

May 15, 1951

F. A. MILLER

2,553,378

MATERIAL HANDLING DEVICE

Filed July 9, 1947

4 Sheets-Sheet 1

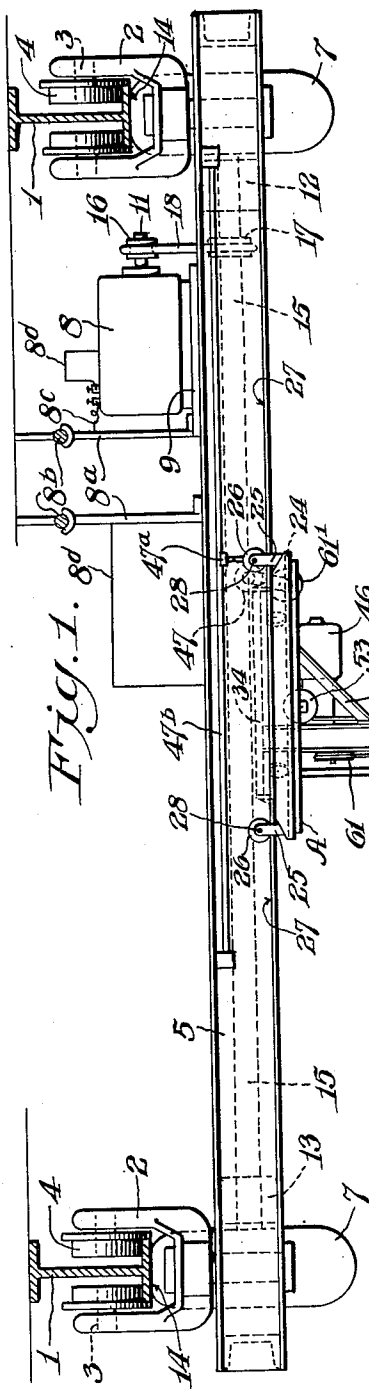


Fig. 1.

Fig. 2.

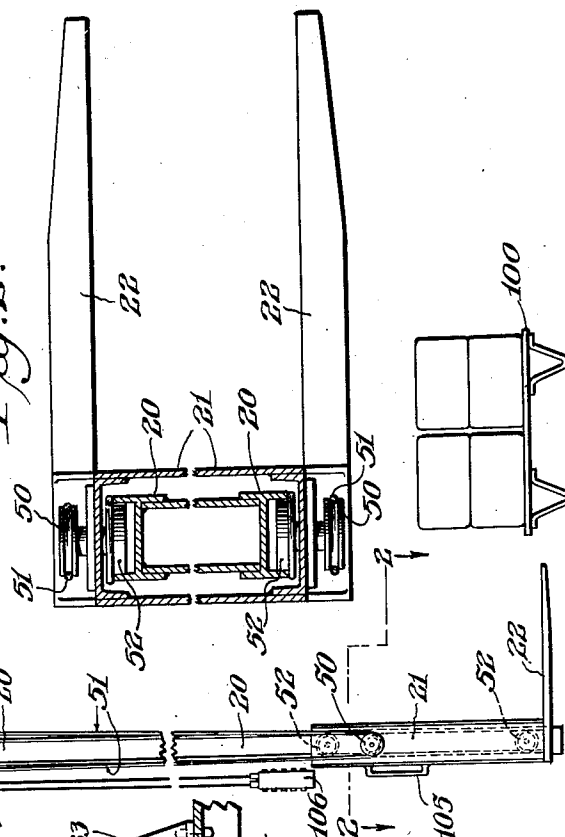
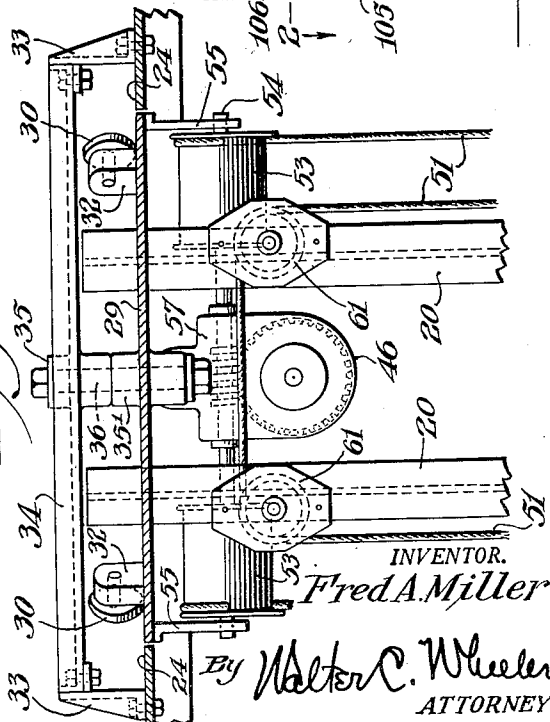


