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(54) **TUBULAR HANDLING APPARATUS AND METHOD**

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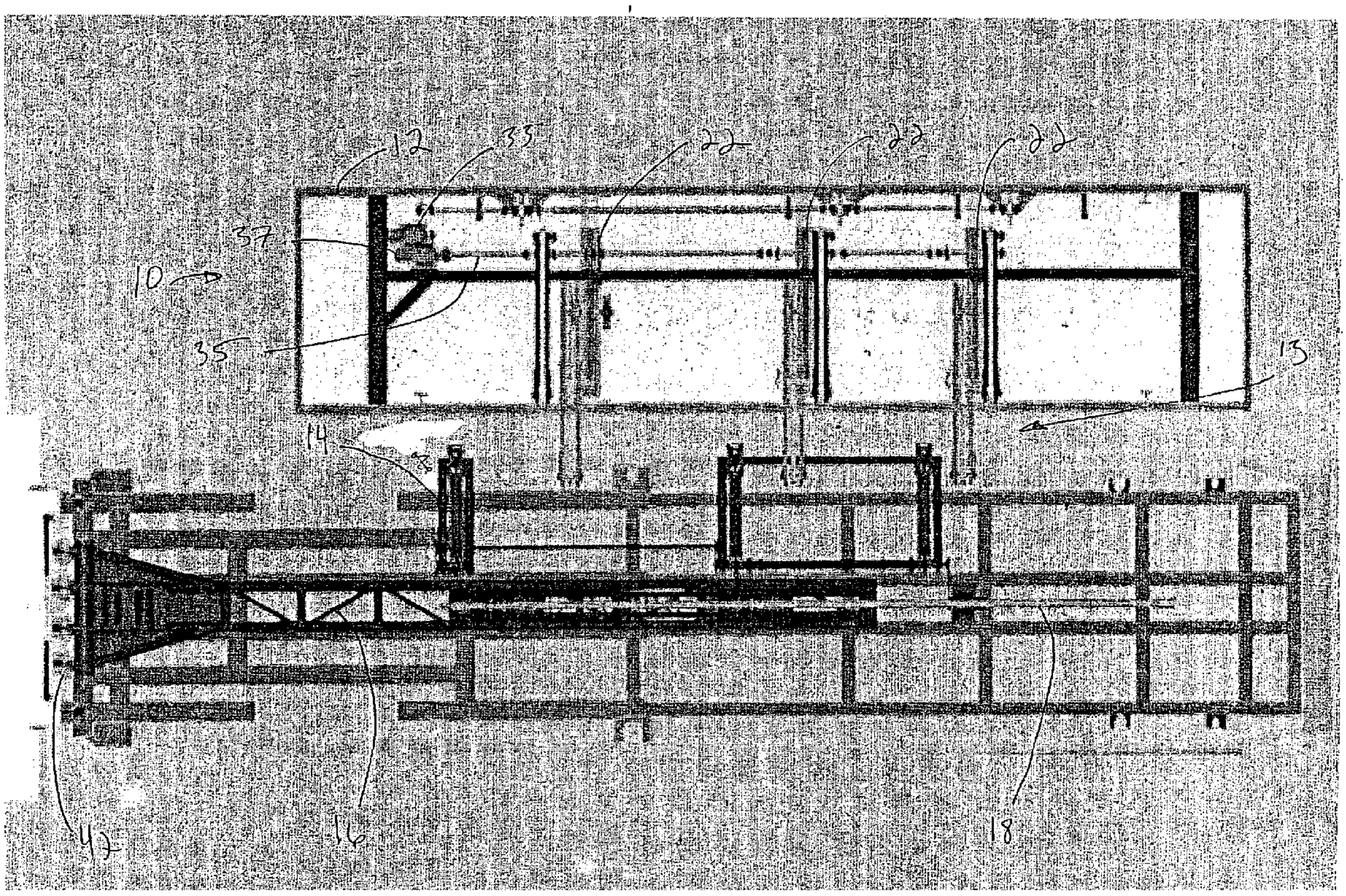
(57) **ABSTRACT**

A pipe handling system comprising at least one pipe magazine, a pipe conveyor system, and a pipe arm for handling pipes in conjunction with a drill rig for drilling a well bore. The pipe handling system operates to transfer pipe joints from each pipe magazine to a pipe arm via the pipe conveyor system. The pipe arm then moves to transfer each pipe to the drilling rig for connection to drill string. The pipe handling system also operates to remove each pipe from the drill string. The arm engages the pipe to be removed and moves to transfer the pipe to the pipe conveyor system. The pipe conveyor system then transfers the pipes to each pipe magazine. The system is alternatively comprises electronic sensors that measure the location of pipe. The entire system is also alternatively operated with software and a general-purpose computer.



