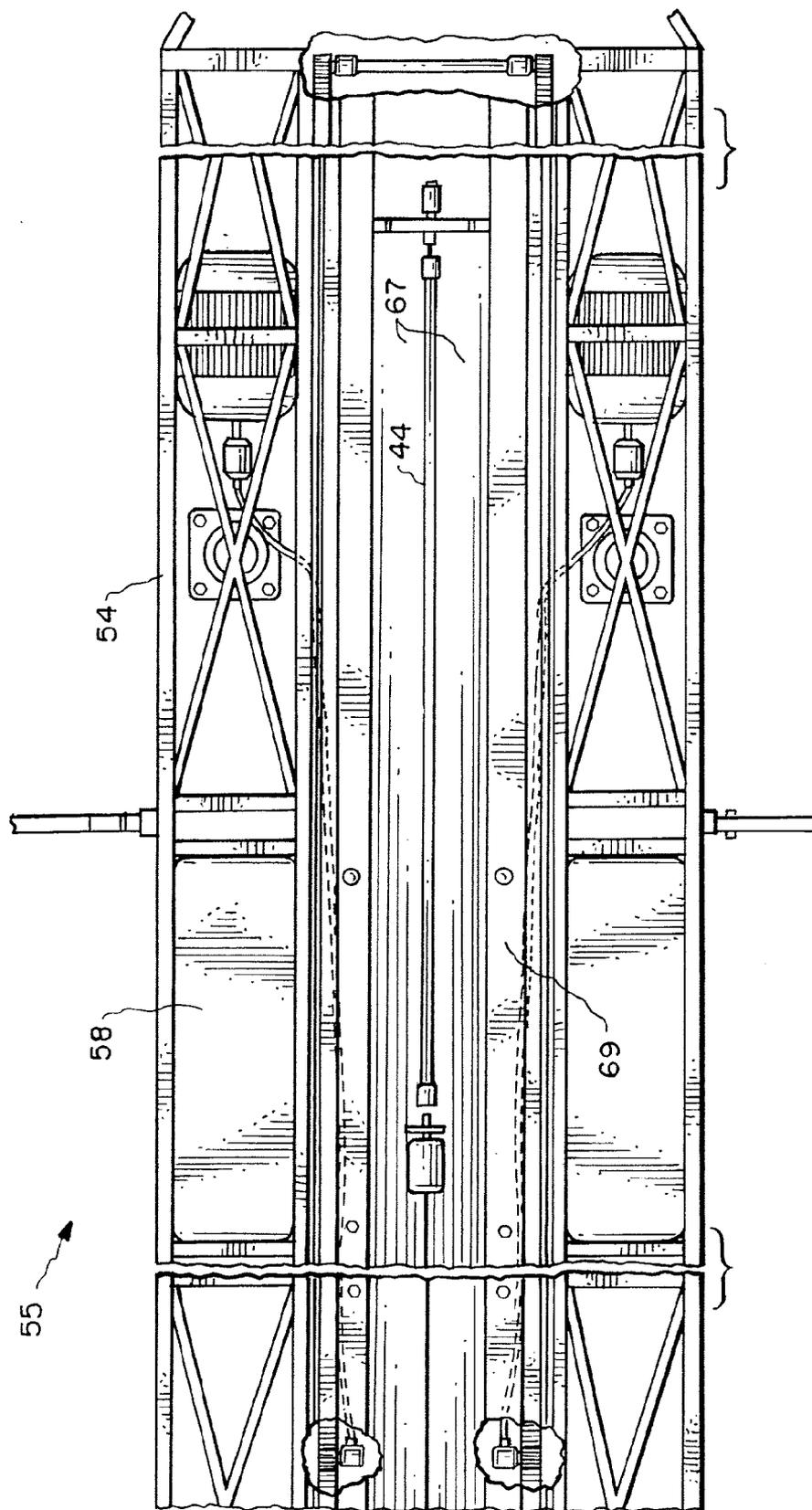


Fig. 33.

**PORTABLE DRILL PIPE HANDLING  
APPARATUS FOR USE WITH OIL AND GAS  
WELL DRILLING RIGS**

CROSS-REFERENCE TO RELATED  
APPLICATIONS

**[0001]** Priority of U.S. Provisional Patent Application Ser. No. 60/956,815, filed 20 Aug. 2007, incorporated herein by reference, is hereby claimed.

