United States Patent

Bertola

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[45] **June 6, 1972**

[54] MECHANISM FOR LIFTING AND CONVEYING MATERIEL

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[73] Assignee: **General Conveyor, Inc.,** El Monte, Calif.

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[52] **U.S. Cl.** .....**212/128,** 214/16.4 A

[51] **Int. Cl.** **B65g 1/06**

[58] **Field of Search** .....214/16.4 R, 16.4 A; 212/11, 212/18, 128–130; 187/95, 9

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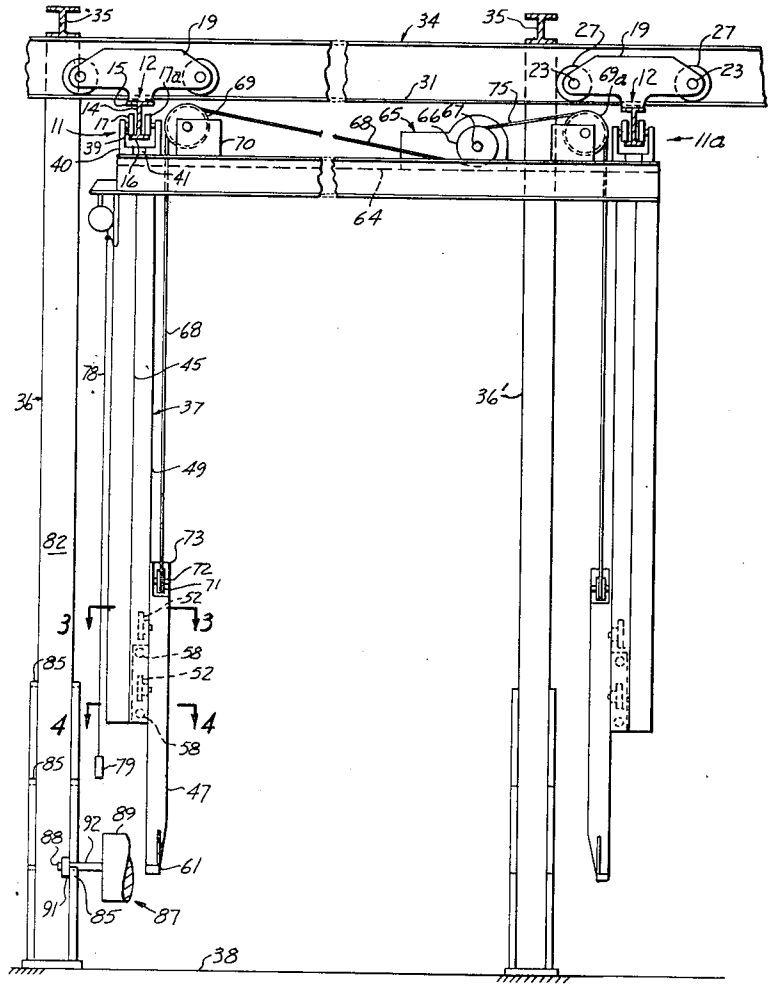
[57] **ABSTRACT**

An overhead travelling crane movable along a path of travel, and also from side to side along the path has fixed to it a depending boom or mast which carries a movable section which can be raised and lowered to pick up materiel from either side of the path by means of a fork-like device near the bottom of the movable section. In the usual arrangement there are two such masts provided with lifting forks spaced apart from each other along the path, such that the forks can lift the two ends of cylindrical or pipe-like objects having cylindrical or tubular end members which can be grasped by the two spaced forks. Objects thus lifted by the forks can be carried along the path to some other location. A guide means equipped with wheels and rollers provides ease of movement of the movable mast sections up and down the fixed mast section without binding even under eccentric loading.

