

United States Patent

Cintract et al.

[15] 3,702,640

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[54] TIPPING GIRDER FOR THE TRANSFER OF RODS OR TUBULAR ELEMENTS

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[52] U.S. Cl.175/85, 214/2.5, 254/139

[51] Int. Cl.E21b 19/00

[58] Field of Search175/85, 5, 7, 8, 10; 214/2.5;
254/139

[56] References Cited

UNITED STATES PATENTS

3,280,920 10/1966 Scott214/2.5

2,692,059 10/1954 Bolling, Jr.175/85
3,177,944 4/1965 Knights.....175/85
3,061,011 10/1962 Paget.....175/85

Primary Examiner—James A. Leppink

Attorney—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] ABSTRACT

A tipping girder for the transfer of rods or tubular elements, comprising a plurality of adjustable guide nippers movably mounted on the girder for movement transverse to the longitudinal axis thereof, and adjustable locking nippers movably mounted on the girder for movement parallel and transverse to the longitudinal axis thereof. The locking nippers are constructed to automatically engage and lock a rod on the girder when it is moved away from a horizontal position.

9 Claims, 14 Drawing Figures

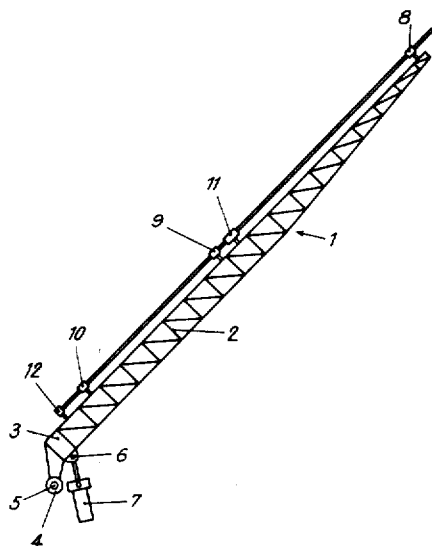


FIG. 1