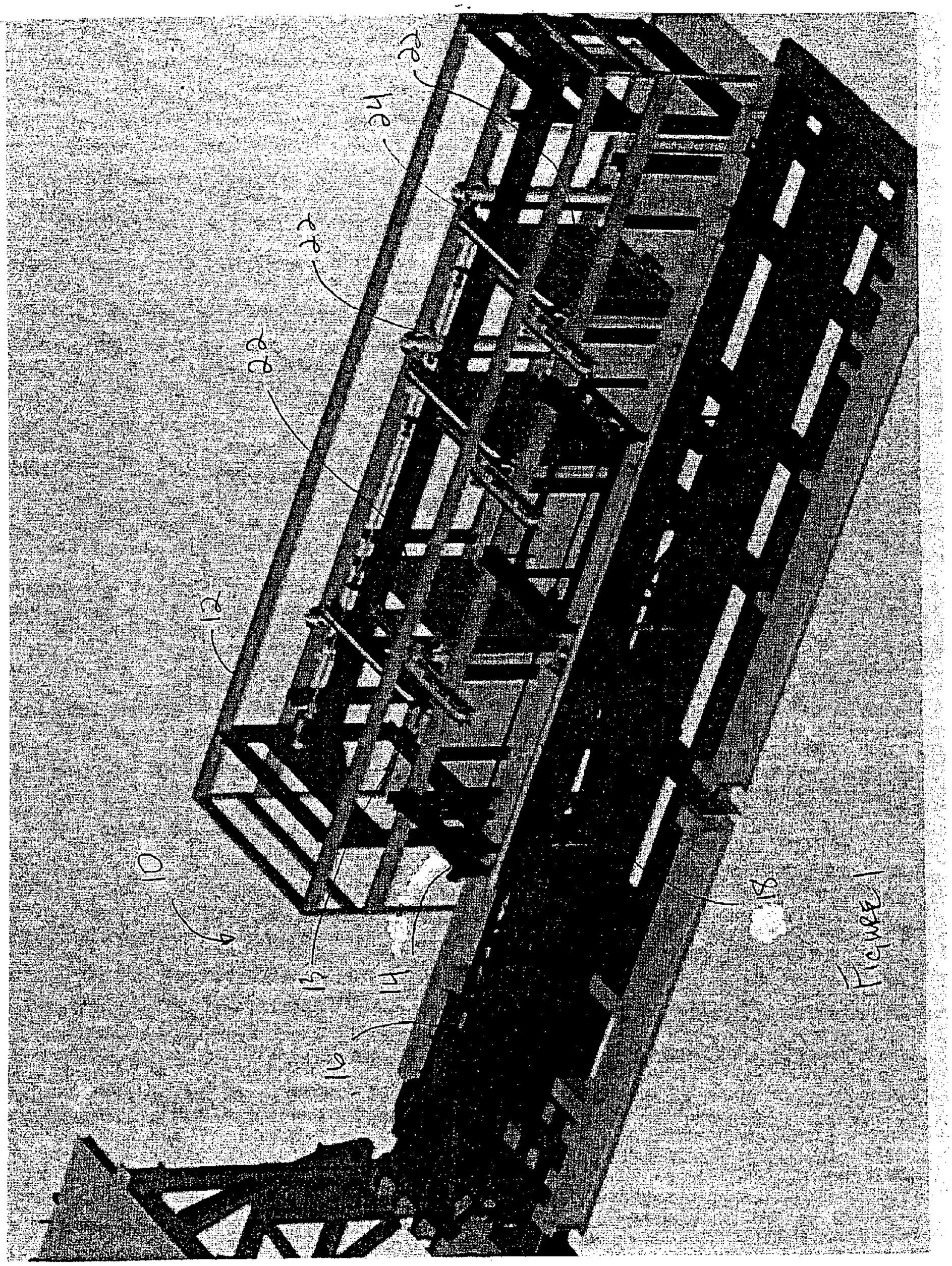


FIGURE 1

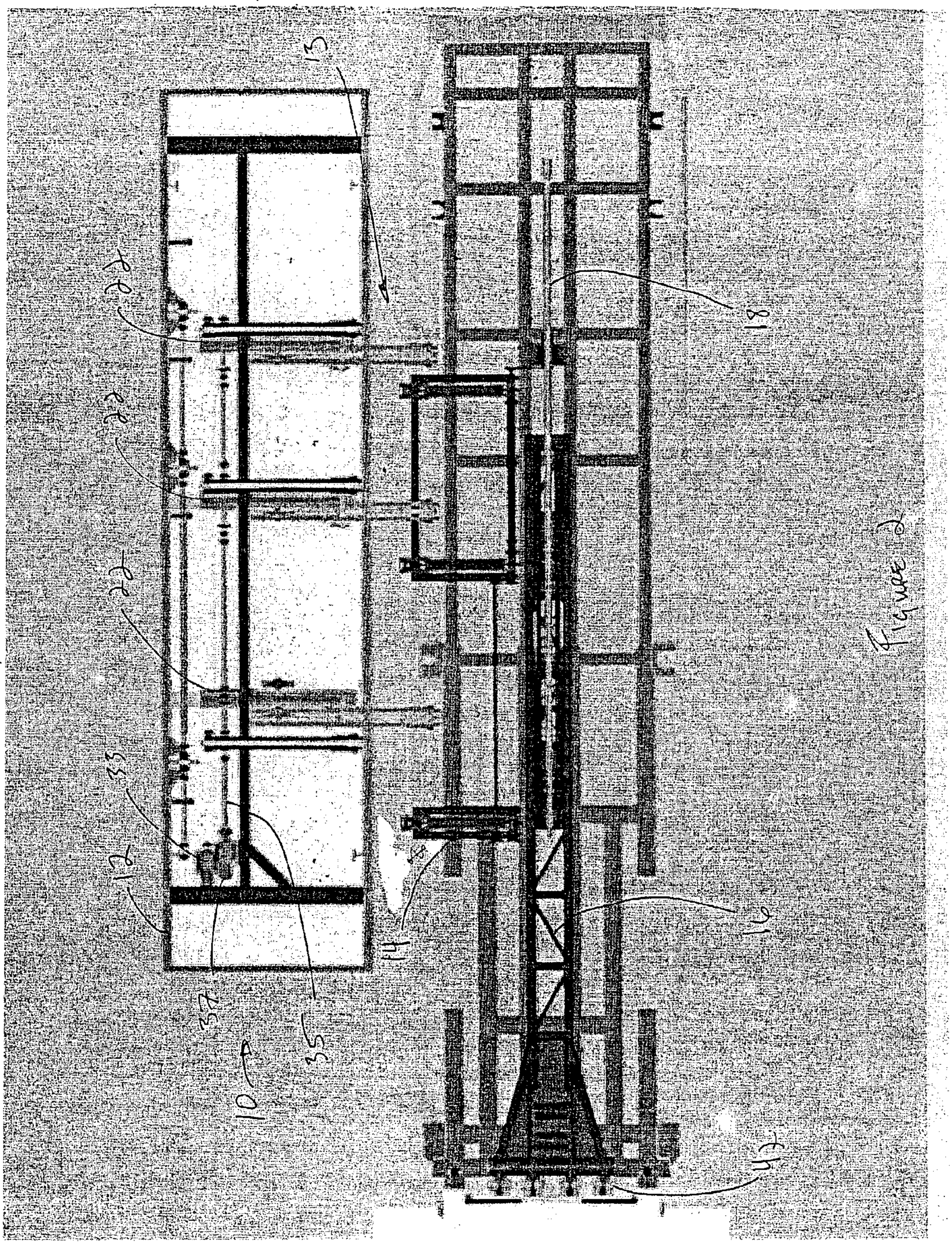


FIGURE 2

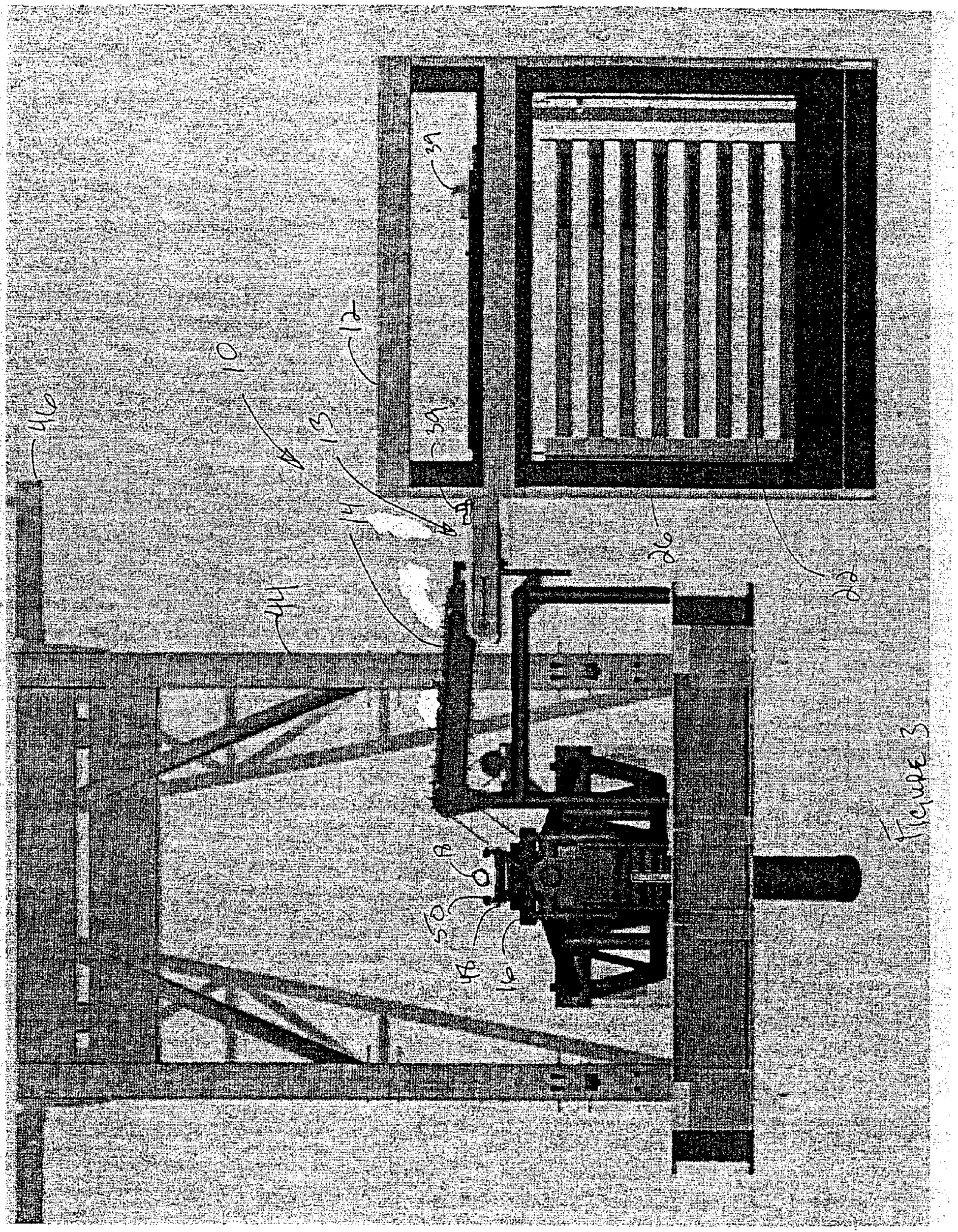

