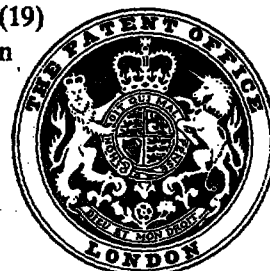


PATENT SPECIFICATION

(11) 1 535 514

1 535 514

- (21) Application No. 50454/75 (22) Filed 9 Dec. 1975 (19)
 (31) Convention Application No. 541264 (32) Filed 15 Jan. 1975 in
 (33) United States of America (US)
 (44) Complete Specification Published 13 Dec. 1978
 (51) INT. CL.² B66C 1/42
 (52) Index at Acceptance
 B8H 702 723 743 745 763 JA



(54) APPARATUS FOR HANDLING ELONGATE ARTICLES

(71) I, CHARLES RICHARD MORSE, a citizen of the United States of America, residing at 720 West 75th, Anchorage, Alaska 99502, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:-

The present invention relates to apparatus for handling elongate articles and which can be used, for example, for unloading lengths of pipe or structural steel from a vehicle and stacking them in a stockpile and which, subsequently, can lift such pipe and structural steel lengths from a stockpile and load them onto a vehicle.

According to the present invention there is provided apparatus for handling elongate articles comprising two article-engaging members for engaging, respectively, opposite end portions of an elongate article to be handled, an elongate frame that is adapted to span the article to be handled along its length, two substantially rigid mounting means each carrying one of the article-engaging members closely underneath the frame, each mounting means being movable along a portion of the frame between its ends to vary the distance between the two article-engaging members for selectively engaging elongate articles of different length, a boom carrying the frame with the length of the frame extending generally transversely of the length of the boom and with respective opposite end portions of the frame projecting substantial distances beyond opposite sides of the boom, and means supporting the boom.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings. In the drawings:-

Figure 1 is a side elevation of an apparatus for handling elongate articles, and

Figure 2 is a similar view showing parts in different adjusted positions;

Figure 3 is an enlarged front elevation of the apparatus with parts broken away; Figure 4 is a further enlarged front elevation of one end portion of the apparatus having parts broken away; Figure 5 is a detail of the structure shown in Figure 4; Figure 6 is an enlarged elevation of a portion of the structure shown in Figure 3 with parts broken away, and Figure 7 is a vertical section taken on line 7-7 of Figure 6; Figure 8 is a top perspective of a portion of the structure shown in Figure 4;

Figure 9 is a front elevation of the apparatus indicating tilting ability of the apparatus; Figure 10 is a transverse section taken on line 10-10 of Figure 12 also indicating tilting ability of the apparatus;

Figure 11 is a plan of a portion of the apparatus indicating pipe-swinging ability of the apparatus;

Figure 12 is a plan of a portion of the apparatus showing mechanism for translating a pipe held by the apparatus; Figure 13 is a detail vertical section of a portion of the structure shown in Figure 12 taken on line 13-13 of Figure 12; Figure 14 is a detail vertical transverse section of a portion of the structure shown in Figure 12 along the line 14-14 of that figure;

Figure 15 is a front elevation of a modified form of the apparatus and Figure 16 is an enlarged elevation of a portion of the structure shown in Figure 3 with parts broken away illustrating an alternate type of construction.

The embodiments of the invention described below may be used for picking up and transporting elongate articles but they are most useful for handling articles at a particular location and perhaps moving such articles for short distances. Typical uses are for unloading articles, e.g. lengths of pipe from a truck, a railway car or a pallet and

loading such lengths of pipe on another vehicle, or placing them in a stockpile for later use, or placing them in positions for installation, or even for actually installing the pipes in some instances. Alternatively, the apparatus could be used for picking up pipes from a stockpile and loading them onto a vehicle, or placing them in positions for installation, or actually installing them.

To be able to handle elongate articles for such purposes, it is desirable to be able, not only to transport the articles through short distances, but also conveniently to raise and lower the article, to move the article transversely of its length, to swing the article about an upright axis, and to tilt it. The apparatus constituting the embodiment of the invention described below is sufficiently versatile to be able to manipulate a pipe length in these various ways quickly and conveniently.

The apparatus is provided as an attachment or an accessory for a lift truck 1 shown in Figures 1 and 2. The apparatus is directly mounted on an upright supporting strut 2 carried by the swinging end of a hoisting frame 3 swingably mounted on the lift truck by a horizontal pivot 4. Swinging of the frame about such pivots between the solid-line position and the broken-line position of Figure 1 can be accomplished by a fluid-pressure jack 5 to alter the elevation of the upright supporting strut between the solid-line position and the broken-line position of Figure 1.