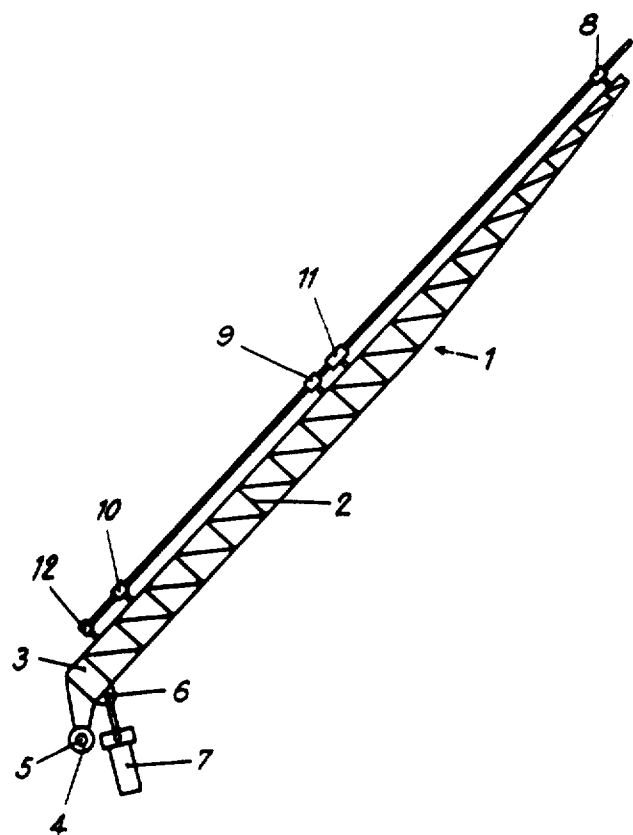


FIG. 2

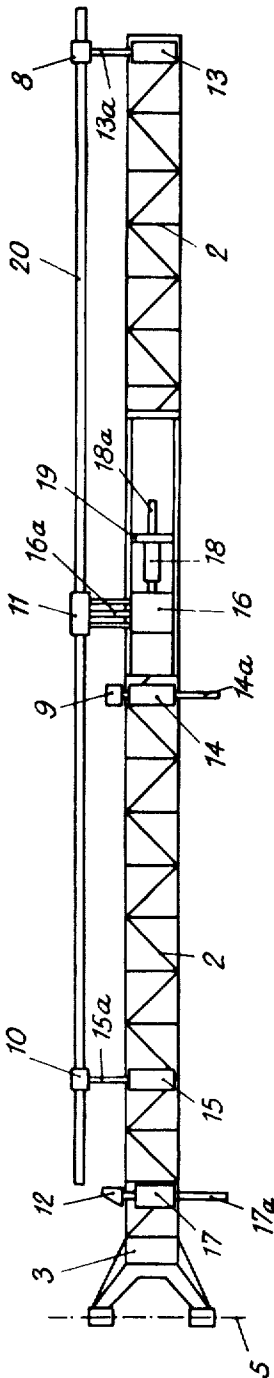


FIG. 3

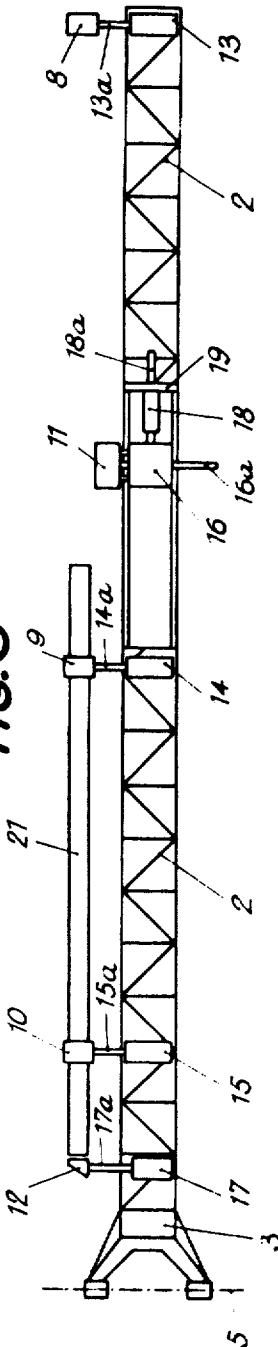


FIG. 4

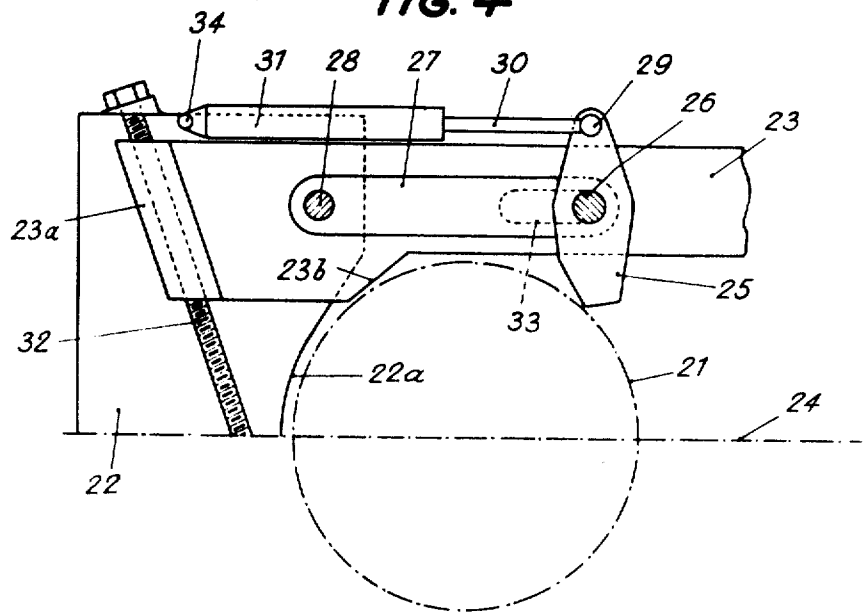


FIG. 5

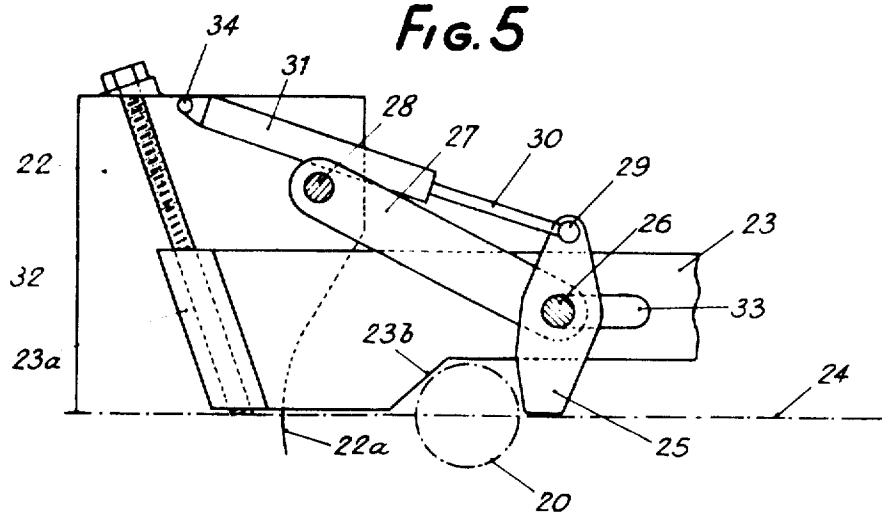


FIG. 6

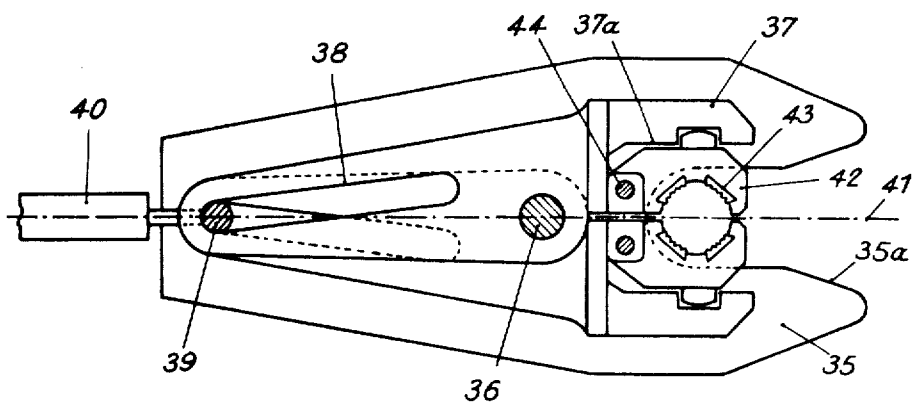


FIG. 7

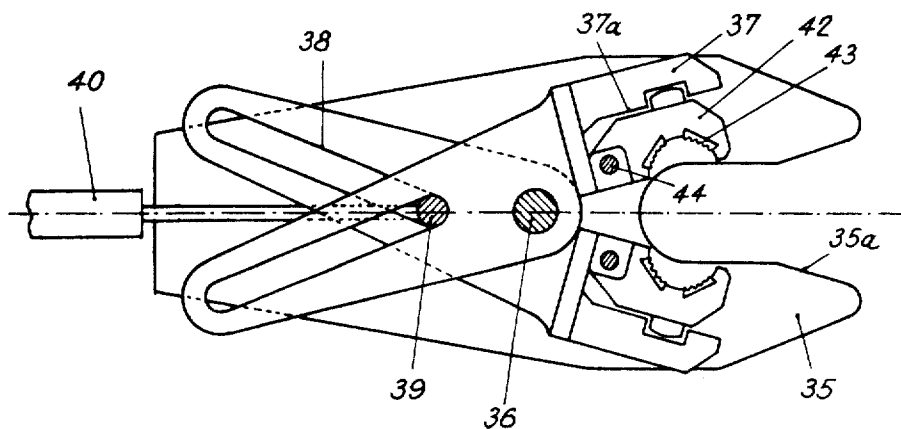


FIG. 8

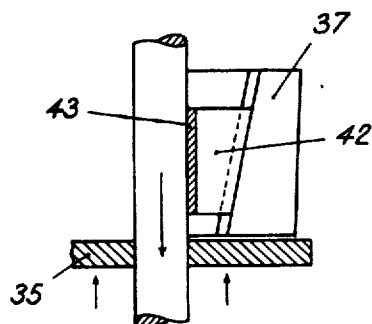


FIG. 9

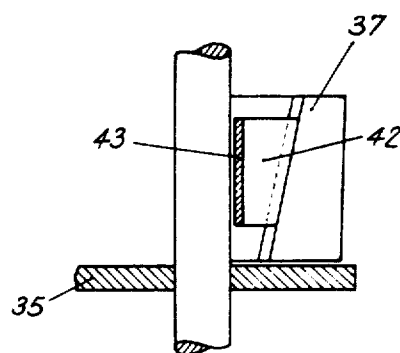


FIG. 8a

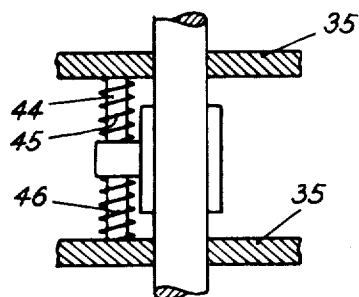


FIG. 9a

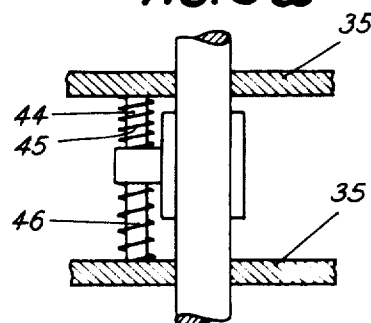


FIG. 8b

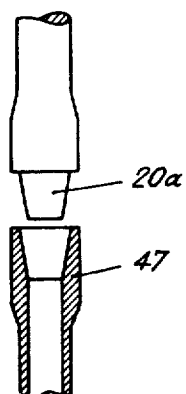


FIG. 9b

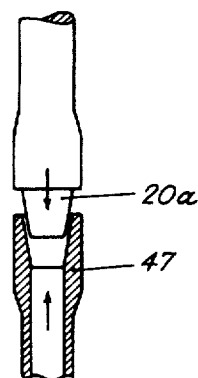
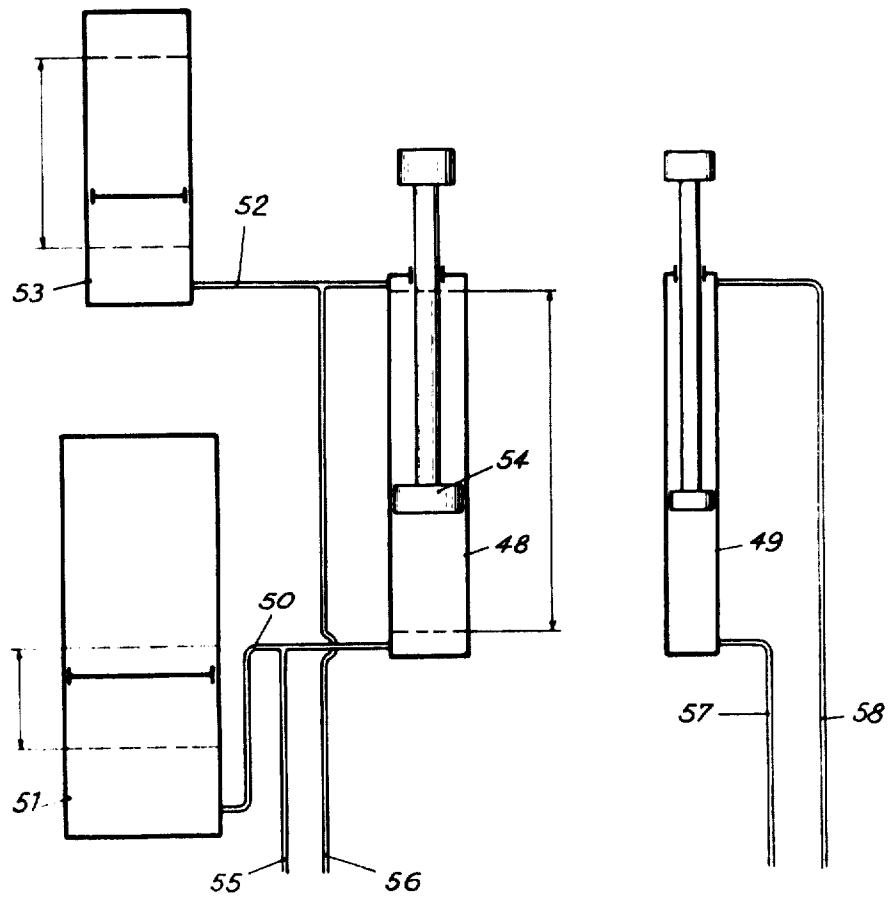


FIG. 10



TIPPING GIRDER FOR THE TRANSFER OF RODS OR TUBULAR ELEMENTS

BACKGROUND OF THE INVENTION

This invention relates to a tipping girder for the transfer of rods or tubular elements and, more particularly for the movement of such rods or tubular elements from a horizontal position to a vertical position. This kind of handling is required, for example, to provide a derrick with rods when these elements are lined up in horizontal stacking systems.