1 Claim, 6 Drawing Figures



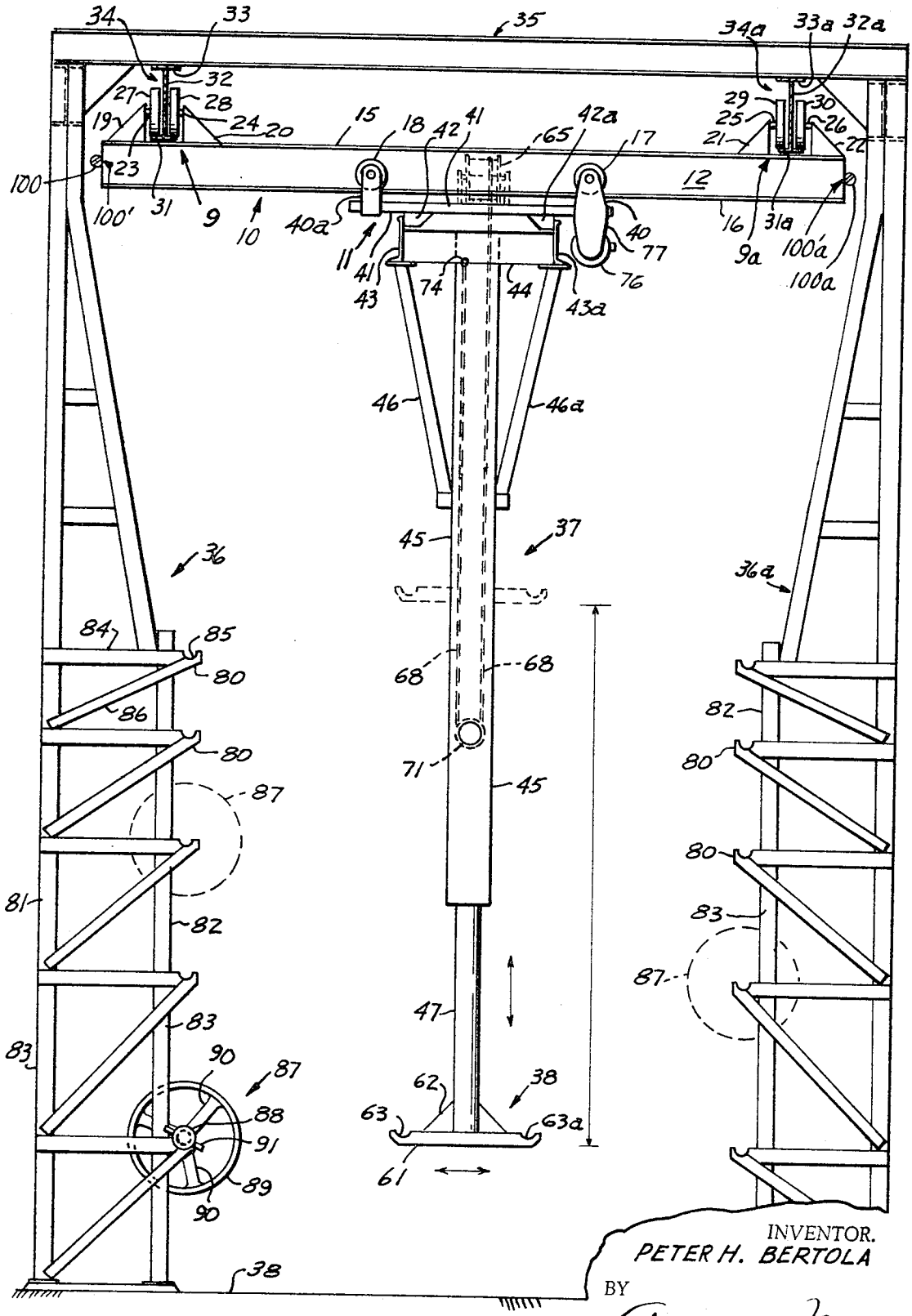

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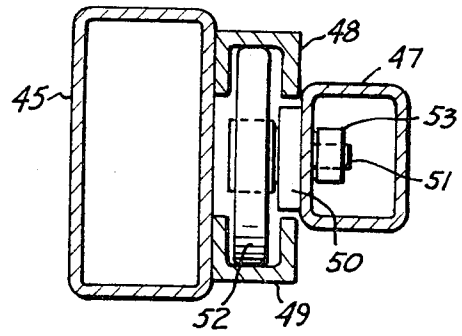
FIG. 1