In order to enable the strut 2 to be maintained in upright attitude in all swung positions of the frame 3, the lower portion of such strut is mounted on the swinging end of the frame by a horizontal pivot 6. The upper portion of the strut 2 is braced from the hoisting frame by a fluid-pressure jack 7 interconnecting such strut upper portion and the hoisting frame. As the effective length of the jack 3 is altered to effect corresponding swinging of the hoisting frame 3, the length of jack 7 can be changed correspondingly so that the supporting strut will remain upright despite the change in angle of the hoisting frame as it is swung about the axis of pivot 4 relative to the lift truck.

The apparatus includes a boom 8, the root end of which is carried by the upright strut 2. Such boom includes a cantilever inboard section 9 and an outboard draw section 10 attached by a pivot 11 to the free end of the inboard boom section 9. The upper portion of the outboard boom section is supported in its lowered position by guys 12 connected between the supporting strut 2 and anchor posts 12' on the boom draw section. The draw section of the boom can be swung between the horizontal position of Figure 1 and the upwardly swung position of Figure 2 by a fluid-pressure jack 13 connected be-

tween the inboard boom section and the outboard boom section 10. The guys 12 can include turnbuckles 14 adjustable to vary the lengths of the guys for distributing the load equally between them and for establishing the desired lowered position of the outboard boom section 10.

An elongated frame 15 is carried by the boom with the length of such frame extending transversely of the length of the boom. As shown in Figure 11, such frame includes at least one, and preferably two, longitudinal members 16 extending transversely of the length of the boom 8 and of a length at least as great as the length of the longest pipe sections to be handled. If two of such longitudinal members are provided in parallel relationship, two lengths of pipe P can be handled at the same time, as indicated in broken lines in Figure 1. Such longitudinal members are held in parallel relationship by suitable diagonal bracing, as illustrated in Figure 11.

The longitudinal members 16 extend beneath the boom 8, as shown in Figure 3, and superstructure 17 of the pipe spanning frame extends over and includes supporting members at opposite sides of the boom, as shown in Figure 3. Guys 18 span between such superstructure and different locations of the longitudinal members 16 spaced outward from the central portion of such longitudinal members to support such horizontal members without their end portions sagging. To enable the apparatus to handle pipes which are quite long, longitudinal member extensions 16' shown in Figure 9 can be attached to the opposite ends of the frame members 16 and their portions farthest from the frame members 16 are supported by guys 18'.

The opposite ends of pipe lengths P are gripped by gripping means movable lengthwise of the longitudinal frame members 16. Pipe-gripping members are rigidly mounted on carriages 19 riding on the lower flanges of the I beam longitudinal members 16 constituting tracks. Each pipe-gripping member may include a cylindrical pipe-gripping head 20 arranged with its axis parallel to the longitudinal member 16 and mounted by one end. A beveled nosing 21 supported by a bracket 22 projects from the opposite end of the head 20 to facilitate entry of the head into the end of a pipe. Such beveled nosing is of conical segmental shape at least approaching a semicone, as shown in Figures 6 and 7.

An endless loop drive chain 23 extends along each longitudinal member 16 of the pipe spanning frame at each side of the superstructure 17. Opposite ends of each chain loop are connected to a carriage 19 carrying a pipe-engaging head 20, as shown in Figure 6. Each chain is driven by a drive

sprocket 24 (figure 5) mounted on a longitudinal member 16 adjacent to the superstructure 17. Such sprocket is rotated by a remotely actuated motor 25. The opposite end of the chain loop is supported by an idler sprocket 26 mounted on a shaft 27 passing through a slot 28 the length of which extends lengthwise of the longitudinal member 16. The shaft 27 can be adjusted along the length of the slot and clamped to the longitudinal member to tighten the drive chain 23. To grip a length of pipe, the motors 25 are operated to drive opposed carriages toward each other so that their heads are inserted into opposite ends of a pipe length. While thus gripped, the pipe is steadied against rocking by saddles (Figures 6 and 8) including crosspieces 29, the opposite ends of which carry rollers 30 engageable with the upper portion of a pipe P, as shown best in Figure 8, so as to make the saddles of anti-friction character to enable the pipe to roll into proper position as it is being engaged by a pipe gripping head 20.