STATEMENT REGARDING FEDERALLY  
SPONSORED RESEARCH OR DEVELOPMENT

**[0002]** Not applicable

REFERENCE TO A "MICROFICHE APPENDIX"

**[0003]** Not applicable

BACKGROUND OF THE INVENTION

**[0004]** 1. Field of the Invention

**[0005]** The present invention relates to oil and gas well drilling and to an apparatus for handling pipe that is used during oil and gas well drilling (including geothermal and/or mineral drilling). More particularly, the present invention relates to an improved pipe handling apparatus for transferring successive lengths of drill pipe from a pipe rack to the deck of a drilling rig, wherein a moving section of the apparatus lifts pipe upwardly along an inclined path with a trestle that is driven to travel upon a base or supporting frame, the trestle gradually increasing in inclination as it moves between a lower beginning position and an upper final inclined position that presents the length of the drill pipe to workers on the rig floor.

**[0006]** 2. General Background of the Invention

**[0007]** During the drilling of oil and gas wells, an elongated "string" of pipe is made up of separate joints of pipe (e.g. drill pipe can be in lengths of thirty feet (30') (9.1 meters), casing typically in lengths of forty feet (40') (12.2 meters) that are connected end to end during the "trip" into the well and as drilling progresses deeper and deeper into the earth. The lower end of the string carries a drill bit. These same joints of pipe are each separated from the drill string one joint at a time when the drill string is removed from the well bore after such a "trip" into a well.

**[0008]** Drill pipe joints can be stored (e.g. horizontally) on pipe racks next to the drill rig cat walk. Typically, the drill rig floor is at a considerably higher elevation than the pipe racks and cat walk. Many drillers face the problem of transferring drill pipe from the pipe rack to the elevated rig deck.

**[0009]** One of the problems with the transportation of drill pipe is that of maintaining a proper orientation of the section of the drill pipe relative to the rig floor, especially when it is about to be either removed from the pipe transportation unit to the rig floor or transferred from the rig floor back to the pipe transportation unit. For example, it is important that the pipe be oriented in the correct position so that it can be elevated to lower the collar of the pipe directly into waiting pipe elevators.

**[0010]** Another problem with the transportation of pipe racks to the drill floor is that the pipe is typically stacked in layers. This means that each layer must be unstacked one layer at a time. Pipe can be stacked many layers thick especially if the drilling operation is going very deep into the earth.

**[0011]** There have been numerous approaches to the task of transferring pipe from a lower pipe rack to an upper, elevated rig floor. Some pipe handling devices are ground supported mechanical units. Others are truck units with a main high line and a fast line to feed and retrieve the pipe trough.

**[0012]** The mechanical units are heavy and are designed for individual rigs. They remain with the drilling rig during drilling operations. The truck mounted units are more diversified and portable, but take up more space because of the typically large truck portion of the apparatus.

**[0013]** Some patents have issued that are directed to the problem of conveying oil and gas well drilling pipe joints from a pipe rack to the floor of the drilling rig. The following table lists possibly relevant patents, the order of listing having no significance.

TABLE 1

Patent No.	Title	Issue Date MM-DD-YYYY
4,235,566	Pipe Conveying Catwalk	11-25-1980
4,403,898	Pipe Pick Up and Lay-down Machine	09-13-1983
3,774,780	Portable Pipe Pick-Up, Conveying and Racking Device	11-27-1973
4,040,524	Apparatus for Handling Pipe At Well Site	08-09-1977
4,081,087	Pipe Laydown and Pickup Machine	03-28-1978
4,610,315	Pipe Handling Apparatus for Oil Drilling Operations	09-09-1986
4,082,193	Pipe Handling Apparatus	04-04-1978
2,656,052	Apparatus for Feeding Lengths of Drill Pipe in Succession to the Drill Pipe Elevator of Drill Rigs	10-20-1953
3,464,507	Portable Rotary Drilling Pipe Handling System	09-02-1969

BRIEF SUMMARY OF THE INVENTION

**[0014]** The present invention differs from these prior art devices by providing an improved drill pipe conveyor.

**[0015]** The apparatus of the present invention comprises a pipe handling apparatus for transferring successive lengths of drill pipe that are stored in a generally horizontal position on a pipe rack, to an elevated position on the rig deck of an oil and gas well drill rig. The apparatus includes an elongated frame that includes a base section with a folding section that can be inclined. Both the base and folding sections provide toothed racks. A trestle section travels from the base section toward the inclined section. Pinion gears at opposed end portions of the trestle section engage the toothed racks of the base and folding sections. The trestle section gradually increases in inclination as its front end portion travels toward and up hoisting rails of the inclined folding section. While the rear end of the trestle section remains on the base section, the front end portion of the trestle section climbs the toothed racks of the inclined rails. The trestle section carries a trough that cradles a section of drill pipe to be carried to the rig floor. When the trestle section reaches its full upper position, the rear end of the trough can be elevated to a generally horizontal position using a hydraulically powered scissor lifting arrangement to more properly position the drill pipe for receipt by the drill rig deck area.