FIG. 3



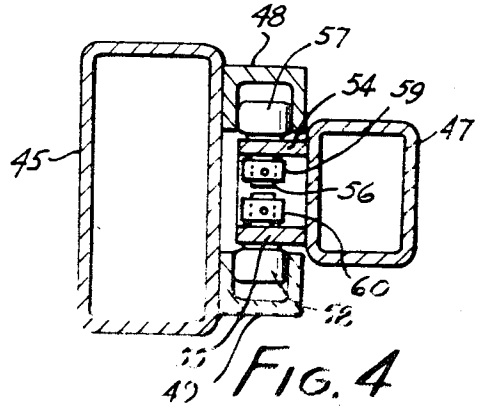


FIG. 4

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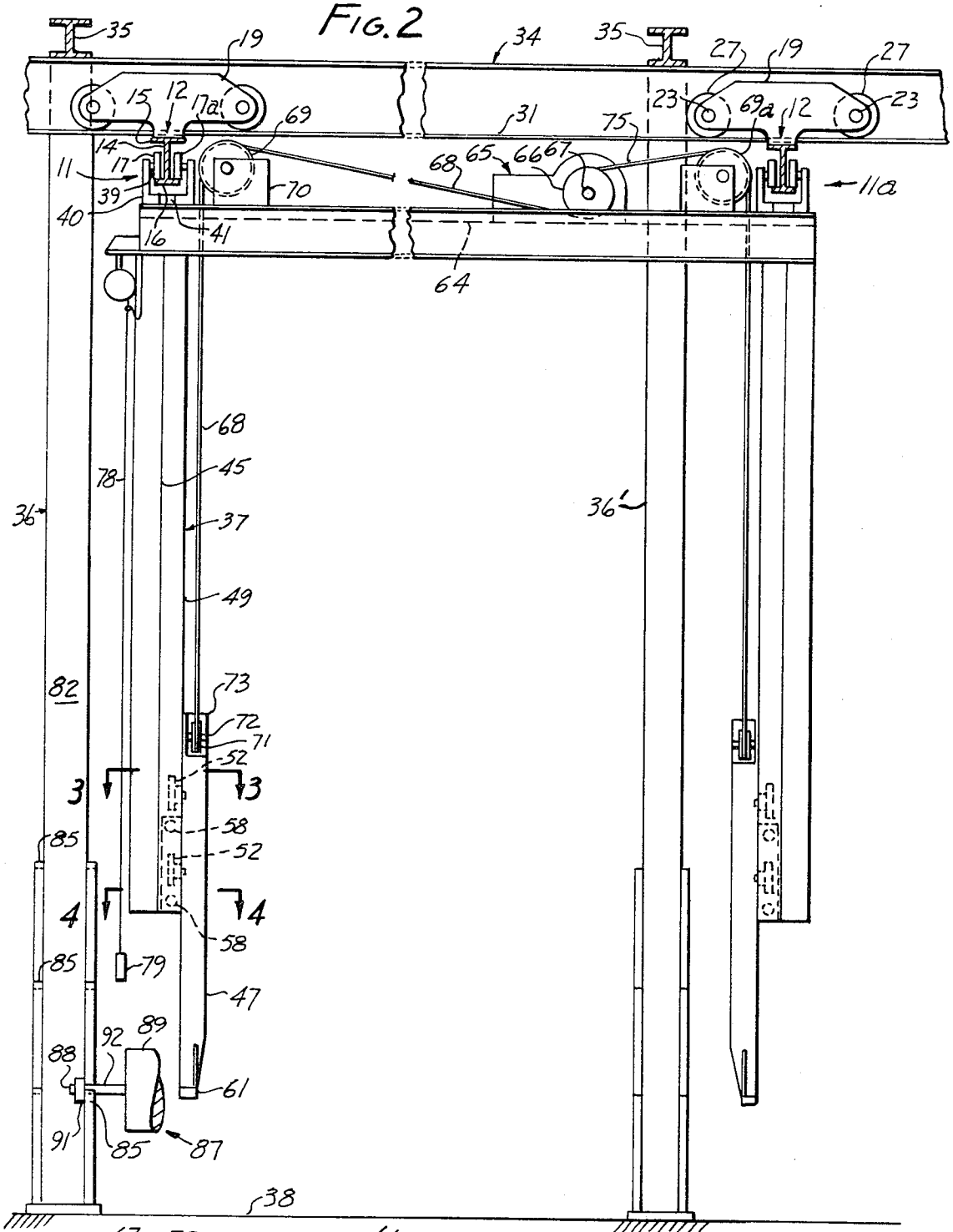
FIG. 2