Fig. 3.



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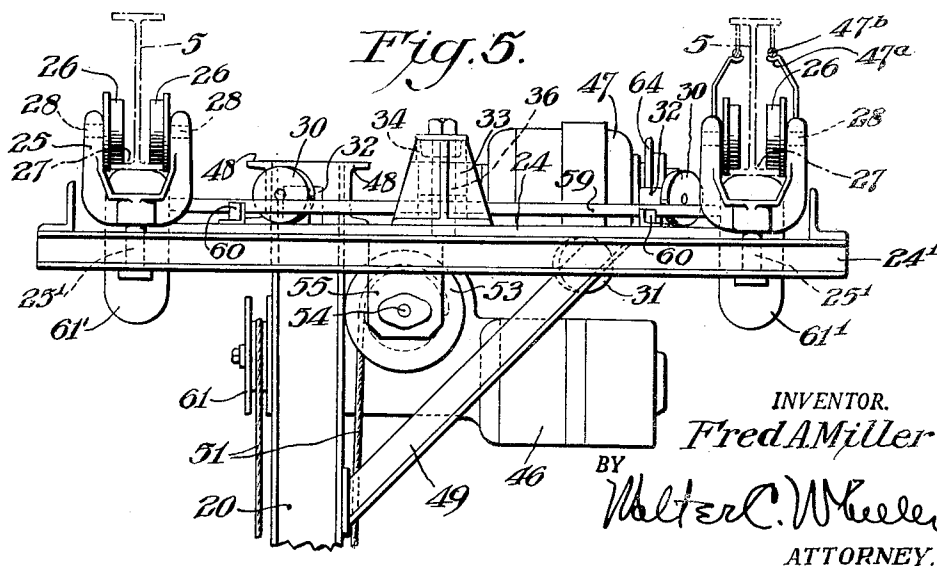
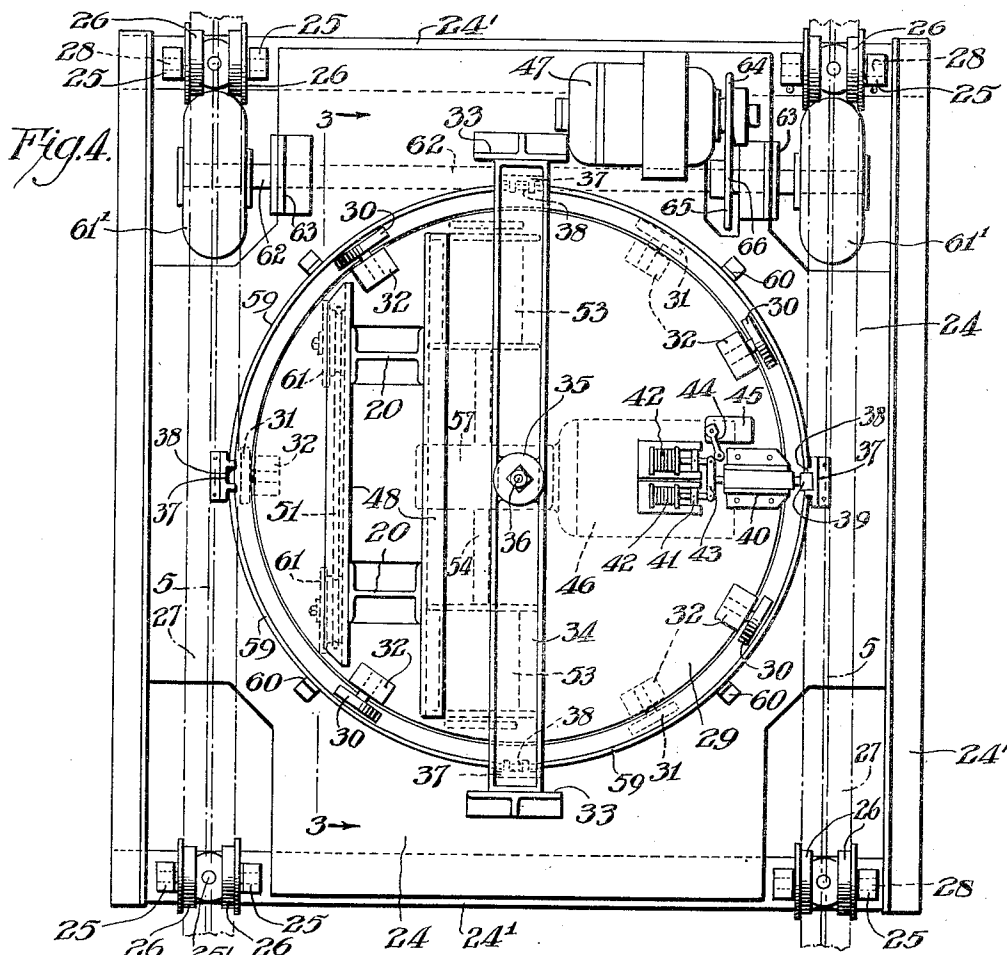
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Fig. 6.