BRIEF DESCRIPTION OF THE SEVERAL  
VIEWS OF THE DRAWINGS

**[0016]** For a further understanding of the nature and objects of the present invention, reference should be had to the fol-

lowing detailed description, taken in conjunction with the accompanying drawings, in which like parts are given like reference numerals, and wherein:

[0017] FIG. 1 is a perspective view of a first embodiment of the apparatus of the present invention;

[0018] FIG. 2 is a partial side elevational view of the first embodiment of the apparatus of the present invention showing the main frame and folding section in folded position;

[0019] FIG. 3 is a side elevation view of the first embodiment of the apparatus of the present invention showing the folding section in an inclined position;

[0020] FIG. 4 is a partial elevational rear view of the first embodiment of the apparatus of the present invention showing the pick-up arms in a lower most position;

[0021] FIG. 5 is a rear elevational view of the first embodiment of the apparatus of the present invention showing the pick-up arms in a loading position;

[0022] FIG. 6 is a partial, sectional rear view of the first embodiment of the apparatus of the present invention with jacks elevated;

[0023] FIG. 7 is a partial side elevational view of the first embodiment of the apparatus of the present invention with lift rails in folded position;

[0024] FIG. 8 is an elevational rear view of the first embodiment of the apparatus of the present invention showing the trough trestle in an inclined position;

[0025] FIG. 9 is a rear elevational view of the first embodiment of the apparatus of the present invention showing the trough in a tilted, generally horizontal position;

[0026] FIG. 10 is a side elevational view of the first embodiment of the apparatus of the present invention with trough trestle elevated;

[0027] FIG. 11 is a side view of the first embodiment of the apparatus of the present invention showing the pipe and trough elevated to a horizontal position at the drilling rig floor;

[0028] FIG. 12 is a partial elevational view of the first embodiment of the apparatus of the present invention with trough trestle folded for shipping and jacks elevated;

[0029] FIG. 13 is a top view along lines 13-13 of FIG. 12;

[0030] FIG. 14 is a partial sectional fragmentary view of the front lifting rails and hinges;

[0031] FIG. 15 is a sectional view taken along lines 15-15 of FIG. 13 with safety boot;

[0032] FIG. 16 is a partial sectional view of the first embodiment of the apparatus of the present invention illustrating the rubber tipped pneumatic safety pin portion thereof in activated position and traveling safety boot;

[0033] FIG. 17 is a partial sectional elevational view of the first embodiment of the apparatus of the present invention with trough raised, scissor folded;

[0034] FIG. 18 is a partial sectional elevational view of the first embodiment of the apparatus of the present invention with rear of trough raised by scissor system for pipe collar elevation on rig floor;

[0035] FIG. 19 is a fragmentary rear cross-sectional view of the first embodiment of the apparatus of the present invention illustrating loading of a joint of pipe into the trough, gear racks and pinions;

[0036] FIG. 20 is a fragmentary rear cross-sectional view of the first embodiment of the apparatus of the present invention illustrating the removal of a joint of pipe from the trough with adjustable pickup or lay down arms;

[0037] FIG. 21 is a perspective view of the second embodiment of the apparatus of the present invention;

[0038] FIG. 22 is a side view of the second embodiment of the apparatus of the present invention shown in folded position;

[0039] FIG. 23 is a side view of the second embodiment of the apparatus of the present invention shown in unfolded, operating condition;

[0040] FIGS. 24-26 are fragmentary end views of the second embodiment of the apparatus of the present invention;

[0041] FIG. 27 is a partial, schematic side view of the second embodiment of the apparatus of the present invention with trough trestle raised and pipe/trough in delivery position;

[0042] FIG. 28 is a fragmentary side view of the second embodiment of the apparatus of the present invention showing hinges for folding lifting rails;

[0043] FIG. 29 is an elevation view of the second embodiment of the apparatus of the present invention with jacks raised for stacking pipe;

[0044] FIG. 30 is a plan view taken along lines 30-30 of FIG. 29 showing trough with travel boot and pop up safety pins for pipe containment;

[0045] FIG. 31 is an end view taken along lines 31-31 of FIG. 30 showing adjustable pickup arms, jacks, safety pins, pipe boot electric and hydraulic motors;

[0046] FIG. 32 is a sectional view of the second embodiment of the apparatus of the present invention showing hydraulic motors and gear racks; and

[0047] FIG. 33 is a partial, enlarged plan view of the second embodiment of the apparatus of the present invention showing motors, pumps and drivers.