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Figure 3

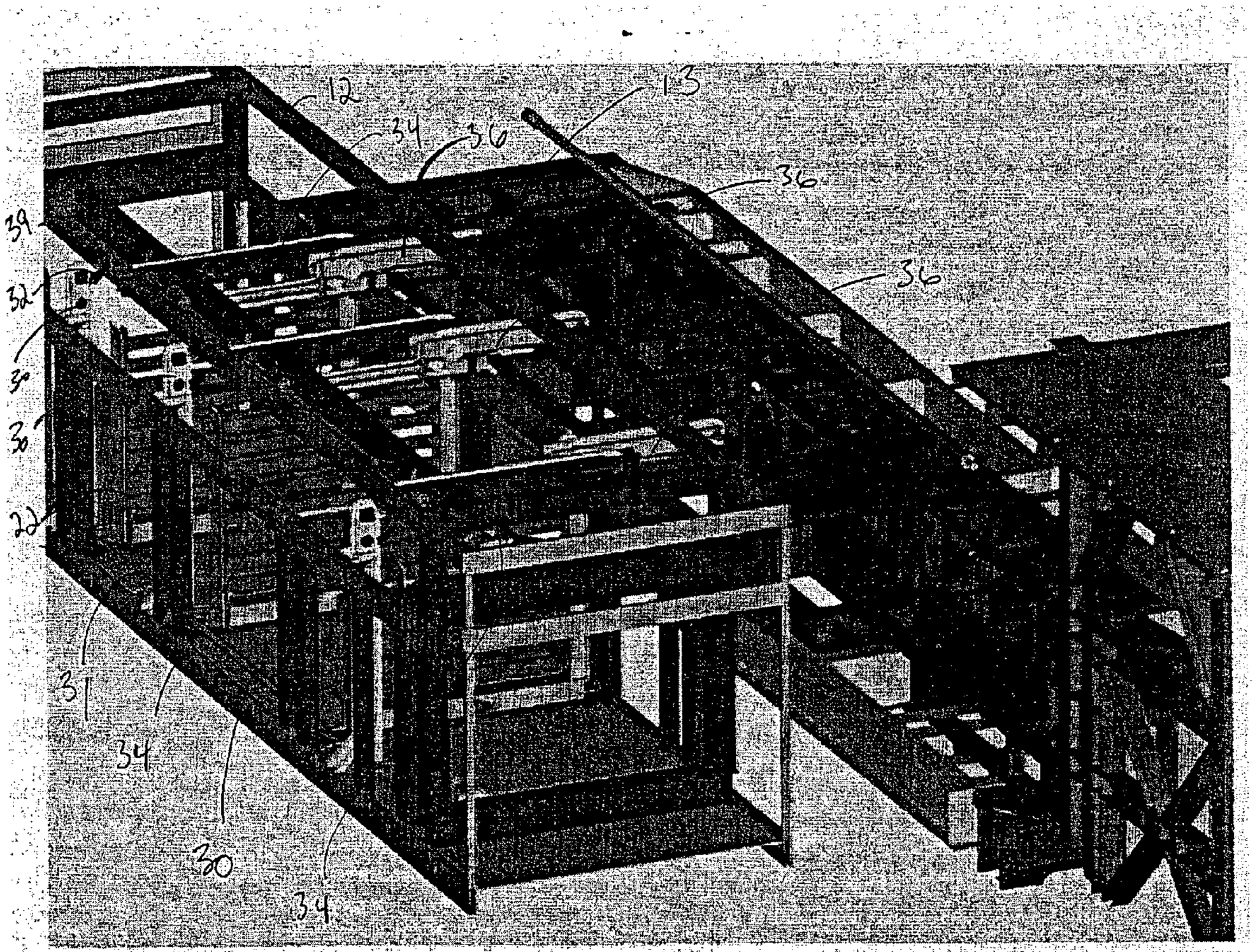

FIGURE 4