The pipe-spanning frame 15 is mounted on a carriage 31 shown in Figure 12 having rollers 32 riding on the lower flanges of I beams 33 which form tracks. Such I beams constitute the longitudinal members of the outboard draw section 10 of the boom. When the draw section is in its lowered position of Figure 1, such longitudinal members are aligned with corresponding longitudinal members 33' of the inboard boom section 9. The carriage 31 is maintained in the desired position transversely of the boom by thrust rollers 34 carried by the pipe-spanning frame carriage and riding along the webs of the I beam longitudinal boom members 33 and 33', as shown in Figure 13.

The pipe-spanning frame carriage 31 can be moved along the boom toward and away from the lift truck 1 to translate pipe lengths transversely of their length by carriage-traversing mechanism 35. Such carriage-traversing mechanism includes two fluid-pressure cylinders operating in tandem, the plunger 36 of one jack is movable relative to its cylinder 37 which is of the double-acting type so that it can operate either to draw plunger 36 into the cylinder or push it out of the cylinder.

The end of such plunger remote from its cylinder is connected by pivot 38 to a portion of the pipe-spanning frame such as a longitudinal member 16. The other cylinder of the pair includes the plunger 39 having one end connected by a pivot 40 to the basal end of the inboard boom section 9 and its opposite end received in cylinder 41 which also is of the double-acting type.

The two cylinders 37 and 41 are arranged alongside each other, and their central portions are mounted on a jack-supporting carriage 42, as shown in Figures 12 and 14.

Such carriage is supported by rollers 43 rolling on the lower flanges of I beam longitudinal members 33' of the inboard boom section. By moving either plungers 36 or plungers 39 in to their respective cylinders, the position of the pipe spanning frame carriage along the longitudinal members 33 of the boom outboard section 10 can be adjusted to nearly any position. If all of the plungers are retracted fully into their respective cylinders, the carriage 31 can be shifted generally to the central portion of the inboard boom section 9, as shown in Figure 2. With the carriage in this position, the jacks 13 can be contracted to swing the outboard boom section 10 into the upwardly swung or draw position of Figure 2.

In some instances the boom 9, 10 may not be precisely perpendicular to a pipe which it is desired to span with the pipe-spanning frame and engage with the gripping members. To enable the pipe spanning frame to be placed with its length parallel to the length of a pipe length under such circumstances, the pipe spanning frame is mounted on the boom so that it can be swung relative to the boom about an upright axis. To enable such an operation to be performed, the pipe spanning frame carriage 31 includes substantially diagonal struts 44 crossing to support an upright pivot 45, as shown in Figure 12. Figure 3 shows that this pivot is above the pipe-engaging head 20.

If the portions of the frame members 44 adjacent to the rollers 32 have underslung members 46 from which a lower flange 47 projects, the shelf formed by the upper side of each such flange is engaged by the horizontal flange of an angle member 48, the upright flange of which is welded to the upper flange of a longitudinal member 16 of the pipe spanning frame 15 as shown in Figure 13. The pipe spanning frame can then be swung about the upright axis of pivot 45 by differential actuation of the compound jacks 35 on opposite sides of the boom. One of the cylinders 37 can push out its plunger 36 while the other cylinder is drawing in its plunger 36 correspondingly. Alternatively, one of the cylinders 41 can push its plunger 39 out while the other cylinder is drawing its plunger in correspondingly. By such manipulation of the cylinders, the pipe spanning frame can be swung between the solid line position and a broken-line position such as illustrated in Figure 11.

In some instances it may be necessary for the lift truck 1 to approach a stockpile of pipes over uneven ground. In such an instance, the lift truck may be tilted relative to the lengths of pipe in a stack. The pipe-spanning frame can be tilted relative to the lift truck between the broken-line positions of figure 9 to compensate for such tilt of the lift truck and place the pipe spanning frame

70

75

80

85

90

95

100

105

110

115

120

125

130

28

parallel to the pipes to be handled. To enable the pipe spanning frame to be thus tilted, the boom is mounted for swiveling relative to the lift truck. The boom-supporting arch 49 is engaged with an arcuate guide flange 50 (Figure 10) forming the upper portion of the upright boom-supporting strut 2. The boom can swivel relative to the lift truck about the axis of a pivot 52 which extends lengthwise of the boom.