There are already in existence devices for moving rods from a horizontal position in the vicinity of a derrick to a vertical position on the derrick. One of them consists in guiding a mobile arm, serving as a support for the transported element, by controlling the ends of the arms so that they will rest in the guide rails mounted on the derrick itself. The movement is performed either with the help of a handling cart or with the help of the pulley block of the derrick. In spite of the advantages of this system, it is subject to a significant disadvantage in that it requires space on the derrick. Furthermore, this kind of system lacks rapidity, especially when the pulley block of the derrick is used to control the movement of the mobile arm. One can obtain slightly greater speed by using a motorized cart but regardless of the method of movement used, one runs, by virtue of the very nature of the movement of the carrying arm on the rails, into difficulties when it comes to assuring practical guidance of the control cables of the attachment organs for the elements transported on the mobile arm.

In order to eliminate this inconvenience, attempts have been made to eliminate the guide rails by replacing the carrying arm of the rod element with a tipping girder; but the tipping girder cannot be easily moved laterally, as was the case with the carrying arm of a rod in order to move the latter into the axis of the drill hole, and the positioning of the horizontal pivot of the girder was so selected that the tipping of the girder in the vertical position would move the transported rod along the axis of the drill hole. As a result, the handling time for the lowering or raising of the set of rods was necessarily increased by the need for raising the pulley block of the derrick prior to tipping the girder into the vertical position.

SUMMARY OF THE INVENTION

The main object of this invention consists in a tipping girder for the purpose of transporting a rod or any other tubular element from one position to another, characterized by the fact that the girder involves at least one means for the guidance of the transported element and locking nippers for the element, the girder involving at least one mechanism for the movement of the locking nippers so as to move it from a position near the girder to a position spaced therefrom, as well as means for controlling the opening or the closing of the locking nippers.