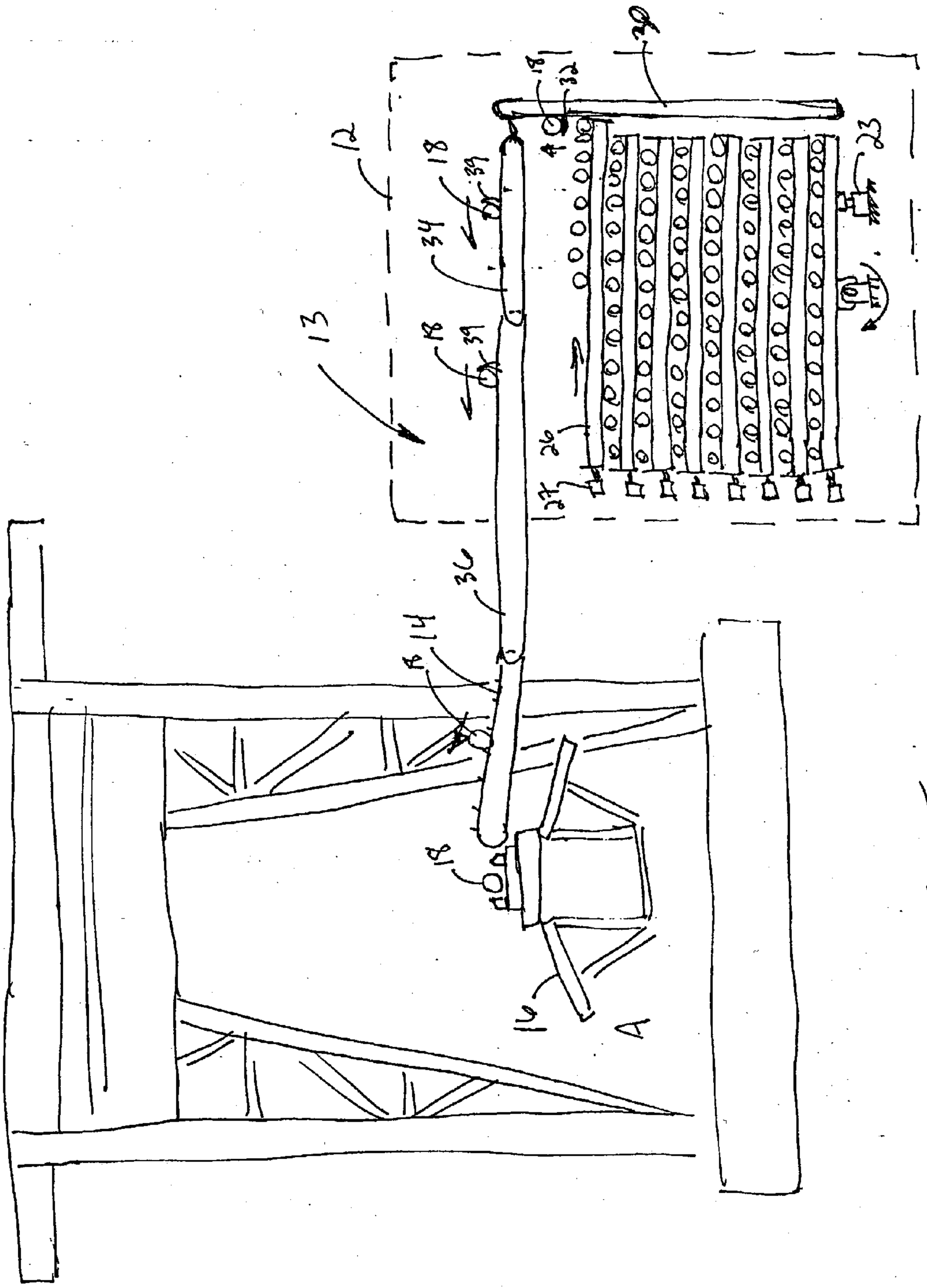

Figure 5

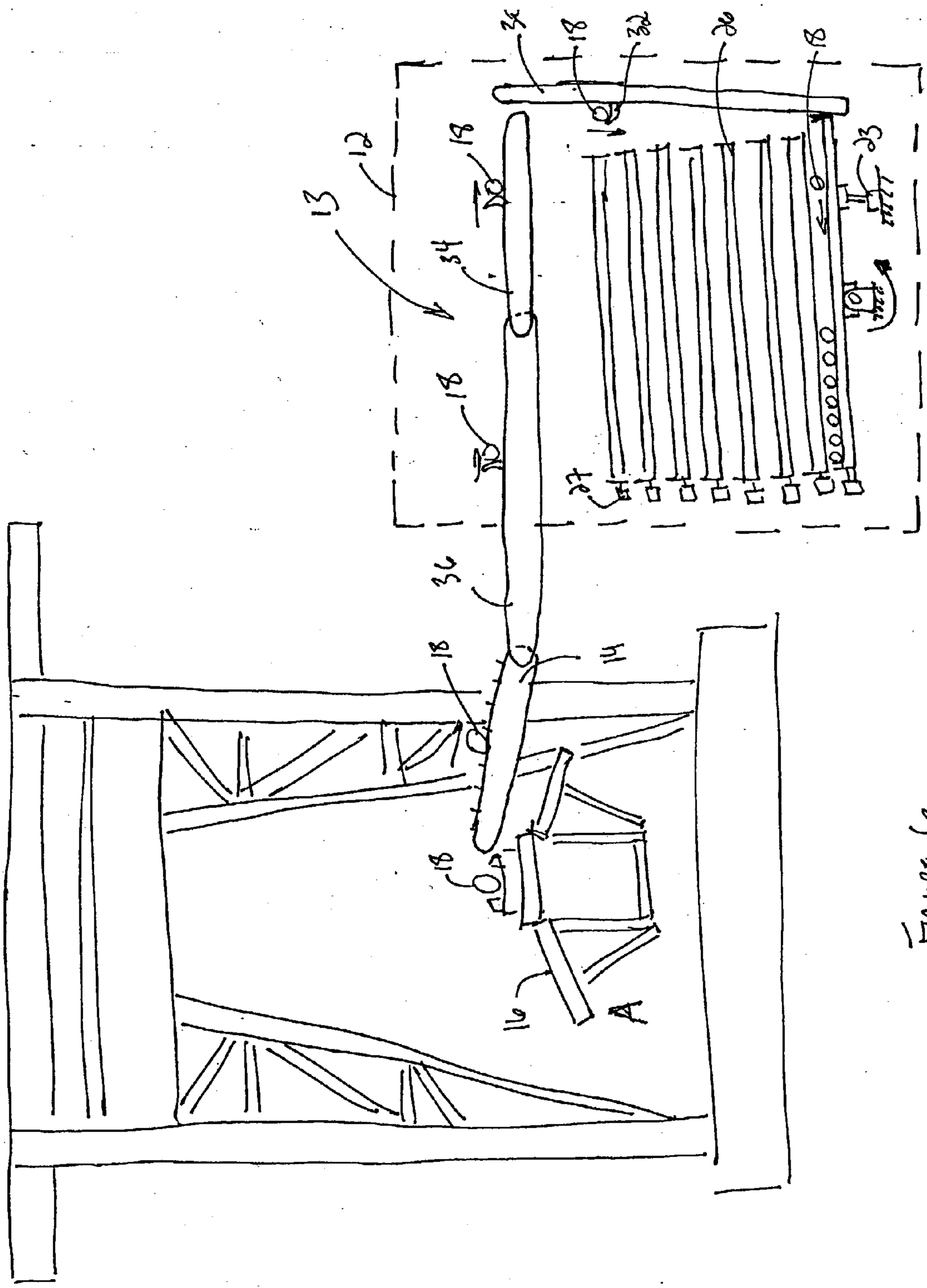

Figure 6

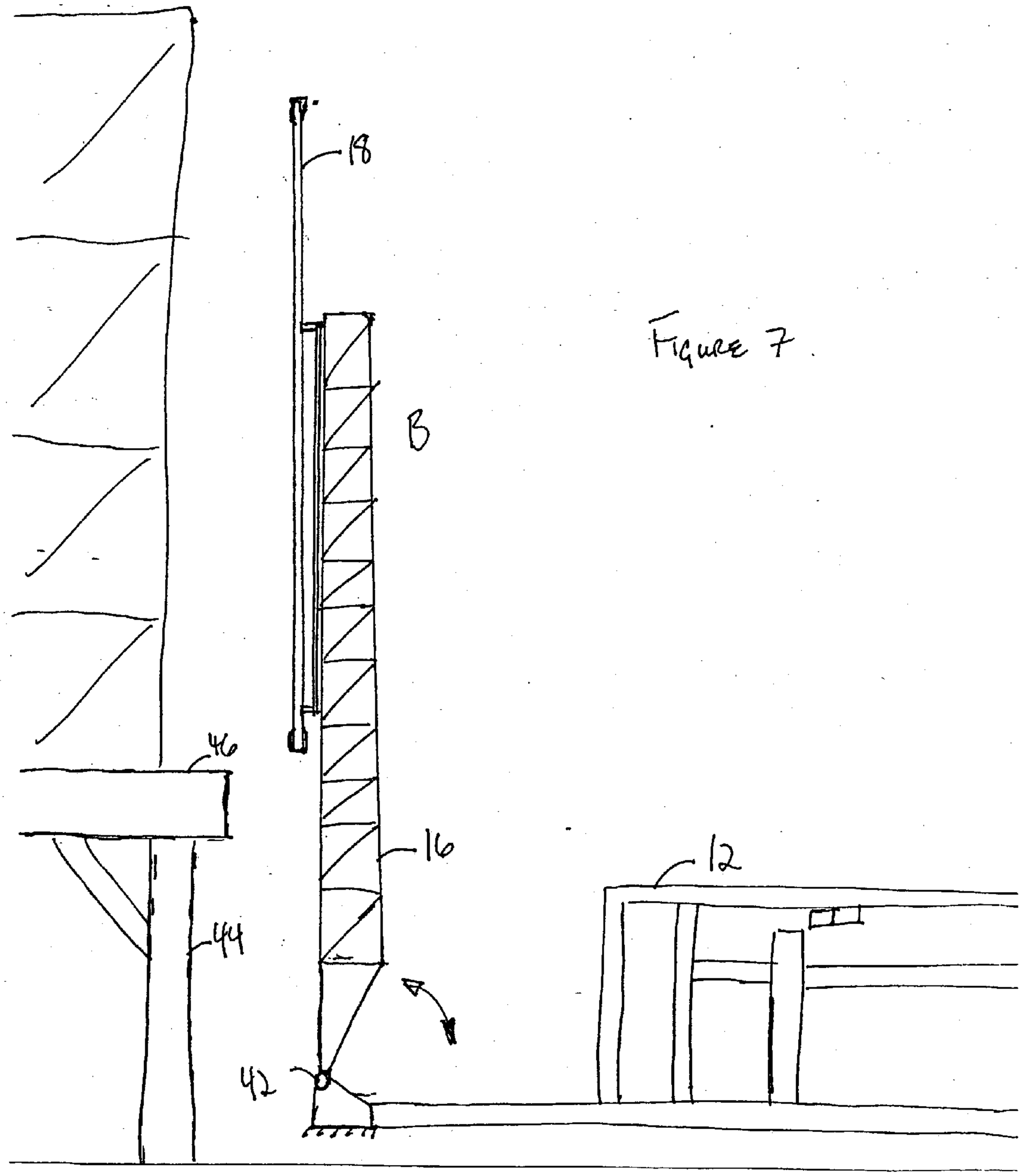

FIGURE 7.