The degree to which the boom is swiveled relative to the lift truck is accomplished and controlled by fluid-pressure jacks 53 connected between lugs 54 on the boom arch 49 and a central projection 55 extending upward from the central portion of the arch guide flange 50. Figure 10 shows one jack 53 contracted and the other jack 53 extended to swivel the boom to the solid-line position of that figure.

While the pipe-gripping heads 20 have been shown as including a beveled nosing 21 supported by a bracket 22, the type of gripping head 20' shown in Figure 16 could be used instead to grip the end portion of a length of pipe. In this instance, the head carries a wheel 55 mounted on an axle 56 extending transversely of the direction of movement of the head. Such axle is supported by arms 57 projecting from the head 20'. As the head is moved toward the end of a pipe length to be handled, the pipe length and may engage the upper periphery of the wheel. Continued movement of the head toward the pipe length end will cause the wheel to rotate and lift the pipe end by rolling on the inner surface of the pipe end upper portion so as to slide the pipe end up and over the head 20. Such head has an elastomer coating 58 to prevent scraping of the pipe. The wheel would roll correspondingly on the underside of the end portion of other types of elongate articles. A typical operation of the apparatus would involve the lift truck approaching the side of a load of pipe lengths on a truck raising the boom to the broken-line position of Figure 1 with the outboard draw section raised and the pipe-spanning frame 15 carried by the inner section, as shown in Figure 2. The boom can then be swiveled by operation of jacks 53 and the pipe-spanning frame swung by differential operation of the two compound traversing jacks 35 on opposite sides of the boom to place the pipe-spanning frame in parallelism with one or two pipe lengths. The boom would next be lowered until the saddle rollers 30 rested on the pipes. The motors 25 can then be energized for driving chains 23 to shift carriages 19 along the longitudinal members 16 of the pipe-spanning frame to insert the pipe-gripping heads 20 into opposite ends of one or two generally parallel pipe lengths.

When one of the heads 20' shown in Figure 16 has been engaged with one end of a pipe to be handled, the end of the pipe will actuate a limit switch 59 to deenergize the motor driving that head while the motor driving the other head will continue to operate until such other head also has been engaged with its end of the pipe being handled.

With pipe lengths gripped, as shown in Figure 6, the jacks 5 would be operated to raise the boom and the pipes from the truck, as shown in broken lines in Figure 1 and solid lines in Figure 9. After the pipe is thus raised, the motors 25 can both be energized, but running in opposite directions, so that both carriages 19 will be moved conjointly in the same direction to shift the pipe lengthwise in one direction or the other to a centered or balanced position. The lift truck can then be driven to a stock-pile location, and the pipe lengths can be deposited on such stock pile by operating motors 25 in reverse to drive chains 23 and carriages 19 for withdrawing the pipe-gripping heads 20 from the opposite ends of the pipe lengths. In thus stacking the pipes on a stock pile, it may or may not be necessary to operate the compound jacks 35 for shifting the pipe-spanning frame outwardly along the boom.

If the pipes cannot be stacked in a desired location on a stock pile without extending the boom, the compound jacks 35 can be operated conjointly to shift the carriage 31 supporting the pipe-spanning frame from the position shown in Figure 2 to the position shown in Figure 1 in which the outboard draw section of the boom is swung downward by jacks 13. The pipe-spanning frame 15 can then be moved outward beyond the main section of the boom onto the draw section, as shown in broken lines in Figure 1, for deposit of the pipe sections P at a considerable distance from the lift truck. Similarly, when it is desired to remove pipes from a stock pile, the boom may be extended by lowering the draw section from the position of Figure 2 to the position of Figure 1 to pick up pipes at a considerable distance from the lift truck. Because of the extended reach provided by the outboard draw section, stock piles can be made considerably higher than would otherwise be possible, for example, five tiers high for pipe four feet in diameter.

For handling short lengths of pipe the apparatus can be used as shown in Figure 15 in which the pipe-spanning frame extensions 16' have been omitted or removed from the pipe-spanning frame. The apparatus in this form can be operated in the manner described above for handling pipes or other elongate articles.

Moreover, while the pipe spanning frame 15 has been shown as being supported on

the boom of a lift truck, such frame could be supported in other ways for handling elongate articles, such as by being carried by a swinging crane boom.

WHAT I CLAIM IS:-

1. Apparatus for handling elongate articles comprising two article-engaging members for engaging, respectively, opposite end portions of an elongate article to be handled, an elongate frame that is adapted to span the article to be handled along its length, two substantially rigid mounting means each carrying one of the article-engaging members closely underneath the frame, each mounting means being movable along a portion of the frame between its ends to vary the distance between the two article-engaging members for selectively engaging elongate articles of different length, a boom carrying the frame with the length of the frame extending generally transversely of the length of the boom and with respective opposite end portions of the frame projecting substantial distances beyond opposite sides of the boom, and means supporting the boom.