#### DETAILED DESCRIPTION OF THE INVENTION

[0048] FIGS. 1-20 show the preferred embodiment of the apparatus of the present invention, designated generally by the numeral 10 in FIG. 1. Drill pipe transfer apparatus or "pipe skate: 10 is used with drilling rig 11, enabling the transfer of successive lengths or joints 44 of drill pipe that are stacked and stored in a generally horizontal position on a pipe rack 15, to an elevated deck or floor 17 of an oil and gas well drilling rig 11 having a base 12 (see FIG. 1).

[0049] The apparatus 10 of the present invention provides an optionally portable pipe skate for the safe transportation of the pipe joint members 44 from a horizontal position on pipe rack 15 and then diagonally to the drilling rig floor 17 and/or to a pipe elevator for vertical positioning (see pipe string P, FIG. 1) before transport into the well bore.

[0050] The apparatus 10 of the present invention includes a main frame 20 that can be positioned on the top of a drill rig catwalk 14. The apparatus 10 includes folding section 19 with a pair of spaced apart lifting or hoisting rails 21 having one end portion pivotally mounted to the main frame 20 and a free end portion that rests against the catwalk ramp or rig floor as shown in FIG. 1. The hoisting rails 21 are diagonally positioned during use as shown in FIG. 3.

[0051] The pipe joints 44 are rolled to adjustable pick up arms 31 on the main frame 20 and then placed into a trough 39 portion. Each pickup arm 31 can have a removable stop pin.

[0052] A moving trestle 22 travels upon main frame 20 and carries the trough 39 and the pipe joint 44, then rises up to the rig floor 17. The trestle 22 gradually increases in inclination relative to the horizontal catwalk 14 and main frame 20. Once fully inclined, the trestle 22 provides a trough 39 that can

extend forward from the trestle 22 bringing the pipe joint 44 collar 46 to a rig elevator or well bore (see FIGS. 8-11).

[0053] The rear of the trough 39 can be raised by means of a scissor hydraulic mechanism 24 (see FIG. 11), thus lowering the pipe collar 46 to a workable height or into pipe elevators on the rig 11. The pipe joint 44 is moved forward in the trough 39 in the direction of arrow 34 in FIG. 11 by a traveling safety boot 40. The rig 11 crown block 18 (or other lifting device) can then raise the pipe joint 44 to a vertical position above the well bore or pipe string P.

[0054] Extracting pipe joints 44 from pipe string P that extends into the well requires a reverse process as each pipe joint 44 is returned to a horizontal position on the pipe rack 15. Multiple layers of pipe joints 44 can be stacked on the same rack 15 with main frame 20 jacks 30.

[0055] The present invention provides transportation of heavy tubular pipe members 44 (and optionally tools) from the pipe racks 15 to the rig floor 17 or well bore and back. Such tools can be short subs, reamers, drill bits or pipe handling tools. The apparatus 10 includes a main frame 20 that can be a light weight lattice truss or like frame. The main frame 20 is supported upon a plurality of (e.g. hydraulic) jacks 30.

[0056] A plurality of adjustable pick-up arms 31 are provided that can be used for transferring each joint 44, one at a time to the trough portion 39 of the apparatus 10 (see FIG. 19). The jacks 30 raise and lower the main frame 20 for easy stacking and unstacking of pipe joints 44. The adjustable pick-up arms 31 can either lift pipe joints 44 to the trough 39 or can be used as lay-down ramps when returning pipe joints 44 to the racks 15 (see FIG. 20).

[0057] The main frame 20 includes a folding section 19 that can be in the form of hoisting rails that can be folded into a collapsed position on the main frame 20 (for transport) or rotated upon pivot 37 to an inclined position (see arrow 24 FIG. 3) so that a free end portion of the hoisting rails 21 rests against the drill rig floor 17.

[0058] The trough trestle 22 can be gear driven, having a front end portion that travels up the hoisting rails of folding section 19. The trestle 22 has a rear end portion that engages and travels upon the base section 20. The trestle 22 can be gear driven front and rear as it progresses down the base section 20 and up the rails 21 of folding section 19 during an elevation of each pipe section 44 diagonally to a height just above the rig floor 17.

[0059] The trough trestle 22 thus begins at a horizontal position where it is entirely disposed upon the main frame 20. However, as the trestle 22 moves toward the rig floor 17, its front end portion climbs the rails 21 of the folding section 19 using a hydraulically powered pair of pinion gears that register in 26, 26A, 26B toothed racks 35 on the lifting rails 21.