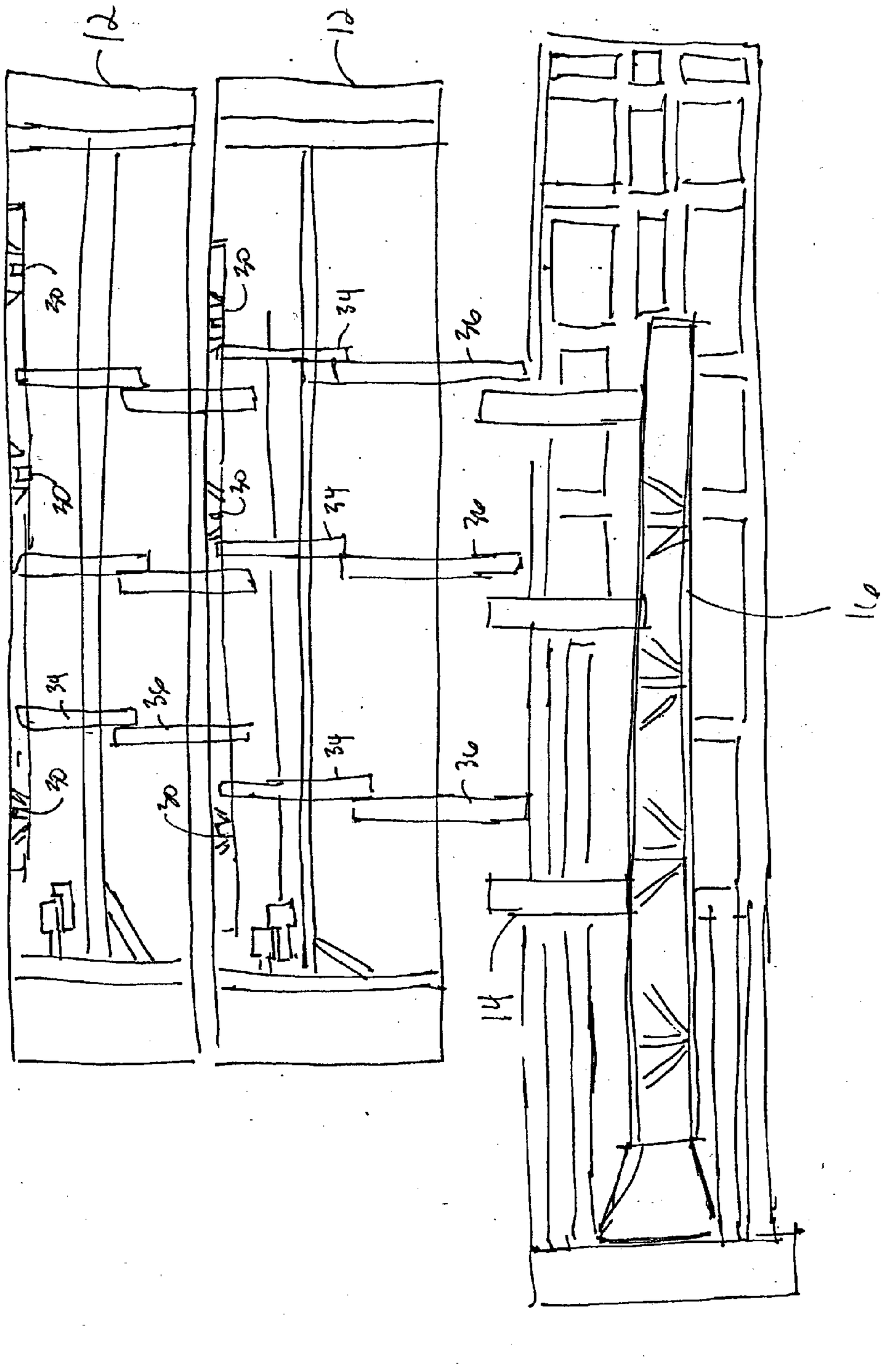

Figure 8

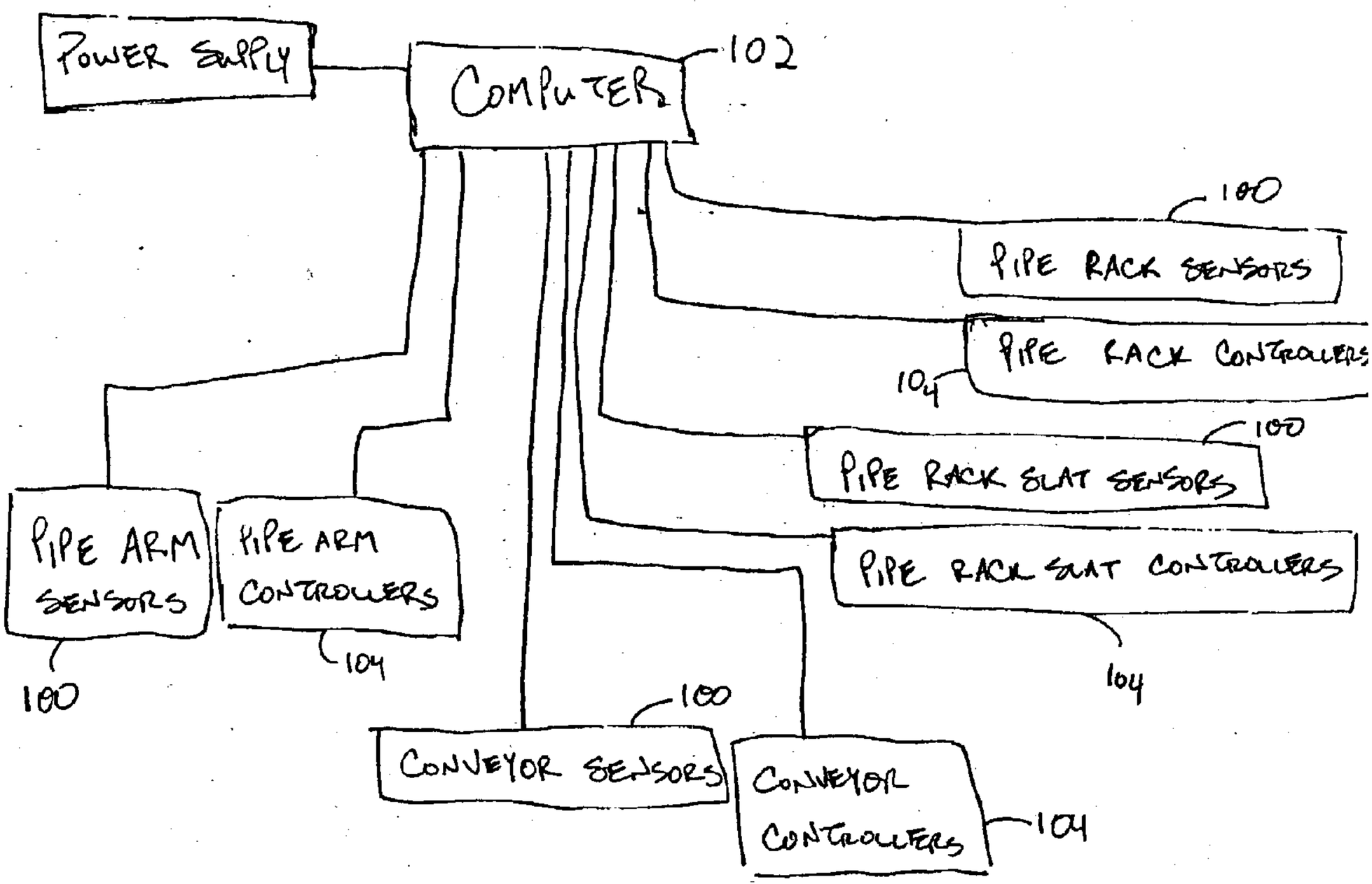
POWER SUPPLY
COMPUTER
102
100
PIPE RACK SENSORS
PIPE RACK CONTROLLERS
104
100
PIPE RACK SLAT SENSORS
PIPE RACK SLAT CONTROLLERS
104
PIPE ARM SENSORS
100
PIPE ARM CONTROLLERS
104
100
CONVEYOR SENSORS
CONVEYOR CONTROLLERS
104

FIGURE 9

TUBULAR HANDLING APPARATUS AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit of 35 U.S.C. §111(b) provisional application Serial No. 60/359,535 filed Feb. 25, 2002, and entitled "Tubular Handling Apparatus and Method", hereby incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable.

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] The present invention relates generally to handling well bore tubulars. More particularly, the present invention relates to a system for handling and storing the tubulars as they are inserted into and removed from a well bore.

[0005] 2. Description of the Related Art

[0006] Drilling an oil or gas well involves two main operations: drilling and tripping. To commence the drilling procedure, a drill string composed of drill pipe and terminating with a drill bit is positioned within a drilling rig. A rotating drive mechanism rotates the drill string to bore the drill bit into the ground. The components of the drill string, such as drill collars and drill pipe, are threaded for interconnection. Depending on what type of drive system is being used, the uppermost length of drill pipe in the drill string is connected to the drive mechanism. As the drill bit advances and the top of the drill string approaches the working platform or drill floor of the drilling rig, additional lengths of drill pipe must be added to the drill string in order to advance the drill string further into the ground. Pipe is added by temporarily supporting the top of the drill string using "slips" and disconnecting the drive mechanism from the top of the drill string. The rig's elevating system then lifts a new section of drill pipe into position and the new section of pipe is connected to the top of the drill string. The drive mechanism is then reconnected to the drill string, and drilling operations resume until it is again necessary to add more sections of drill pipe.