The advantage of such a girder is represented by the fact that it can be used in any automated system without involving any loss of time whatsoever. If we take the example of the movement of rods of a horizontal stacking system up to the derrick with a view to the lowering of the set of rods, we can see that we are no longer forced to select the placement of the girder with precision because, after tipping into the vertical posi-

tion, it suffices to activate the mechanism for moving the locking nippers for the rod so as to move the latter away from the girder a sufficient distance to reach the axis of the drill hole. Furthermore, since the element can be held against the tipping girder during its entire movement, it is no longer necessary to wait for the pulley block of the derrick to be turned aside in order to control the pivoting motion of the girder, since the girder no longer prevents the movement of the pulley block.

Likewise, during the operation of loading the transported element, it is no longer necessary to move the element to an accurate position on the girder itself since the girder can, by the simple action of the mechanism for moving the locking nippers, pick up the element at the position where it has been moved and then move it back against it.

Finally, the control links for the various members for the guidance and locking of the rods are only subjected to a rotary movement below the girder and not to a complex rotary and longitudinal displacement movement, as in the case of a carrying arm whose ends are guided by rails, and the girder therefore offers remarkable qualities of easy handling and safety.

Another object of the invention is a girder of the above type in which the guidance means consists of nippers with an adjustable inside opening so as to guide rods of varying dimensions effectively, said nippers furthermore involving an automatic control means for the opening and closing of its jaws, so as to pick up or release a rod element, as well as a displacement mechanism permitting its approach toward or movement away from the girder.

Such a system in particular enables us to move large-dimension rods, for example, an assembly of three 9-meter rods, which could not be envisaged with existing tipping girders because these would have relatively reduced dimensions not only to reduce the weights in motion but also to prevent the complete rise of the pulley block when the rods are moved on the derrick, so that their dimension could not exceed 9 meters.

The system involved in this invention furthermore offers the advantage of being economical and efficient because only a single locking mechanism is required and the guidance means can be very simple, since considerable leeway can be left between the transported element and the walls of the guidance means. This leeway can furthermore be provided for when the rods are presented in positions not parallel to the axis of the girder, since movements of the guidance means, perpendicular to the girder, are controlled individually.

Another object of the invention is a girder of the above type, involving furthermore, in the vicinity of its axis of articulation, a stop, as well as a mechanism for the movement of said stop, so as to move it away from or bring it back toward the axis of the girder. When it is necessary to supply a derrick, not with rods, but with particularly heavy tubing elements, it thus becomes possible to use the same girder guidance means in order to transfer three elements without having to use the locking nippers since the tubing element rests, with one of its ends, on the stop.

Another object of the invention is a girder of the above types, wherein the locking nippers involve a frame having two side plates between which there

moves a pair of arms having a curved end and a body including a groove, said arms being pivoted on an axis of said frame, a jaw in the form of an angle capable of being moved along a slide inside the curved end of each arm and perpendicularly to said frame, said jaw being held between two springs which work against each other by resting on each of said side plates, the opening and closing of the arms being accomplished by the simple longitudinal movement of a shaft whose end is moved into said groove which is in each of said arms.

The advantage of such a combination is that it enables us, on the one hand, to pick up a rod by the simple opening of the nippers and to introduce jaws around said rod, followed by the closing of the nippers and, on the other hand, it also facilitates the automatic locking of the rod due to the effect of its own weight, the moment the girder ceases to be horizontal.

Another object of the invention is a tipping girder involving locking nippers of the type indicated and furthermore including a mobile cart which can be moved parallel to the axis of the girder, said nippers and its control means being attached to said cart.

When a girder picks up a horizontal rod and tips it vertically, the jaws of the angle-shaped locking nippers lock the rod as explained above. The mobility imparted to the nippers, due to the fact that the latter forms one piece with a cart that can be moved parallel to the axis of the girder, thus enables us to lower the rod until it runs into a suitable obstacle that serves as a point of support for it. It then suffices to continue the movement of the cart slightly downward in order to release the rod from the corners of the jaw. We thus get an extremely reliable and easily handled means for the movement of very long and relatively heavy rods from a horizontal position to a vertical position.