[0060] The rear end of the trough trestle 22 provides hydraulically driven pinion gears that engage toothed rack 38 portions on the main frame 20. While the front of the trestle 22 climbs up the inclined hoisting rails 21, the rear of the trestle 22 moves in a horizontal plane upon main frame 20, approaching the drilling rig 11, but not changing in elevation. The effect of this action is to gradually increase the inclination of the trestle 22 as it moves from a starting, entirely horizontal position adjacent to the pipe rack 15 to a final inclined position with its front end adjacent to the rig floor 17 (see FIGS. 1 and 3).

[0061] Once a joint 44 of pipe is elevated slightly above the rig floor 17, the pipe skate 10 operator can advance the trough

39 forward on the trestle 22, moving the pipe joint 44 to the rig elevator or close to rotary table 16 or well bore so that the joint 44 can then be added to pipe string P. On very large rigs 11 where the bore hole is some distance from the edge of the rig floor 17, the pipe collar 46 can prove to be at an unworkable height at the time it reaches the elevator. Therefore, the rear of the trough 39 can be elevated with respect to the trestle 22 using a hydraulic or pneumatically operated scissors mechanism 24 (see FIG. 11) that lowers the front of the pipe or pipe collar 46 to a position next to rotary table 16 or next to the rig elevator. To aid in a solution to this problem, a traveling safety boot 40 at the rear of the trough 39 can be used to accommodate varying lengths of pipe (e.g. particularly casing).

[0062] The trough 39 can be provided with air operated kickers or eject pins 23 that eject the pipe 44 from the trough 39 and then down to lay arms 31 and then to the pipe rack 15. Safety pins can be provided at location 42 in the form of a plurality of pop-up air pins on each side of the trough 39 to contain or stabilize the pipe joint 44 when it is in the trough 39 (see FIG. 6). The stop pins 42 can be installed at various places on the trough 39 top surface to stop the pipe from rolling off the trough 39 during operation. Stop pins can be hydraulically, manually, or pneumatically operated to pop up or retract.

[0063] Traveling safety boot 40 is placed at the rear of the trough 39 for the pipe joint 44 to butt-up against. Safety boot 40 can travel forward and back to accommodate varying lengths of drill pipe joint 44 or to push pipe forward. The safety boot 40 can be provided with a stationary air pin in the center. This stationary air pin stabs into the rear of the pipe joint 44 bore to prevent it from exiting the trough 39 except in the proper forward motion. Manual boots 40 can be placed in the trough for picking up short pipe subs and smaller drilling equipment.

[0064] The present invention 10 thus provides an improved pipe handling apparatus for transferring successive lengths of drill pipe 44 that are stored in a generally horizontal position on a lower elevation pipe rack 15, to an elevated deck or floor 17 of an oil and gas well drilling rig 11.

[0065] The apparatus 10 includes an elongated main frame 20 with front and rear end portions and a folding section 19 that pivots upon the front end portion of the base section between inclined 19 (FIGS. 1 and 3) and folded (FIG. 7) positions.

[0066] In the folded position (FIG. 7), the folding section 19 nests on the base section 20. In the inclined position, the folded section 19 forms an obtuse angle with the base section 20.

[0067] The folding section 19 has spaced apart, parallel hoisting rails 21 and a free end portion. In the inclined position, the free end portion is extendable to the elevated deck 17 of the oil and gas well drilling rig 11. For example, the free end portion of the folding section 19 can simply rest against the drill rig deck 17 as a support. The folding section 19 includes a pair of opposed hoisting rails 21.

[0068] The frame 20 includes a moving trestle 22 section having front and rear portions. The trestle section 22 is movable upon the combination of the frame 20 and the folded section 19 between an lower position that nests the trestle 22 section upon the frame 20 and an upper position that positions the front end portion of the trestle 22 near the free end of the folded section 19 when the folded section is inclined (FIG. 1).

[0069] The trestle section 22 thus forms a triangle with the folding 19 and frame 20 sections when the trestle 22 moves to

the upper position of FIGS. 1 and 10, 11, wherein the front end portion of the trestle 22 section engages the folding section 19 and the rear portion of the trestle 22 engages the frame 20.

[0070] A pipe joint 44 carrying skate member or trough 39 is mounted upon the trestle 22 section and is movable along the length thereof between extended and retracted positions.

[0071] A conveyor arrangement can be used to transport the trestle 22 upon the frame 20 and folding 19 sections between upper and lower position when the folding section 19 is in the inclined position of FIG. 1, so that the trestle section 22 forms a gradually increasing acute angle with the frame 20 moving from the lower (FIGS. 12-13) to the upper position (FIGS. 1, 10-11).

[0072] In the preferred embodiment, powered pinion gears engage toothed racks 27 on the inclined rails 21 of the folding section 19. Pinion gears also engage toothed racks 38 on the main frame 20.