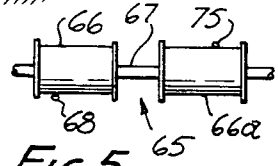


FIG. 5

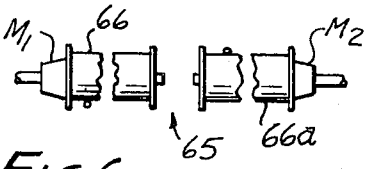


FIG. 6

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MECHANISM FOR LIFTING AND CONVEYING MATERIEL

This invention relates to lifting and conveying mechanisms and more particularly to devices for moving objects and material from one place to another within a local area.

An object is to provide a mechanism of this character having improved versatility and load-carrying capacity.

Mechanical devices have long been in use in places such as factories and other industrial premises for moving materiel from one place to another. Examples are overhead travelling cranes movable in one or more directions and having depending receptacles or scoops which lift and transport objects from place to place within the range of the crane. The lifting elements of such devices have been limited in the extent of their lifting capability and in their directions of movement.

In accordance with the present invention, the versatility of operation of such lifting and conveying mechanisms is greatly enhanced. The invention is carried out by use of a boom or mast fixed to and suspended from a movable overhead support. The mast is of a telescoping type having a movable section slidable up and down along the section fixed to the overhead supports. The boom may thus be effectively raised and lowered. The movable section is provided with a materiel support means such as a fork or the like. The overhead support is a crane trolley or the like capable of carrying the mast in its vertical attitude, from one place to another.

According to a preferred feature, the support means is constructed to support materiel on either side of the mast so that the travelling overhead support can be moved to either side to pick up materiel.

A preferred feature resides in the use of two such masts such that their movable sections may be raised or lowered in unison, or independently of each other.

Another preferred feature resides in the use of two masts held at a definite distance apart from each other and movable from side to side, either in unison, or independently of each other as desired.

Another feature resides in the construction of roller and guide means permitting free movement of the movable mast section relative to the fixed mast section even when under eccentric loading.

Use of the present invention makes it possible to pick up materiel or objects stored on either or both sides of an aisle and transport it to another location along the aisle.

The foregoing and other features and advantages will be better understood from the following description and the accompanying drawings, of which:

FIG. 1 is an end view of a materiel handling mechanism according to this invention;

FIG. 2 is a side view of part of the mechanism of FIG. 1;

FIG. 3 is a cross-section view taken at line 3—3 of FIG. 2;

FIG. 4 is a cross-section view taken at line 4—4 of FIG. 2;

FIG. 5 shows a detail of an optional modification which may be used in the mechanism; and

FIG. 6 shows a detail of another optional modification which may be used in the mechanism.

The drawings show an overhead travelling crane **10** having a trolley **11** movable to the left and to the right (with reference to FIG. 1) on a horizontal bridge girder **12** having a central vertical web **14** and upper and lower horizontal plates **15** and **16**, the lower plate **16** of which provides a track on which rollers **17** and **18** of the trolley roll.

Girder beam **12** has fixed near the ends of its upper plate **15**, supports **19**, **20**, **21** and **22** to which are fixed respective pairs of spindles **23**, **24**, **25** and **26** on which are rotatably mounted respective pairs of rollers **27**, **28**, **29** and **30** of a trolley **9**. Rollers **27** and **28** ride on a track provided by the lower horizontal plate **31** of a beam **34**, having a web **32** and an upper plate **33**. Rollers **29** and **30** similarly roll on the lower horizontal plate **31***a* of another beam **34***a* having a web **32***a* and an upper plate **33***a*. The beams **34** and **34***a* are spaced apart and extend parallel to each other and perpendicular to beam **12** and are near the ends of beam **12**. The spacing of beams **34** and **34***a* is approximately the width of a path or aisle along which beam **12** can move to the left or right, with reference to FIG. **2**.