[0007] Tripping is a necessary but unproductive part of the overall drilling operation, and involves two basic procedures. The first procedure is extracting drill pipe from the well (referred to as "pulling out of hole" mode, or "POH"), and the second is replacing drill pipe in the well ("running in hole" mode, or "RIH"). Tripping may be necessary for several reasons, such as for replacement of worn drill bits, for recovery of damaged drill string components, or for installation of well casing.

[0008] In POH mode, the drive mechanism is removed temporarily, the drill string is connected to pipe elevators, and the drill string is pulled partially out of the hole as far as the hoisting mechanism and geometry of the drilling rig will permit. The slips then support the drill string so that the section or sections of the drill pipe exposed above the drill floor may be disconnected or "broken out" and moved away from the well. The elevators then reengage the top of the drill string so that more of the drill string may be pulled out of the hole. This process is repeated until the desired portion of the drill string has been extracted. The procedure for RIH mode is essentially the reverse of that for POH mode.

[0009] Whatever type of rig is being used, drilling operations require a convenient storage area for drill pipe that will be either added to or removed from the drill string during drilling or tripping. On many rigs, drill pipe is stored vertically, resting on the drill floor and held at the top in a rack known as a "fingerboard." This system typically requires a "derrickman" working on a "monkey board" high up in the rig, to manipulate the top of the drill pipe as it is moved in and out of the fingerboard. Other rigs use a "pipe tub", which is a sloping rack typically located adjacent to and extending below the drill floor. Drill ships and ocean-going drilling platforms often provide for vertical or near-vertical storage of drill pipe in a "Texas deck" located under the drill floor, with access being provided through a large opening in the drill floor.

[0010] When sections of drill pipe are being added during drilling or in RIH mode during tripping, the pipe must be transported into position from the pipe storage area. The opposite applies in POH mode during tripping, when pipe removed from the drill string must be transported away from the well and then to the storage area. With most if not all known drilling rigs, these pipe-handling operations cannot be conveniently performed using the rig's main hoist, because the main hoist typically is centered over the well hole, and cannot be moved laterally. The pipe has to be moved laterally using either manual effort or auxiliary machinery. In addition, drilling a well bore requires pipe joints of different size and different maximum tool-end upsets. The placement and sizing of the pipe handling devices must take into account the range of sizes of pipes and their maximum too-end upset so as to contact the pipe body only and not the pipe ends.

[0011] It can readily be seen that the efficiency and economy of a well-drilling operation will increase as the amount of time and effort required for handling drill pipe is decreased. Drill pipe is typically manufactured in standard-length "joints." One common length for a pipe "joint" is 31 feet. Many known rigs handle "stands" made up of two joints ("doubles," in industry parlance) or three joints ("triples"), and such rigs are typically thought to provide significant operational cost savings over rigs that can handle only single joints of pipe.

[0012] Multiple-joint rigs have significant disadvantages, however. To accommodate doubles and triples, they must have taller masts. For instance, if the rig is to handle triples that are 93 feet long, the hoist must be able to rise 100 feet or more above the drill floor and the mast has to be even higher than that. Because of the increased height, the mast will obviously be heavier and therefore more expensive than a shorter mast, even though the maximum hoisting loads that the mast must be designed for might be the same in either case. A taller mast's weight and cost will be even further increased by the need to design it for increased wind loads resulting from the mast's larger lateral profile. A larger mast also requires a larger base to support the higher structure. The larger the size of the base, or "footprint", the greater the overall cost of the well.

[0013] Tall, heavy rigs also have particular drawbacks when used on ocean-going drill platforms or drill ships. Each floating platform or drill ship has its own particular total weight limit, made up of dead weight plus usable load capacity. Every extra pound of rig weight adds to the dead weight and reduces the usable load capacity correspondingly. Extra dead weight not only increases fuel costs for transportation, but also increases expenses for supply ships, which must make more frequent visits because the platform or drill ship has less available load capacity for storage of supplies. Moreover, ocean-going rigs generally need to be even taller than comparable land-based rigs. The additional height is needed compensate for vertical heave of up to 15 feet or more to keep the drill bit working at the bottom of the hole under an essentially constant vertical load when the platform or drill ship moves up or down due to wave action.

[0014] Another shortcoming of tall rigs is that the center of gravity of the rig, as well as that of the entire drilling platform, generally rises higher as the mast becomes taller. This is especially true for rigs that have heavy hoisting equipment mounted high in the mast. In stormy conditions, drilling and tripping operations can become impractical, unsafe, or both. This risk increases as the rig's center of gravity rises, such that a tall rig generally will have to be shut down to wait out bad weather sooner than a shorter rig in the same weather. Downtime due to weather conditions, known as "waiting on weather" time (or "WOW" time) in drilling parlance, is extremely expensive. Experience in drilling operations has been that WOW time averages as much as 10% of total rig deployment time. Because the total expense of operating an offshore rig is commonly in the range of $150,000 or more per day, it is readily apparent that the pipe-handling economies made possible by offshore rigs with tall masts can be offset significantly by a corresponding risk of increased WOW time.

[0015] Another disadvantage of high mast rigs involves the transportation of mobile rigs from site to site. Typically, portable rigs are loaded onto trucks and moved to different locations. The cost and difficulty of transportation of the rigs can increase as the size of the rig increases. Transporting rigs can also involve travel over narrow roads and bridges and travel in hazardous weather. Thus, large rigs can provide obstacles as to the conditions and locations in which they can be transported.

[0016] Additionally, traditional rigs require certain manual intervention in handling the drill pipes at various stages of the drilling process. The process of manually moving pipe or manually operating equipment used to lift and or rotate pipe can be tedious and dangerous. Humans are sometimes required to load pipe onto pipe racks, roll pipe across the racks, pull single pipes to the rig floor, screw the threaded connections together, and stand pipe in combinations of two or three joints into the fingers of the racking board of a conventional derrick.

[0017] For all the reasons outlined above, there is a need in the well-drilling industry for a drilling rig: (1) that via automation and other means, provides for a safer work environment than that of a conventional rig; (2) that delivers significant cost savings derived from transporting drill pipe to and from a pipe storage area automatically so as to eliminate or minimize the need for time-costing manual labor; (3) that is light and easily movable to facilitate rig moves; and (4) that can work on narrow well centers and have a very small footprint.

SUMMARY OF THE EMBODIMENTS

[0018] In one embodiment, the pipe handling system comprises a pipe magazine, a pipe conveyor system, and a pipe arm for use in automatically handling pipes in conjunction with a drill rig for drilling a well bore. Alternatively, the pipe handling system includes multiple pipe magazines, each with conveyor systems that transport the pipe from one pipe magazine to another until the pipe is delivered to the pipe arm.

[0019] In operation, the pipe handling system runs in two modes, RIH mode where pipe is delivered from the magazine and POH mode where pipe is delivered to the magazine.

[0020] In the RIH mode, the pipe magazine delivers joints of pipe to the pipe conveyor system. The pipe conveyor system receives the joint of pipe from the magazine and then delivers the joint of pipe to the pipe arm. Clamps on the pipe arm then clamp around the pipe joint and hold it as the pipe arm pivots from a horizontal position to a vertical position. The pipe arm then presents the pipe joint over the well hole center where elevators on the rig latch on to the pipe. Once the elevators latch on to the pipe, the clamps on the pipe arm open and the pipe arm pivots back to its horizontal position.

[0021] The POH mode executes the opposite process from the RIH mode. Once the pipe elevators latch on to a pipe joint and the connection is broken from the drill string, the clamps on the pipe arm clamp around the pipe. The elevators then unlatch, release the pipe, and are raised out of the way of the pipe arm. The pipe arm then pivots back down to the horizontal position to deliver the pipe to the pipe conveyor system. "Kickers" on the pipe arm push the pipe onto the pipe conveyor system. The pipe conveyor system then delivers the pipe to the pipe magazine for loading and storage.

[0022] The entire system is alternatively automated and sequenced via electronic sensors and signals that measure the location of pipe at specific intervals. The entire system is also alternatively integrated with software and a general-purpose computer to ensure the pipe is passed from one machine to the next as seamlessly as possible.

[0023] The embodiments thus provide a pipe handling system for a drilling rig that provides for a safer work environment than that of a conventional rig. The system also delivers significant cost savings derived from transporting drill pipe to and from a pipe storage area automatically so as to eliminate or minimize the need for time-costing manual labor. The pipe handling system is also light and easily movable to facilitate rig moves. Finally, the pipe handling system is part of a drilling rig that can work on narrow well centers and have a very small footprint.