[0073] FIG. 1 shows generally the preferred embodiment of the apparatus of the present invention designated by the numeral 10. In FIG. 10 there can be seen a drilling rig 11 having a base 12, derrick 13, catwalk 14. The drill rig 11 has a rotary table 16 and a crown block 18. Pipe rack 15 holds a plurality of drill pipe joints 44 as shown in FIG. 1. Each joint 44 of drill pipe has bore 49, pin end 48, and a box end or collar 46.

[0074] The apparatus 10 of the present invention is used for transporting a pipe joint 44 upwardly to the rig floor 17 and presenting a collar end portion 46 of the drill pipe to the personnel that are operating the drill rig and which occupy a position about the rotary table 16.

[0075] In FIGS. 1-3, the apparatus 10 of the present invention includes a main frame 20 and a folding section 19. Main frame 20 sits upon catwalk 14 and is supported by means of a plurality of telescoping (e.g. hydraulic) cylinder jacks 30. Jacks 30 enable frame 20 to be raised and lowered. The jacks 30 can be raised or lowered depending upon the level of pipe joints 44 that occupy a position upon pipe rack 15 to enable easy transfer of joints 44 between rack 15 and trough 39. The pipe joints 44 can often be stacked many layers deep so that the elevation of the top layer of joints of pipe 44 varies during drilling operations. In FIGS. 2-3, the drill rig 11 and its upper deck 17 are shown with the main frame 20, its folding section 19 that carries hoisting rails 21.

[0076] In FIG. 2, the main frame 20 remains in horizontal position while the folding section 19 is rotated as shown by the curved arrow in FIG. 3 to the inclined position shown. In FIGS. 3, 4 and 5 safety chains 47 can be used to secure the uppermost end portion of folding section 19 to the rig 11 at upper deck 17 as shown.

[0077] FIGS. 4 and 5 illustrate the position of main frame 20 and inclined section 19 when the trestle 22 is in a horizontal position such as when a pipe joint 44 is being transferred from pipe rack 15 to trestle 22. In FIG. 5, a pipe joint 44 has been moved with pick up arms 31 to the trough 39 portion of trestle 22.

[0078] FIGS. 4-5 and 10-11 illustrate delivery of a joint of pipe 44 to the rig floor 17. Trestle 22 begins in a generally horizontal position (FIG. 5) and then moves forward using powered (e.g. hydraulic motor), driven pinion gears 26 of the trestle 22 that engage toothed racks 38 provided on the main frame 20 and toothed racks 27 provided on the hoisting rails 21 of folding section 19. In FIG. 10, trestle 22 has moved to a forward position where its inclination of trestle 22 is greatest.

In this position, a drill pipe joint 44 can be advanced in the direction of the arrow 25 in FIG. 10 using traveling safety boot 40. In order to present the collar 46 end of pipe joint 44 to the rig deck 17 and to the workers at rotary table 16, a scissor apparatus 24 elevates trestle 22 and trough 39 as shown by the curved arrow 33 in FIG. 11. Scissor apparatus 24 places the trough 39 in a generally horizontal position. The traveling safety boot 40 then moves forward in the direction of arrow 34 in FIG. 11 to present the pipe joint 44, collar end 46 to the drillers/personnel on the rig deck or floor 17.

[0079] FIGS. 12-14 show the main frame 20 and its folding section 19 in more detail. In FIGS. 12-13, jacks 30 are shown supporting main frame 20 as it sits upon catwalk 14. Safety chains 45 can be used to form a connection between lower end of main frame 20 and the upper surface of catwalk 14.

[0080] Pick up arms 31 are shown in FIGS. 13 and 19-20. The pick up arms 31 can be a hydraulically operated to a lift pipe joint 44 from the pipe rack 15 and transfer each such pipe joint 44 one at a time to the longitudinal slot 43 on the upper surface of trough 39, so that each joint 44 can then be elevated to the rig floor 17.

[0081] In FIGS. 14-20, further details of construction of main frame 20, trestle 22, and trough 39 are shown. Trestle 22 has a pair of opposed c-shaped beams 35. Each beam 35 provides a toothed rack 36 that engages pinion gear rollers 26B attached to trough 39. Pinion gears 26A on trestle 22 engage toothed racks 38 on main frame 20. In FIGS. 19-20, the outermost pinion gears 26A travel in a toothed rack 38 on main frame 20. Pinion gears 26A are provided at the rear of the trestle 22 and travel in toothed rack 38 on main frame 20 thus driving the rear portion of trestle 22 as it travels toward the rig 11. Pinion gears 26A can be hydraulically powered with motor drives 28 (e.g. hydraulic motors) and pumps 29 or other drive system.