The two beams **34** and **34***a* are fixed to an upper beam **35** which extends across the aisle or path, perpendicular to beams **34** and **34***a*. Cross beam **35** is supported in its position by a pair of rigid opposite towers **36** and **36***a* placed across the aisle from each other and fastened to a solid floor or foundation **38**. By this tower arrangement the beam **35** is firmly held in its horizontal overhead position so that it can firmly support the beams **34**, **34***a* and **13** in their overhead positions.

For the purpose of supporting the beams **34** and **34***a* along the path or aisle, there is provided another pair of towers like towers (of which tower **36'** is shown in FIG. **2**) **36** and **36***a* on opposite sides of the aisle and these last-mentioned towers will carry a cross beam **35** and will be placed at another desired distance from towers **36**, **36***a*, to the right with reference to FIG. **2**. Depending on the length of the aisle, a number of other pairs of the towers with their cross-beams **35** are provided to the left or right, with reference to FIG. **2**. Inspection of the structure thus far described shows that the bridge **12** can be carried by rollers **27**, **28**, **29** and **30** to the left and right, with reference to FIG. **2**, for a distance only limited by the number and positions of pairs of towers **36**, **36***a*. Furthermore, the trolley **11** can be moved to the left and right (with reference to FIG. **1**) across the aisle by rollers **17**, **17***a*, **18** and the counterpart of **18** (not shown) by a distance limited by the length of beam **12**.

The trolley carries a depending mast **37** which carries a lifting fork arrangement **38**. To support this mast the trolley wheels are rotatable on spindles **39** fixed to U-members **40** and **40***a* to the base of which is fastened a bar **41** to the underside of which are fastened lugs **42** and **42***a* to which are attached strips or plates **43** and **43***a* joined by a cross-brace or plate **44**.

A hollow tubular vertical mast section **45** of rectangular cross section is securely fastened to member **44** and braced for rigidity by braces **46** and **46***a*. A movable mast section **47** also of hollow tubular rectangular cross-section is slidably attached to fixed mast section **45**. This sliding attachment is formed by provision of a pair of guides in the form of U-channels **48** and **49** facing each other and fastened vertically along the face of mast section **45** which faces in the direction in which beam **34** extends. The face of mast section **47** which faces section **45** has fastened to it a rectangular piece **50** located between the outer sides of the U-channels, serving as a spacer plate for a spindle **51**, the inner end of which carries a load-bearing wheel **52** which engages the bases of the U-channels **48** and **49**, the spindle being held in position by a nut **53**. A second load-bearing wheel arrangement also comprising elements **50**, **51**, **52** and **53** is placed along mast member **47** at some distance from the wheel **52** just described, as shown in FIG. **2**. The couple provided by the two spaced wheels **52** serves to restrain any tendency of mast section **47** to rotate relative to section **45**, when loaded eccentrically.

To prevent any tendency of mast section **47** to bind against section **45**, there is provided a pair of spaced extensions **54** and **55** from mast section **47** which enter into the region between the U-channels **48** and **49**. A spindle **56** passing in a direction perpendicular to spindle **51**, through these extensions carries a pair of rollers **57** and **58** which engage the inner sides of the U-channels. Collar and set screw arrangements **59** and **60** keep the rollers in position. If smoother sliding be desired, a second roller assembly like members **56**, **57** and **58** may be provided at some distance along the mast from the first-mentioned assembly, as shown in FIG. **2**.

The lower end of mast section **47** has a fork member **61** attached to it and rigidly supported by torque-resisting member **62**. The fork member extends laterally in both directions from the mast so that a load can be picked up either near tower **36** or **36***a*, or both. Recesses **63** and **63***a* serve to aid in holding the load.

The mast section **47** can be raised by a hoist mechanism. For this purpose a beam **64** attached below bar **41** extends parallel to beam **34** to a second crane trolley **9***a* similar to crane trolley **9**, the second crane trolley being supported by another pair of towers like **36** and **36***a* located across the aisle

from each other and to the right, with reference to FIG. 2. Tower 36' of this other pair of towers is shown in FIG. 2.