[0024] Thus, the embodiments comprise a combination of features and advantages that enable them to overcome various shortcomings or problems associated with prior devices. The various characteristics described above, as well as other features, will be readily apparent to those skilled in the art upon reading the following detailed description of the embodiments and by referring to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] For a more detailed description of the embodiments, reference will now be made to the accompanying drawings, wherein:

[0026] **FIG. 1** is a perspective view of the pipe handling system;

[0027] **FIG. 2** is a top view of the pipe handling system;

[0028] **FIG. 3** is a front elevation view of the pipe handling system;

[0029] **FIG. 4** is a perspective view of the pipe handling system;

[0030] **FIG. 5** is a schematic view of the pipe handling system showing pipe being unloaded from the pipe magazine;

[0031] **FIG. 6** is a schematic view of the pipe handling system showing pipe being loaded to the pipe magazine;

[0032] **FIG. 7** is a side elevation view of the pipe handling system showing the pipe arm delivering the pipe to the drilling rig;

[0033] **FIG. 8** is a top view of a pipe handling system with multiple pipe magazines; and

[0034] **FIG. 9** is a block diagram of the sensor and control system for controlling the pipe handling system with a general-purpose computer.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0035] FIGS. **1-4** show a pipe handling system **10** comprising a pipe magazine **12**, a pipe conveyor system **13**, and a pipe arm **16**. The pipe handling system **10** handles pipes **18** in conjunction with a drilling rig **20** for drilling a well bore. The pipe magazine **12** and the pipe conveyor system **13** are modular units that allow for easy assembly, disassembly, and transportation of the pipe handling system **10**.

[0036] As shown in **FIG. 1**, the pipe magazine **12** includes multiple integral pipe racks **22** arranged horizontally and spaced along the length of and inside the magazine **12** for supporting multiple layers of pipes **18** horizontally. The racks **22** pivot on the longitudinal axis of the pipes **18** to gravitationally bias the pipes **18** to one side of the magazine **12** or the other. The racks **22** pivot depending on whether the pipes **18** are being unloaded from or loaded onto the racks **22**. Hydraulic cylinders **23** control the position of the racks **22**. Each rack **22** comprises vertically spaced horizontal supports or slats **26** (**FIG. 3**) for arrangement of the pipes **18**. Hydraulic cylinders **27** control the slats **26** and selectively extend the individual slats **26** for loading and unloading the pipes **18**.

[0037] The pipe conveyor system **13** comprises vertical conveyors **30** on one side of each magazine **12** (**FIG. 4**). The vertical conveyors **30** can be a chain, elevator, belt, or any other suitable conveyor type. The vertical conveyors **30** each have a shovel arm **32** facing the rack **22** for moving the pipe **18** along the vertical conveyors **30**. A motor **33** drives a shaft **31** (**FIG. 4**), which drives the vertical conveyors **30**. Each magazine **12** also has a first set of three horizontal magazine pipe conveyors **34** (**FIG. 4**). As best shown in **FIG. 4**, the first set of magazine horizontal pipe conveyors **34** begins at the vertical conveyors **30** and extends to a second set of three magazine horizontal pipe conveyors **36**. The second set of magazine horizontal pipe conveyors **36** begins at the end of the first set of magazine horizontal pipe conveyors **34** and extends out of the side of the magazine **12** to the pipe conveyor **14**. A motor **37** drives a shaft **35**, which drives the first set of magazine horizontal pipe conveyors **34** (**FIG. 4**). The first and second set of magazine horizontal pipe conveyors **34**, **36** have a shovel arm **39** on each conveyor for moving the pipe **18** along the conveyors **34**, **36**.

[0038] As shown in **FIG. 3**, the pipe conveyor **14** begins at the end of the second set of the magazine horizontal pipe conveyors **36**. As part of the pipe conveyor system **13**, the pipe conveyor **14** transfers the pipe **18** back and forth between the pipe magazine **12** and the pipe arm **16**. The pipe conveyor **14** can be a chain and shovel (ledge) arrangement, a synthetic belt with deep ridges, a push-pull machine that pushes or pulls pipe across a smooth surface, or any other suitable mechanism for moving pipe.

[0039] The pipe arm **16** is a large trussed or beam arm that pivots about a pivot point **42** (**FIG. 2**) located near the base of the drilling substructure **44** that supports the rig floor **46** of the rig (not shown). The arm **16** pivots from a horizontal position to a vertical position. At the horizontal position the arm **16** is loaded with pipe **18** from the pipe conveyor **14**. At the vertical position, the arm **16** delivers pipe **18** to a staging position offset from the centerline of the hole. When the support arm **16** is required to deliver or receive a joint of pipe **18** from the well center, an articulating platform **48** that supports the pipe **18**, pushes or pulls the pipe **18** from the staged position to wellbore centerline. A single hydraulic cylinder (not shown) located some distance from the pivot point **42** is used to pivot the arm **16** from the horizontal position to the vertical position. Clamps **50** hold the pipe **18** firmly against the back of the articulating platform **48**. The clamps **50** do not grip the pipe **18**, but only exert enough pressure to prevent the pipe **18** from moving. The articulating platform **48**, attached to the pipe arm **16**, includes a set of parallel arms with hydraulic cylinders (not shown) that are used to present the pipe **18** over the well center. This "articulating" distance can be adjusted to automatically align the pipe **18** center with the well hole center for a range of different pipe sizes. A lipped pipe stop (not shown), which is part of the articulating platform **48**, can telescope up and down when the arm **16** is vertical. The pipe stop provides flexibility on: (1) how and where the pipe **18** is presented over the hole; (2) the ability to clear the pipe **18** from the pipe stop when offloading toward the magazine **12**; and (3) the ability to engage pipe **18** in the elevators (not shown) without moving the drive mechanism (not shown). Steel rollers (not shown), driven only if necessary, are used to clear the pipe **18** from the pipe stop to offload towards the pipe conveyor **14**, or to load pipe **18** to the pipe stop prior to lifting the pipe **18**. "Kickers" (not shown), integral to the arm **16**, are used to push the pipe **18** either toward the pipe conveyor **14** or toward a bottom hole assembly ("BHA") module (not shown) on the opposite side of the arm **16** than the magazine **12**.

[0040] In operation, the pipe handling system **10** runs in two modes, RIH mode where pipe **18** is delivered from the magazine **12** and RIH mode where pipe **18** is delivered to the magazine **12**.

[0041] As shown schematically in **FIG. 5**, in RIH mode, the pipe magazine **12** delivers joints of pipe **18** to the pipe arm **16** using the pipe conveyor system **13**. The rack hydraulic pistons begin the process by tilting the racks **22** toward the vertical conveyors **30**. The slat hydraulic cylinders then selectively extend a slat **26** to place a pipe **18** in line with the shovel arms **32** of the vertical conveyors **30**. The shovel arms **32** of the vertical conveyors then move the pipe **18** up where the pipe **18** is transferred to the first set of magazine horizontal conveyors **34**. The pipe **18** then travels across the first set of magazine horizontal conveyors **34** and is transferred to the second set of magazine horizontal conveyors **36**. The second set of magazine horizontal conveyors **36** then carry the pipe **18** out of the magazine **12** and onto the pipe conveyor **14**. The pipe conveyor **14** finally carries the pipe **18** to the pipe arm **16**. The clamps **50** on the pipe arm **16** clamp around the pipe joint **18** and hold it against the articulating platform **48** as the pipe arm **16** pivots from the horizontal position "A" as shown in **FIG. 5** to the vertical position "B" as shown in **FIG. 7**. Once in position and the drillstring is ready to receive the pipe **18**, the articulating platform **48** presents the pipe joint **18** over the well hole center. Elevators on the rig then latch on to the pipe **18** and lift it up. After sensors confirm that the pipe **18** has been lifted off and cleared the pipe stop, the clamps **50** open and the articulating platform **48** retracts. The pipe arm **16** then pivots back to its horizontal position "B" to await the loading of another pipe **18**. The connection is then made between the pipe **18** and the rest of the drill string in a conventional manner and drilling or tripping is commenced. The process is repeated with the magazine **12** emptying one slat **26** at a time until no more pipes **18** need to be inserted into the well bore.