[0082] There are two additional pinion gears 26A that support the front of trestle 22. The front pair of outer pinion gears 26A engage toothed rack 27 of folding section 19. The innermost pinion gears 26B are mounted with axle 41 to trough 39 to support trough 39 and move it forward/backward within the C-shaped beam members 35 of trestle 22. Thus the pinion gears 26B move the trough 39 forward or backward with respect to trestle 22.

[0083] In FIGS. 7-10 and 15-16, traveling safety boot 40 is shown having a safety pin 50 that can be activated or deactivated to engage the pipe bore 49. The traveling safety boot 40 can be moved forward or backward relative to the rig floor 17 when the apparatus 10 is in the position shown in FIGS. 1 and 11, using a threaded rod 51 and internally threaded sleeve 71. Rotation of the rod 51 in one direction moves the boot 40 in one direction and vice versa. In FIG. 15, the safety pin 50 is in a deactivated position. In FIG. 16, the safety pin 50 has been advanced and occupies a position within bore 49 of pipe joint 44.

[0084] FIGS. 17 and 18 show more particularly the scissor mechanism 24 that can be used to elevate trough 39 relative to trestle 22. A collapsed position of scissor assembly 24 shown in FIG. 17. An expanded operational position is shown in FIG. 18. Hydraulic cylinder 52 can be used to activate and deactivate the scissor assembly 24. A pinion gear 53 at the bottom of scissor 24 engages a toothed rack 36 of trestle 22.

[0085] FIGS. 21-33 show a second embodiment of the apparatus of the present invention, designated generally by the numeral 55. Drill pipe transfer apparatus 55 can be used to transfer joints 44 of drill pipe between a pipe rack 15 and a

drill rig 11 as with the first embodiment of FIGS. 1-20. In FIGS. 21-33 catwalk 57 replaces the catwalk 14 of FIG. 1. Catwalk 57 can include main frame skate 58.

[0086] Jacks 56 support main frame 58 and can elevate or lower it. Main frame 58 supports trough 69 which can support a pivotally attached forward elevator section or rail(s) 68 that moves between a folded position (FIG. 22) and an unfolded, operating position (FIG. 23).

[0087] Pick up arms 59 can be of adjustable length, providing sections that telescope to change length. In FIG. 31, arm 59 can have inner section 60, outer section 61 (or sleeve), adjustment openings 63, and removable locking pin 64 that fits through aligned openings 63 on sections 60, 61 to define their length.

[0088] In FIGS. 24 and 31, pick up arms 59 are shown moving a pipe joint 44 toward trough 67. In FIGS. 25-26 and 31, 33, pipe joint 44 is in the transport position on trough 67. FIG. 27 shows a pipe joint 44 and supporting trough 67 traveling to drilling rig 11 upon trestle 69 and forward section as indicated by arrows 72, 73/rail(s) 68.

[0089] Main frame 54 supports trestle 69 which supports trough 67. The second embodiment of FIGS. 21-33 also provides a safety boot 70 as with the first embodiment. A hydraulic drive can power both the trough 67 and trestle 69. Pins 71 prevent escape of a pipe joint 44 from trestle 69. Pins 71 are preferably hydraulically or pneumatically operated to extend above surface 66 or to retract to a position at or below surface 66. FIG. 28 can be the same configuration as FIG. 14.

[0090] The following table lists the parts numbers and parts descriptions as used herein and in the drawings attached hereto.

PARTS LIST	
Part Number	Description
P	pipe string
10	portable drill pipe
	transfer apparatus/pipe skate
11	drilling rig
12	base
13	derrick
14	cat walk
15	pipe rack
16	rotary table
17	rig floor
18	crown block
19	folding section
20	main frame
21	hoisting rails
22	trestle
23	eject pin/kicker
24	scissors mechanism
25	arrow
26	pinion gear
26A	pinion gear
26B	pinion gear
27	toothed rack/folding section
28	motor drive
29	pumps
30	jack
31	pick up arms
32	motor drive
33	arrow
34	arrow
35	beam member
36	toothed rack/trestle
37	pivot
38	toothed rack/main frame

-continued

PARTS LIST	
Part Number	Description
39	trough
40	traveling safety boot
41	axle
42	safety pin/location
43	longitudinal slot trough
44	pipe joint
45	safety chain
46	collar
47	safety chain
48	pin end
49	pipe bore
50	safety air pin
51	threaded shaft
52	hydraulic cylinder
53	pinion gear
54	hydraulic tanks
55	drill pipe transfer apparatus
56	jack
57	catwalk
58	main frame skate
59	pick up arm
60	inner section
61	outer section
62	catch pin
63	adjustment opening
64	locking pin
65	lift cylinder
66	upper surface
67	trough
68	elevator rail
69	trough trestle
70	safety boot
71	popup safety pins
72	arrow
73	arrow