Other purposes and features of the invention will emerge from the following specification made with reference to the attached drawing which, by way of nonrestrictive example, represents one way of executing a tipping girder for the transport of elements from a first position to a second position, regardless whether they are or are not situated in the same plane.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevational view of the girder of the present invention in course of operation;

FIG. 2 is a schematic plan view of the girder in the horizontal position, loaded with a drilling rod;

FIG. 3 is a view similar to that of FIG. 2, wherein the girder is loaded with a tubing element;

FIG. 4 is a schematic view of one of the variable-diameter guidance nippers, adjusted for the reception of elements with maximum diameter;

FIG. 5 is a schematic view of the nippers shown in FIG. 4, adjusted for the reception of minimum-diameter elements;

FIG. 6 is a schematic view of the nippers for the locking of the girder in the closed position;

FIG. 7 is a schematic view of the locking nippers in the open position;

FIGS. 8, 8a and 8b represent, respectively, the partial schematic views of the jaw of the locking nippers, seen in elevation; of the position of said jaw as seen from the side; and of the position corresponding to the end of the rod held by said nippers, seen in elevation;

FIGS. 9, 9a and 9b are views corresponding to those shown in FIGS. 8, 8a and 8b, when the end of said rod comes into contact with a stop; and

FIG. 10 is a schematic view of the control jacks for the tipping girder.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Since the girder can be installed so as to be used on a derrick or any other type of device, the foundation on which it rests has therefore not been shown in FIG. 1. It will be understood, therefore, that girder 1, consisting of a reticulated structure 2, with a rectangular cross-section at the base in the example shown herein, may be mounted on any suitable support. For this purpose, the reticulated structure 2 is connected to an element in box 3 having two bearings 4 for the reception of an articulation shaft shown schematically at 5 and two hook-on points 6 for two jacks 7 controlling, respectively, the balancing of the girder and its tipping around the axis of shaft 5.

As an illustrative example, the girder has three nippers serving for the guidance of the transported elements. These guidance nippers 8, 9 and 10 can be identical or on the other hand, they can have dimensions appropriate for the diameters of the elements transported. In addition to these nippers, whose number can be increased or decreased, the girder has locking nippers 11 and a stop 12.

The stop 12 as well as each one of nippers 8 to 11 can be moved perpendicularly to the longitudinal axis of the girder and preferably parallel to the rotation axis 5. FIGS. 2 and 3 show the respective movements of each of these loading members. These movements are controlled by jacks 13, 14 and 15 for nippers 8, 9 and 10 and by jacks 16 and 17 for locking nippers 11 and stop 12. It is clear that the body of each of these jacks 13 to 17 can be attached to its own frame (not shown), which itself will constitute one piece with the girder, and that the connection of each of the individual frames to the girder may be fixed, or removable, or may permit their automatic movement. Likewise, rods 13a to 17a of jacks 13 to 17, respectively, can be attached to an appropriate frame, supporting each of the nippers or stops, or can be directly attached to one of the elements constituting the structure of the nippers or the stops.

In the present embodiment, the jack 16 for the locking nippers 11 is attached to a suitable cart which can be moved parallel to the axis of the girder and is controlled by a jack 18 attached to a movable support plate 19. The jack 18, therefore, controls the movement of the cart carrying jack 16 and the movement of the nippers 11 parallel to the longitudinal axis of the girder. In the illustration in FIG. 2, the locking nippers 11 are in the upper position and the cart carrying jack 16 is in a position removed from the plate 19. In this figure, rod 20 is simply guided by nippers 8 and 10 and it is kept locked by nippers 11.

When the elements to be transported, such as tube 21, has a wide diameter and when it is rather heavy, as shown in FIG. 3, the two guide nippers 9 and 10 and the stop 12 may be used to support it. In order to load tubes, such as 21, when they have too large a diameter, one can remove the support plate 19 toward the top of

the girder. As a matter of fact, since the girder is generally used to tip elements similar to rods 20 or to pipes 21 for a long period of time, it is not necessary to provide automatic control for the movement of the assembly consisting of plate 19 and jacks 16 and 18. In practice it suffices to move this assembly by hand.

The nippers 8, 9 and 10 are intended to permit the effective guidance of small-diameter rods or large-diameter pipes in accordance with the invention. Therefore, nippers similar to those shown in FIGS. 4 and 5 can be used, for example, to guide pipes with a diameter of 33 centimeters and a weight of 5 tons to rods with a diameter of 9 centimeters.

Referring now to FIG. 4, for example, we see that pipe 21 is guided by frame 22 of the guide nippers, two arms 23 which are symmetrical with respect to the axis 24 in the figure and the two oscillating levers 25. Each lever 25 turns around a shaft 26 of a small connecting rod 27, pivoted on shaft 28 of frame 22. The shaft 26 moves in a groove 33 in arm 23. The lever 25 is connected by shaft 29 to rod 30 of jack 31. If we assume that the position arm 23 has been adjusted at a suitable level with the help of screw 32, passing into a threaded sleeve 23a of arm 23, in order to receive large-diameter pipes, we can see that it is sufficient merely to return the rod 30 of jack 31 in order to tip levers 25 around their shafts 26 and thus release the pipe 21.