2. Apparatus as claimed in claim 1, and power means for effecting movement of the two mounting means.

3. Apparatus as claimed in claim 2, the power means being remotely actuated for moving the mounting means by remote control.

4. Apparatus as claimed in claim 2 or 3, the power means including two endless chains carried by the frame for moving the mounting means lengthwise along the frame and motor means for driving said endless chains.

5. Apparatus as claimed in claim 2 or 3, and means actuatable by the end portion of an elongate article for deenergizing the power means when the mounting means have reached a predetermined relationship to the end of an elongate article that is handled.

6. Apparatus as claimed in any one of claims 2 to 5, wherein the frame includes elongate track means having its length extending substantially parallel to the length of the frame and the mounting means for the article-engaging members include two carriages each carrying a respective article-engaging member and movable along said track means.

7. Apparatus as claimed in any one of claims 1 to 5, inclusive, including two sets of article-engaging members engageable with the opposite ends of two elongate articles, respectively, and mounting means supporting the article-engaging members of each set for movement lengthwise of the frame independently of the mounting means for the other set of article-engaging members for engaging elongate articles which are of dif-

ferent lengths.

8. Apparatus as claimed in any preceding claim, adapted to handle pipes and in which at least one of the article-engaging members includes a pipe-engaging head having a beveled nosing extending generally parallel to the length of the frame and insertable in to the end of a pipe.

9. Apparatus as claimed in any one of claims 1 to 7, in which at least one of the article-engaging members includes a head rotatably mounting a wheel about an axis substantially perpendicular to the length of the frame, the wheel being vocated so that the upper periphery of the wheel is adapted to engage with an under surface of an end portion of an elongate article to be handled and to roll along such under surface.

10. Apparatus as claimed in any preceding claim, and antifriction saddle means for steadying an elongate article carried by the article-engaging members, engageable with the upper side of such an article at a location between the ends of the article and spaced from the article-engaging members.

11. Apparatus as claimed in any preceding claim, in which the boom supporting means supports the boom for elevational movement of the boom in substantially level attitude.

12. Apparatus as claimed in any preceding claim, wherein the frame is carried by the boom for movement toward and away from the boom-supporting means.

13. Apparatus as claimed in claim 12, in which the boom includes elongated track means having its length extending lengthwise of the boom, and a carriage supporting the frame and movable along said track means.

14. Apparatus as claimed in any preceding claim, and means for moving the frame generally transversely of its length along a portion of the boom between its ends.

15. Apparatus as claimed in claim 14, the frame-moving including twin jacks having their cylinders disposed in side-by-side relationship and their plungers extending oppositely, respectively, and connected between the boom-supporting means and the frame, and means supporting said twin jack cylinders from the boom for movement longitudinally of the boom.

16. Apparatus as claimed in claim 14 or 15, in which the boom includes an inboard section and an elongate outboard section mounted pivotally on said inboard section and swingable upward relative to said inboard section to dispose its length upright, the frame-moving means being operable to move the frame along each boom section.

17. Apparatus as claimed in claim 17, in which each of the inboard section and the outboard section of the boom includes elongate track means having its length extending

70

75

80

85

90

95

100

105

110

115

120

125

130



the boom of a lift truck, such frame could be supported in other ways for handling elongate articles, such as by being carried by a swinging crane boom.

WHAT I CLAIM IS:-

1. Apparatus for handling elongate articles comprising two article-engaging members for engaging, respectively, opposite end portions of an elongate article to be handled, an elongate frame that is adapted to span the article to be handled along its length, two substantially rigid mounting means each carrying one of the article-engaging members closely underneath the frame, each mounting means being movable along a portion of the frame between its ends to vary the distance between the two article-engaging members for selectively engaging elongate articles of different length, a boom carrying the frame with the length of the frame extending generally transversely of the length of the boom and with respective opposite end portions of the frame projecting substantial distances beyond opposite sides of the boom, and means supporting the boom.

2. Apparatus as claimed in claim 1, and power means for effecting movement of the two mounting means.

3. Apparatus as claimed in claim 2, the power means being remotely actuated for moving the mounting means by remote control.