[0091] Because many varying and different embodiments may be made within the scope of the inventive concept herein taught, and because many modifications may be made in the embodiments herein detailed in accordance with the descriptive requirement of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

1. A pipe handling apparatus for transferring successive lengths of pipe that are stored in a generally horizontal position on a pipe rack to an elevated deck of an oil and gas well drilling rig, comprising;

- a) an elongated frame that includes a base section with front and rear end portions and a folding section that pivots upon the front end portion of the base section between inclined and folded positions;
- b) wherein in the inclined position the folded section forms an obtuse angle with the base section;
- c) wherein the folding section has a free end portion and in the inclined position the free end portion is extendable to the elevated deck of the oil and gas well drilling rig;
- d) the frame including a moving trestle section having front and rear end portions, the trestle section being movable upon the combination of the base and folded section between a lower position and an upper position that positions the front end portion of the trestle near the free end portion of the folded section when the folding section is in the inclined position;
- e) wherein the trestle section forms a triangle frame geometry with the folding and base sections when the trestle

moves to the upper position, wherein the front end of the trestle section engages the folding section and the rear portion of the trestle engages the central portion of the base section;

f) a pipe carrying skate mounted upon the trestle section and movable upon the trestle between extended and retracted positions; and

g) a conveyor that transports the trestle upon the base between upper and lower positions when the folding section is in the inclined position, wherein the trestle section forms a gradually increasing acute angle with the base section when moving from the lower to the upper position.

2. The apparatus of claim 1 wherein the conveyor includes toothed rack portions on the base section and folding section of the elongated frame and one or more pinion gears at the end portions of the trestle section that engage the toothed rack.

3. The apparatus of claim 2 wherein at least some of the pinion gears are powered.

4. The apparatus of claim 1 wherein the pipe carrying skate slides upon the trestle section.

5. The apparatus of claim 1 wherein the pipe carrying skate is powered to move into an angular position relative to the trestle, enabling the pipe to be placed in a generally horizontal position.

6. The apparatus of claim 1 wherein there is further provided a plurality of jacks that enable the elongated frame to be elevated into multiple elevational positions.

7. The apparatus of claim 1 wherein the elongated frame includes a base section with a pair of spaced apart toothed racks thereon and the folding section includes a pair of rails, each having a toothed rack thereon, and wherein the toothed rack portions of the base section and folding section are aligned so that the trestle can travel from the base section to the inclined section on the aligned toothed raked portions, and wherein the trestle is provided with toothed geared portions that engage the toothed rack portions.

8. The apparatus of claim 1 further comprising a plurality of pins that enable a joint of pipe to be supported upon the skate.

9. The apparatus of claim 1 further comprising a traveling boot that carries a projecting pin portion for securing a pipe joint at its pipe joint bore when the pipe joint is on the skate.

10. The apparatus of claim 1 further comprising a plurality of jacks that support the base section, the jacks enabling the elevation of the base section to be varied.

11. A pipe handling apparatus for transferring successive lengths of drill pipe that are stored in generally horizontal positions on a pipe rack to an elevated deck of an oil and gas well drilling rig that is at a much higher elevation than the pipe rack comprising:

a) an elongated linear structural frame that includes a base section with front and rear end portions, an inclined section that is attached to the front end portion of the base section forming an obtuse angle with the base section, and a trestle section that is supported upon the base and inclined sections for travel between inclined and horizontal positions, wherein in the horizontal position the trestle section nests on the base section;

b) wherein the inclined section has a free end portion that extends to the elevated deck of the oil and gas well drilling rig;

c) the trestle section having front and rear end portions, the trestle section being movable upon the combination of the base and folded sections between a lower position that nests the trestle section upon the base section and an upper position that positions the front end portion of the trestle near the free end portion of the folded section;

d) wherein the trestle section forms a triangle with the folding and base sections when the trestle moves to the upper position, wherein the front end of the trestle section engages the folding section and the rear portion of the trestle engages the central portion of the base section;

e) a pipe carrying skate member mounted upon the trestle section and movable along the length thereof between extended and retracted positions; and

f) a conveyor that transports the trestle upon the base and folding sections between upper and lower positions when the folding section is in the inclined position so that the trestle section forms a gradually increasing acute angle with the base section when moving from the lower to the upper position.

12. The inventions substantially as shown and described herein.

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