When we want to handle rods with smaller diameters, the height of arm 23 can be adjusted by movement of screw 32. FIG. 5 shows the guide nippers represented in FIG. 4, in the case where the girder must tip a small-diameter rod 20. The parts of the guide nippers have thus been shown here with the same numerical references. Since arms 23 are moved closer toward each other when a small diameter rod is to be supported, the shafts 26 of the small connecting rods 27 assume a new position in their grooves 33 and rotate the small connecting rods around their shafts 28. The oscillating levers 25, which accompany the shafts 26 in their descent, in turn rotate the jacks 31 around their shafts 34. The shape of the lower portion 23b of arms 23, when we have small-diameter rods, enables us to compensate for the large gap between the circumference of rod 20 and the inside contour 22a of frame 22. Thus rods, such as 20, are effectively guided in spite of their small-diameter. Their disengagement is accomplished as hereinbefore explained through the withdrawing of the rods 30. This withdrawal of the rods 30 of the jacks 31 causes the levers 25 to tip around the shafts 26. It is clear that the jacks 31 can be simultaneously controlled or individually controlled.

Any suitable means, such as jacks (not shown) could be used to move the guide nippers perpendicularly to the axis of the girder. Such means could be attached to frame 22. As far as the device for the positioning of the level of arms 23 is concerned, it is obvious that adjusting screws 32 could be replaced by series of perforations made in frame 22 along two symmetrical and inclined axes, With screws and bolts enabling us easily to attach the arms 23, which carry at least two holes for fixation at the desired levels.

The locking nippers 11 have been shown in FIGS. 6 and 7 in two positions, that is, respectively, open and closed. The nippers 11 includes a frame 35 having a shaft 36 on which two arms 37 pivoted. The

forward portion 35a of the frame has a flared shape which facilitates the introduction of a rod. The rear portion may be connected to the rod 16a of jack 16 in any suitable manner (not shown).

Each arm 37 has a groove 38 in which moves the end 39 of a rod of jack 40 whose axis is in the plane of symmetry 41. The forward portions 37a of arms 37 are inclined, as shown in FIG. 8, and serve as guides for the floating jaws 42 which are equipped with knurled portions 43. The jaws 42, visible in FIGS. 8 and 8a, are supported by shafts 44, in FIGS. 6, 7 and 8a, and are engaged by two springs 45 and 46 surrounding each shaft 44 so as to keep each jaw 42 in a middle position with respect to frame 35.

When the rod end 39 of jack 40 is extended outward as in the case of FIG. 7, arms 37 open up and release the transported rod. When rod end 39 is pulled back in as shown in FIG. 6, the jaws 42 are moved along with the arms 37 and close upon the rod introduced between the portions 35a of the frame. The moment the girder is inclined to a predetermined extent, the weight of the transported rod causes angle-shaped jaw 42 to slide downward, as shown in FIG. 8, bringing about a slight compression of spring 46, FIG. 8a. When the girder assumes the vertical position, arm 37 rests on frame 35, thus lightening the load on shaft 36. In FIG. 8b, we show the end 20a of the rod moved into the vertical position and below it a stop 47 which can also, for example, be the end of another rod.

If we want to connect the rods using conventional joints, we must first of all unlock jaw 42 while maintaining the guidance and support of the rod. For this purpose, we effect the movement of rod 18a of jack 18, FIG. 2, which brings about the movement of the locking nippers 11 and the control jack 26 along the girder, until end 20a of the rod rests on stop or piece 47. When the descending movement of the frame 35 continues, the jaw 42 goes up with respect to arm 37, as shown in FIGS. 9, 9a and 9b, which releases the rod from the jaws. Thereafter, the arms 37 and jaws 42 are opened by the outward extension of rod end 39 of jack 40. The springs 45 and 46 then return the jaws 42 to their middle position relative to the frame 35, and the nippers are immediately ready for another operation.

The advantages of such a girder reside mainly in the flexibility of its employment and in its efficiency. We have seen, in effect, that such a girder can transport all kinds of elements, rods or pipe, with short or long dimensions and with diameters that can vary within large proportions, and that it can handle heavy pipes by using a stop at the base of the girder. Furthermore, the girder offers the advantage of being able to pick up the element presented to it or the element which is waiting in a position that can vary by a distance equal to the lateral clearance of the nippers. We can further improve the flexibility and efficiency of the girder by balancing it with a first jack 48, as in FIG. 10, and by controlling its movement with a maneuvering jack 49. For this purpose, the lower portion of jack chamber 48, filled with a suitable fluid such as oil is connected by conduit 50 to a piston and cylinder unit 51, whereas the upper portion of the jack chamber is connected by conduit 52 to a piston and cylinder unit 53. While the girder is tipping, the piston 54 of jack 48 runs through the length of the jack chamber, whereas the oil levels of

units 51 and 53 vary in proportion to the course of the jack. A gas, such as nitrogen, in the units 51, 53 may be compressed more or less by introducing new quantities of oil through circuits 55 or 56 in order to obtain the desired variation in the restoring-force torque. We then need a relatively low power to control the maneuvering jack 49 by means of circuits 57 and 58. We thus increase the speed of the girder's tipping.