A cable hoist 65 attached to beam 64 is provided with a drum device 66 mounted on a shaft 67 in the hoist. The drum has wound around it a number of turns of cable 68 which passes over a pulley 69 which is freely rotatable and mounted by a suitable mounting 70 on top of beam 64 with the left edge of the pulley directly over the upper end of mast section 47, so that the cable 68 is brought down to pass under a pulley 71 freely rotatable on a pin 72 mounted in a slot 73 at the top of mast section 47. After passing under pulley 71, the cable 68 is brought up and fastened to a fastening member 74 fixed to the head member 44 of the travelling crane. The shaft 67 on which the hoist drum 66 is mounted constitutes the shaft of an electric motor, the wiring for which is not shown. It will be recognized that operation of the motor will turn the drum to wind up more of the cable 68 and thereby raise the mast section 47 vertically upward along the upper mast section 45. Suitable locking means for the drum 66 is provided so that when the motor is not being operated, the lock can be applied to prevent the weight of mast section 47 from unwinding the cable drum to drop the mast section. The shaft and drum of the hoist are also provided with a suitable braking means such that when it is desired to lower the mast section 47 the locking mechanism can be unlocked while the braking mechanism is applied, in such a manner that the weight of mast section 47 will unwind the drum against the frictional force of the brake and allow the mast section to come down slowly to any desired level at which the drum may again be locked in place to prevent further drop of the mast section.

Another drum 66*a* like drum 66 may also be attached to the hoist shaft 67, as shown in FIG. 5, and this second drum carries a cable 75 wound on the drum in the opposite direction from the cable winding on drum 66. The cable 75 passes over a pulley 69*a* corresponding to pulley 69 located on beam 64 at a position over the lower mast section of the mast which is suspended at the right end of beam 64 (with reference to FIG. 2). Thus, rotation of the drums in the same direction serves to raise and lower the mast section 47 and the movable mast section of its counterpart simultaneously and by the same amount per revolution of the drums.

An alternative hoist arrangement, shown in FIG. 6, would be to make the drums 66 and 66*a* of hoist 65 separately operable, each having its own driving motor, M_1 and M_2 respectively, so that for particular applications it would be possible to raise or lower only one of the two masts at a time or even to raise or lower the two masts at different rates.

An electric motor 76 supported by a member 77 depending from member 40 of the trolley is suitably belted or geared to the shafts of rollers 17 and 17*a*, and the electric power line 78 from this motor is brought up from a suitable operating switch 69 to the motor so that turning on or off the switch will operate the motor to more the trolley along beam 12 as desired. The motor is of the reversable type and the switch device 79 is arranged with the cable 78 to run the motor in either direction so that the trolley can be sent in either direction along the beam. The trolley 11*a* which is located at the mast structure at the right of FIG. 2, is operated by a similar motor from the same switch 79 to move the two trolleys simultaneously in the same direction along their track beams.

The parallel beams 34 and 34*a* can be made of any desired length, which will ordinarily be determined by the distance it is desired to have the travelling masts move along their path or aisle. Ordinarily, there will be a number, and often a considerable number, of the opposite pairs of towers like 36 and 36*a* which support the beams 34 and 34*a*. Thus, these pairs of spaced uprights like 36, 36*a* in effect form the aisle along which the bridges 12 carrying the depending masts will travel.

The travelling movement of these masts by means of the rollers 27, 28, 29 and 30 can be done in any desired manner. For example, there can be provided a pair of cables 100, 100*a* extending parallel to beams 34 and 34*a* and attached at 100' and 100'*a*, respectively, near the respective ends of beam 12. Where it is desired that each mast shall move along the aisle independently of the other, these two cables can be attached only to the beam 12 which supports the trolley for the one mast. The cables can extend the full length of the aisle formed by the uprights 36, 36*a* and be pulled by a drum operated by an electric motor at each end of the aisle. Thus, when one of these drum motors is operated it will pull the mast toward it and when the motor at the other end of the aisle is operated it will pull the mast toward it. If it is desired that the two masts be maintained at the same distance from each other along the aisle, the cables can be attached to the beam 12 for each mast.