[0042] As shown schematically in **FIG. 6**, in POH mode, the opposite process from the RIH mode is executed. The rack hydraulic pistons **23** tilt the racks **22** away from the vertical conveyors **30**. At the rig, the pipe elevators latch on to a pipe joint **18** and the connection is broken from the drill string in a conventional manner. The articulating platform **48** then extends from the pipe arm **16** and the clamps **50** clamp around the pipe **18**. After sensors (not shown) sense that the articulating platform **48** and the pipe stop have engaged the pipe **18**, the elevators unlatch, release the pipe **18**, and are raised out of the way of the pipe arm **16**. The articulating platform **48** then retracts and the pipe arm **16** pivots from position "B" shown in **FIG. 7** back down to the horizontal position "A" to deliver the pipe **18** to the pipe conveyor **14**. "Kickers" (not shown) on the pipe arm **16** then push the pipe **18** onto the pipe conveyor **14**. The pipe conveyor **14** then delivers the pipe to the second set of horizontal conveyors **36** on the pipe magazine **12**. The pipe **18** travels on the second set of horizontal conveyors **36**, back into the magazine **12**, and onto the first set of horizontal conveyors **34**. The pipe **18** then travels across the first set of horizontal conveyors **34** until they reach the vertical conveyors **30**. The magazine vertical conveyors **30** then lower the pipe **18** to the selected extended slat **26**. When the pipe **18** engages the extended slat **26**, it rolls to the end of the slat due to the tilt of the rack **22**. In this manner, each slat **26** of the rack **22** is filled until the magazine **12** is full or until no more pipe joints **18** need to be removed from the bore hole.

[0043] Alternatively, the entire pipe handling system **10** is automated and sequenced using electronic sensors **100** and a general-purpose computer **102** as shown in **FIG. 9**. The sensors measure the location of the pipe **18** at specific intervals. The sensors **100** and the general-purpose computer **102** are used to load pipe **18** to and from the correct slat **26** in the magazine **12**. There is also an assortment of sensors **100** on the pipe arm **16** to control the mechanisms that hold the pipe **18** to the arm **16**, and release the pipe **18** at the correct time. The general-purpose computer **102** uses software to gather information from the sensors **100** and activate controllers **104** throughout the entire pipe handling system **10**. The controllers **104** control various operations throughout the pipe handling system **10** to handle the pipes **18** such as operating the pipe arm **16**, the conveyor system **13**, the pipe racks **22**, and the pipe slats **26**.

[0044] As shown in **FIG. 8**, in another alternative, more than one pipe magazine **12** can be used in the pipe handling system **10**. The additional pipe magazines **12** are spaced lengthwise so that the second set of horizontal conveyors **36** of the additional magazines **12** extend into the next magazine **12** closer to the pipe conveyor **14** and pipe arm **16**. The operation is the same except the pipe joints **18** from the additional magazines **12** are transferred from pipe magazine **12** to pipe magazine **12** across the first set of horizontal conveyors **34** and the second set of horizontal conveyors **36** of the next magazine **12** closest to the pipe conveyor **14**. The pipe joints **18** travel across the sets of horizontal conveyors **34, 36** until they reach the pipe conveyor **14** and the process of loading the pipe into the drillstring is carried out for the RIH mode. In the POH mode, the process is reversed and when one of the magazines **12** is filled, the pipe joints **18** are transferred across the sets of horizontal conveyors **34, 36** to the next magazine **12** and loaded as described above. The additional magazines **12** can also be operated independently. One magazine **22** can thus operate normally as described above while another magazine is loaded or unloaded to or from a forklift. In addition, pipe may be unloaded from or loaded to any of the pipe magazines **12** in any order.

[0045] The embodiments thus provide a pipe handling system for a drilling rig that, via automation and other means, provides for a safer work environment than that of a conventional rig. The system also delivers significant cost savings derived from transporting drill pipe to and from a pipe storage area automatically so as to minimize the need for time-costing manual labor. The pipe handling system is also light and easily movable to facilitate rig moves. The pipe handling system **10** is also capable of handling pipe joints of different size and different maximum tool-end upsets to contact the pipe **18** body only and not the pipe **18** ends. Finally, the pipe handling system is part of a drilling rig that can work on narrow well centers and have a very small footprint.

[0046] While embodiments have been shown and described, modifications can be made by one skilled in the art without departing from the spirit or teaching of this invention. The embodiments described are exemplary only and are not limiting. Many variations and modifications of the system and apparatus are possible and are within the scope of the invention. Accordingly, the scope of protection is not limited to the embodiments described, but is only limited by the claims that follow, the scope of which includes all equivalents of the subject matter of the claims.

What is claimed is:

1. A pipe handling system for use in conjunction with a drilling rig for drilling a well bore comprising:

at least one pipe magazine for holding at least one pipe, each pipe magazine comprising at least one pipe rack;

a pipe arm;

a pipe conveyor system for transferring each pipe from each pipe magazine to the pipe arm; and

where the pipe arm transfers each pipe to and from the drilling rig.

2. The pipe handling system of claim 1 where each pipe magazine comprises more than one pipe rack, each pipe rack comprising at least one slat for holding pipes.

3. The pipe handling system of claim 1 where the pipe conveyor system comprises a vertical pipe conveyor and more than one horizontal pipe conveyor associated with each pipe magazine and an external pipe conveyor for transferring each pipe to the pipe arm.

4. The pipe handling system of claim 1 where the pipe conveyor system further comprises shovel arms for handling each pipe.

5. The pipe handling system of claim 1 wherein the system is capable of transferring pipe from each of the pipe magazines to the drilling rig and also transferring pipe from the drilling rig to each of the pipe magazines.

6. The pipe handling system of claim 1 further comprising more than one pipe magazine where the pipe conveyor system also transfers pipe between each pipe magazine.

7. The pipe handling system of claim 1 where the pipe handling system further comprises sensors for sensing pipe information during handling by the system.

8. The pipe handling system of claim 7 where a general-purpose computer operates the pipe handling system.

9. The pipe handling system of claim 1 where each pipe rack is capable of moving between at least two positions to gravitationally bias each pipe.

10. The pipe handling system of claim 1 where the pipe arm moves from a first position to a second position to transfer each pipe to the drilling rig.

11. A method of transferring at least one pipe from a pipe magazine to a drilling rig comprising:

rotating at least one pipe rack in the pipe magazine to gravitationally bias each pipe while on each pipe rack;

transferring each pipe from each pipe rack to a pipe arm in a first position using a pipe conveyor system;

moving the pipe arm from the first position to a second position; and

transferring each pipe from the pipe arm to the drilling rig.

12. The method of claim 11 where the pipe conveyor system comprises a vertical pipe conveyor and more than one horizontal pipe conveyor associated with the pipe magazine and an external pipe conveyor located between the pipe magazine and the pipe arm.

13. The method of claim 11 further comprising handling each pipe on the pipe conveyor system using shovel arms.

14. The method of claim 11 further comprising multiple pipe magazines, with the pipe conveyor system capable of transferring pipe between the pipe magazines, and further comprising transferring pipe from each pipe magazine to the pipe arm for transfer to the drilling rig.

15. The method of claim 11 further comprising monitoring information on each pipe during handling by the system.

16. The method of claim 15 further comprising controlling the pipe handling system using a general-purpose computer.

17. A method of transferring at least one pipe from a drilling rig to a pipe magazine comprising:

rotating at least one pipe rack in the pipe magazine to gravitationally bias each pipe while on each pipe rack;

transferring each pipe from the drilling rig to a pipe arm in a second position;

moving the pipe arm from the second position to a first position;

transferring each pipe from the pipe arm to each of the pipe racks using a pipe conveyor system.

18. The method of claim 17 where the pipe conveyor system comprises a vertical pipe conveyor and more than one horizontal pipe conveyor associated with the pipe magazine and an external pipe conveyor located between the pipe magazine and the pipe arm.

19. The method of claim 17 further comprising handling each pipe on the pipe conveyor system using shovel arms.

20. The method of claim 17 further comprising multiple pipe magazines, with the pipe conveyor system capable of transferring pipe between the pipe magazines, and further comprising transferring pipe from the pipe arm to each pipe magazine.

21. The method of claim 17 further comprising monitoring information on each pipe during handling by the system.

22. The method of claim 21 further comprising controlling the pipe handling system using a general-purpose computer.

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