4. Apparatus as claimed in claim 2 or 3, the power means including two endless chains carried by the frame for moving the mounting means lengthwise along the frame and motor means for driving said endless chains.

5. Apparatus as claimed in claim 2 or 3, and means actuable by the end portion of an elongate article for deenergizing the power means when the mounting means have reached a predetermined relationship to the end of an elongate article that is handled.

6. Apparatus as claimed in any one of claims 2 to 5, wherein the frame includes elongate track means having its length extending substantially parallel to the length of the frame and the mounting means for the article-engaging members include two carriages each carrying a respective article-engaging member and movable along said track means.

7. Apparatus as claimed in any one of claims 1 to 5, inclusive, including two sets of article-engaging members engageable with the opposite ends of two elongate articles, respectively, and mounting means supporting the article-engaging members of each set for movement lengthwise of the frame independently of the mounting means for the other set of article-engaging members for engaging elongate articles which are of dif-

ferent lengths.

8. Apparatus as claimed in any preceding claim, adapted to handle pipes and in which at least one of the article-engaging members includes a pipe-engaging head having a beveled nosing extending generally parallel to the length of the frame and insertable in to the end of a pipe.

9. Apparatus as claimed in any one of claims 1 to 7, in which at least one of the article-engaging members includes a head rotatably mounting a wheel about an axis substantially perpendicular to the length of the frame, the wheel being vocated so that the upper periphery of the wheel is adapted to engage with an under surface of an end portion of an elongate article to be handled and to roll along such under surface.

10. Apparatus as claimed in any preceding claim, and antifriction saddle means for steadying an elongate article carried by the article-engaging members, engageable with the upper side of such an article at a location between the ends of the article and spaced from the article-engaging members.

11. Apparatus as claimed in any preceding claim, in which the boom supporting means supports the boom for elevational movement of the boom in substantially level attitude.

12. Apparatus as claimed in any preceding claim, wherein the frame is carried by the boom for movement toward and away from the boom-supporting means.

13. Apparatus as claimed in claim 12, in which the boom includes elongated track means having its length extending lengthwise of the boom, and a carriage supporting the frame and movable along said track means.

14. Apparatus as claimed in any preceding claim, and means for moving the frame generally transversely of its length along a portion of the boom between its ends.

15. Apparatus as claimed in claim 14, the frame-moving including twin jacks having their cylinders disposed in side-by-side relationship and their plungers extending oppositely, respectively, and connected between the boom-supporting means and the frame, and means supporting said twin jack cylinders from the boom for movement longitudinally of the boom.

16. Apparatus as claimed in claim 14 or 15, in which the boom includes an inboard section and an elongate outboard section mounted pivotally on said inboard section and swingable upward relative to said inboard section to dispose its length upright, the frame-moving means being operable to move the frame along each boom section.

17. Apparatus as claimed in claim 17, in which each of the inboard section and the outboard section of the boom includes elongate track means having its length extending

70

75

80

85

90

95

100

105

110

115

120

125

130

31



* C L M S *

6

1,535,514

6

lengthwise of each boom section, and the frame-moving means includes a carriage supporting the frame and movable along said track means of each boom section.

5 18. Apparatus as claimed in any preceding claim, in which the boom-supporting means supports the boom for tilting about a generally horizontal axis substantially perpendicular to the frame and substantially as high as the portions of the article-engaging members engageable with the article to be handled.

10 19. Apparatus as claimed in any preceding claim, in which the boom-supporting means includes a lift truck supporting the boom in cantilever fashion.

15 20. Apparatus as claimed in claim 19, in which the boom-supporting means includes means mounting the boom on the lift truck for elevational movement of the boom through a substantial distance relative to the lift truck.

20 21. Apparatus as claimed in claim 20, in which the boom-mounting means include a

hoisting frame mounted on the lift truck for swinging about a horizontal axis extending transversely of the boom to lift the boom in substantially constant horizontally projecting attitude.

22. Apparatus as claimed in claim 19, 20 or 21, the boom being supported from the lift truck for swiveling relative to the lift truck to tilt the frame relative to the lift truck.

23. Apparatus for handling elongate articles substantially as hereinbefore described with reference to and as illustrated in Figures 1-14 of the accompanying drawings or modified substantially as hereinbefore described with reference to and as illustrated in either Figure 15 or Figure 16 of the accompanying drawings.

F. J. CLEVELAND & COMPANY
Chartered Patent Agents
40/43 Chancery Lane
LONDON W.C.2
Agents for the Applicant