From the foregoing description, it will be recognized that the depending masts can be moved from one side of the aisle formed by uprights 36, 36*a* to the other side, as desired, and also that the two masts may be moved in unison or independently, according to the attachments of their driving mechanisms. Furthermore, the telescoping mast section 47 may be raised or lowered vertically to any desired degree within the limitations of its dimensions. It will also be recognized that the masts may be moved down the aisle either in unison or independently, depending on the attachments of their driving mechanisms. These permissible movements of the masts permit the handling of material located at either side of the aisle and at various heights off the floor; and the material thus picked up by one or both forks from one or both sides of the aisle can be brought back to the center of the aisle and carried any desired distance down the aisle and placed again in a desired position at the side of the aisle and at some desired height above the floor.

Such movement is adapted for the handling of such materiel as mandrels some of which can be very large and heavy, and are provided with end shafts for handling and attachment.

The towers 36 and 36*a* are especially designed for storing materiel of a type having a shaft or pipe-like structures which in this case are shown as large cylindrical mandrels having end portions fitted with extending shafts. Such mandrels are used for manufacturing such products as resin-impregnated fiber pipe. For the purpose of storing such mandrels, each of the towers 36 and 36*a* is provided with a number of racks 80 arranged one under the other on the tower. For supporting these racks, the lower portion of each tower is constructed with an outer vertical plate 81 and an inner vertical plate 82, each plate having side flanges 83. The racks 80 are formed of horizontal strips 84 attached on the outside of the flanges 83 of each of the outside plates 81 and inside plates 82. The innermost portion of each strip 44 is dished to form a semicylinder 85 of the proper dimensions to receive an end shaft of a mandrel to be stored. Each receptacle 85 is braced by a strut 86 attached to its underside and extending obliquely downwardly to the outermost plate 81 where it is attached.

One of the mandrels 87 is shown with one of its protruding mandrel shafts 88 rested in one of the receptacles 85. The cylindrical member 89 is rigidly held to its shaft 88 at each end of the mandrel by three webs or spokes 90; and to prevent a mandrel shaft 88 from sliding out of its receptacle 85 which would cause the mandrel to drop, there is provided a pin 91 fitted through each mandrel shaft 88 near its outer end.

Each mandrel to be stored is ordinarily symmetrically constructed, that is, with the shaft and pin protruding from each end thereof, and furthermore each mandrel will ordinarily be of the same length. In fact, the spacing of the opposite pairs of towers along the aisle will be established to conform with the length of the mandrels. Thus, the mandrel 87 shown in FIG. 2 will extend from a receptacle of a tower 36 to a similar receptacle located at the same height above the floor of the next tower to the right (with reference to FIG. 2).

FIG. 1 shows five racks, one above the other along each side of plate 82. This allows five such mandrels to be stored in the horizontal position shown, one above the other between one tower 36 and the next. Similarly, the five racks, one above the other, located at the left side of the tower (with reference to FIG. 2) will extend to the left with reference to FIG. 2, and be

supported so that the mandrels supported at one end in these receptacles will have their other ends supported in the receptacles of the next tower down the aisle on the same side of the aisle.

The machine or equipment to which the material is to be conveyed, which will be pipe winding machines in the case of the mandrels illustrated, will be located adjacent the aisle but along the aisle from the storage area. Thus, for lifting one of the mandrels and transporting it to its winding machine, the usual operation will be to fix the distance along the aisle of the two masts **37** by a suitable bar or beam or cable arrangement so that the receptacle **63** of the fork member **61** of each mast will coincide with the region **92** of each mandrel shaft **88**. The movable mast section **47** of each mast will then be lowered so that it is somewhat below the level of the shaft **88**, and the two trolleys will be moved to the left (with reference to FIG. **1**) until a fork receptacle **63** is directly beneath each mandrel shaft at the ends of the mandrel. Then the movable shaft **47** will be raised to lift the mandrel off its racks, in which case the mandrel shafts at both ends will be resting in the two fork receptacles **63** which are on the same side of the mast. The two masts will then be carried down the aisle along tracks **34** and *34a* on the rollers **27**, **28**, **29** and **30**, until the mandrel arrives at its machine. Thereupon the mandrel will be raised sufficiently by its mast hoists and the trolleys will carry the mast over to the machine at the side of the aisle and set it in place.