Along with the greater handling flexibility obtained by the clearance of the locking and guide nippers, this increased element transfer speed helps increase the area of application of the tipping girder which has just been described and which can also be used to equip an automatic system for the horizontal stacking of rods, as well as in a system for the alignment of pipes by means of overhead traveling cranes, since the girder is capable of grasping any element in order to move it from a first position to a second position, which may or may not be situated in the same plane.

We claim:

1. A girder assembly for the handling and transfer of elongated tubular members from one position to another, comprising:

- a. means mounting one end of the girder for rotation about a horizontal axis,
- b. means coupled to the girder for controlling the rotation of the girder about said axis,
- c. an abutment stop member mounted adjacent said one end of the girder and movable with respect thereto in a direction parallel to said axis,
- d. a plurality of guide members mounted on the girder and movable with respect thereto in a direction parallel to said axis,
- e. a transfer member mounted on the girder and movable with respect thereto in a first direction parallel to said axis and in a second direction parallel to the longitudinal axis of the girder,
- f. openable and closable gripping means mounted on the transfer member for lockingly engaging a tubular member being handled,
- g. means individually coupled to the stop member and the guide members for controlling the movement of the stop member and the guide members in a direction parallel to said axis,
- h. means coupled to the transfer member for controlling the movement of the transfer member in said first and second directions, and
- i. means coupled to the gripping means for controlling the opening and closing of the gripping means.

2. A girder assembly, as in claim 1 wherein said guide members each comprise a guide nipper having an adjustable opening for the reception of tubular members of different size, said guide nipper comprising movable levers and means for opening and closing said levers so as to release or retain a tubular member.

3. A girder assembly, as in claim 1, wherein said gripping means comprises locking nippers having a frame with two side plates between which moves a pair of arms having a curved end and a body including a groove, said arms being pivoted on a shaft on said frame, an angle-shaped jaw movable along a slide inside the curved end of each arm and perpendicularly to said frame, said jaw being positioned between two mutually opposing springs which rest on each of said side plates, said arms being opened and closed by the simple longitudinal movement of a shaft whose end is moved in said groove in each of said arms.

4. A girder assembly, as in claim 1, wherein said gripping means is constructed to automatically engage and lock a tubular member on the girder when it is moved away from a horizontal position.

5. A girder assembly, as in claim 4, further comprising a mobile cart which can be moved parallel to the longitudinal axis of the girder, said transfer member being attached to said cart.

6. A girder assembly, as in claim 5, wherein said cart is controlled by a jack that is secured to a support plate movably mounted on the girder.

7. A girder assembly, as in claim 2, wherein said guide nippers each comprises a frame having an inwardly curved portion for the guidance of large-diameter tubular members, two symmetrical arms whose opposing edges define surfaces for the guidance of all such members, said arms being movable toward and away from each other on said frame, means for retaining said arms in a desired position on said frame, two pivotable jacks on said frame, each of said jacks having rods with ends connected to said movable levers for retaining tubular members, two small connecting rods pivoted at one of their ends on said frame and having a shaft at the other end thereof that is slidable in a groove in the adjacent arm, each of said retaining levers being pivoted on the adjacent shaft and being movable to an open position releasing the tubular member when the rod of said jack is withdrawn to a retaining position when the rod of said jack is extended.

8. A girder assembly as in claim 1, wherein said gripping means comprises a locking nipper in the middle portion of the girder, there are three guide members mounted respectively on the lower portion of the girder, and the stop member is situated below the lower guide member, each of said guide members and said stop being connected to a jack for moving said guide members and said stop perpendicularly to the girder.

9. A girder assembly, as in claim 1 further comprising, a box-shaped element at the lower end thereof having two bearings adapted to receive a shaft for pivotally supporting said girder and having two-hook-on points, one for the attachment of the rod of a balancing jack and the other one for the attachment of the rod of a control jack.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,702,640 Dated November 14, 1972

Inventor(s) Bernard G. CINTRACT et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE HEADING:

The claim to priority was omitted. Should read:

--Foreign Application Priority Data

November 14, 1969 France6939135--.

IN THE SPECIFICATION:

Col. 2, line 62, after "transfer", delete "three" and insert
--these--.

Col. 4, line 68, after "can", delete "remove" and insert
--move--.

Col. 6, line 37, after "jack", delete "26" and insert --16--.

Signed and sealed this 8th day of May 1973.

(SEAL)
Attest:

EDWARD H. FLETCHER, JR.
Attesting officer

ROBERT GOTTSCHALK
Commissioner of Patents