Although the receptacle arrangements of the mast forks and the storage towers have been shown especially designed to accept end shafts of mandrels, it will be recognized that other materiel than mandrels can be lifted and transported; for example, pipe or other materiel having generally cylindrical or similar parts. For handling materiel which does not have cylindrical parts like shafts or piping, other shapes can be given to the fork and storage receptacles.

Use of the invention is especially advantageous for the handling of heavy and unweildy objects such as elongated mandrels which cannot easily be handled manually. Furthermore, use of the invention makes possible the handling of either double or single loads, that is, a load on either or both sides of the mast.

The structural members will ordinarily be made of steel, capable of handling heavy loads.

It will be recognized that variations in the mechanism can be introduced without departing from the scope of the invention. Variations may readily suggest themselves in the construction of the overhead support arrangement from which the masts are suspended and also in the paths of travel of these overhead mast supports or trolleys. Variations may likewise be made in the powering units for powering the hoists as well as for moving the mast supports. For example, the hoist units may comprise an air hoist drum unit, or alternatively air or hydraulic cylinder, or hydraulic rams could be used to operate the hoist cables.

It will be recognized that use of this invention makes possible the provision of masts which are independent of each other rather than being a pair of interconnected or braced units as is usually the case. It will further be recognized that use of the invention makes possible a unique construction of a telescopic lifting device or mast provided with sheaves, guides and rollers, constructed as an integral unit which can be independently fastened to an overhead load bar travelling crane.

What is claimed is:

1. A mechanism for lifting and conveying objects comprising means defining a first overhead path of travel, a movable support frame having means thereon defining a second overhead path of travel disposed transversely relative to said first path of travel, means for moving said support frame along said first overhead path of travel, means mounted on said support frame for moving a mast along said second overhead path of travel, a mast having a pair of spaced first sections fixed to said last named means and depending downwardly therefrom and a second pair of spaced sections mounted on and movable up and down relative to said first sections, load handling means attached to and extending laterally from opposite sides of each of said second sections, said load handling means having recessed portions adjacent each end thereof operative to handle cylindrical objects, means for raising and lowering said second sections independently of each other and relative to said first sections, each of said first section of said mast comprising a tubular member with two horizontally spaced U-shaped channel members attached to one side of the tubular member, the openings of said U-shaped channel members being disposed in a facing relationship to each other and thereby defining a vertical guide channel for said second mast sections, each of said second mast sections comprising a tubular member with vertically spaced guide wheel means mounted thereon, said wheel means being rotatable on a horizontal axis so that the circumference of said wheel means enters between the sides of the U-shaped channel members and engages the base of each of said U-shaped channel members of said first sections, vertically spaced pairs of rollers mounted on each of said second sections and rotatable about a horizontal axis perpendicularly to the axis of said wheel means so that one of the rollers of each of said pairs of rollers engages a respective adjacent side of the two sides the U-shaped channel members of said first mast section whereby the second sections and load handling means thereon can be moved vertically to facilitate a load handling operation.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,667,618 Dated June 6, 1972

Inventor(s) Peter H. Bertola

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

In the Patent

Column 1, line 5	Change "material" to --materiel--.
Column 2, line 10	After"towers" insert --(of which tower 36' is shown in FIG.2)--.
Column 2, line 11	After "towers" cancel "(of which tower 36' is shown in FIG. 2)".
Column 2, line 13	Cancel "a" and substitute --another-- before "cross beam 35"; same line, cancel "another" and substitute --a-- before "desired".
Column 3, line 54	Change "more" to --move--.
Column 4, line 25	Change "material" to --materiel--.
Column 4, lines 26 and 27	Change "material" to --materiel--.
Column 5, line 5	Change "material" to --materiel--.

Signed and sealed this 2nd day of January 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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