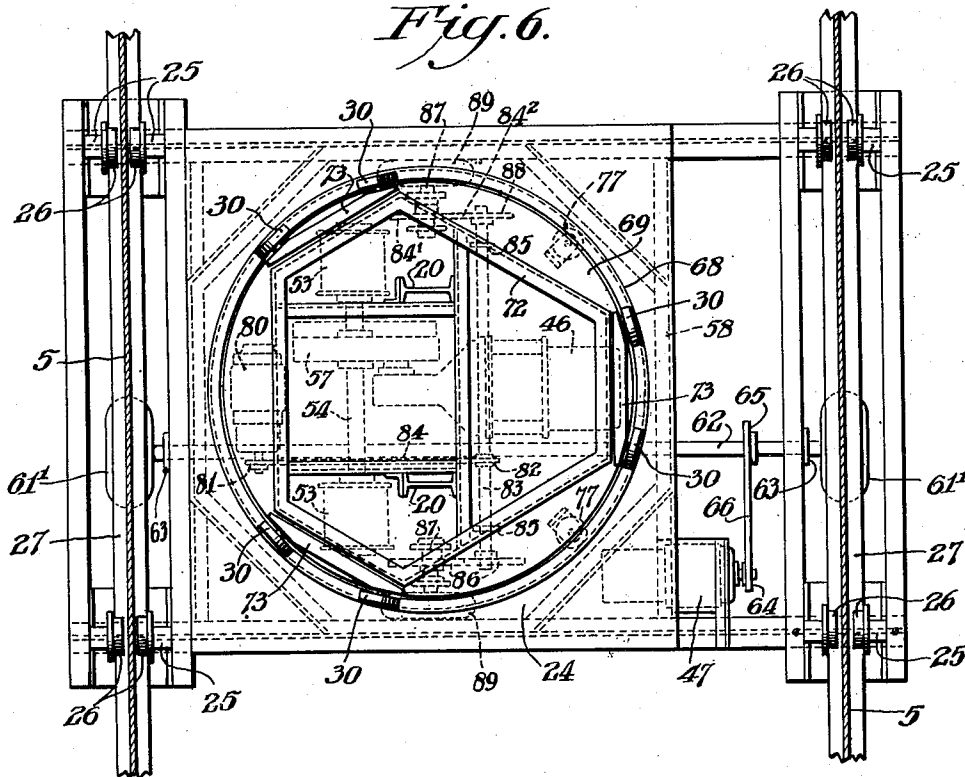
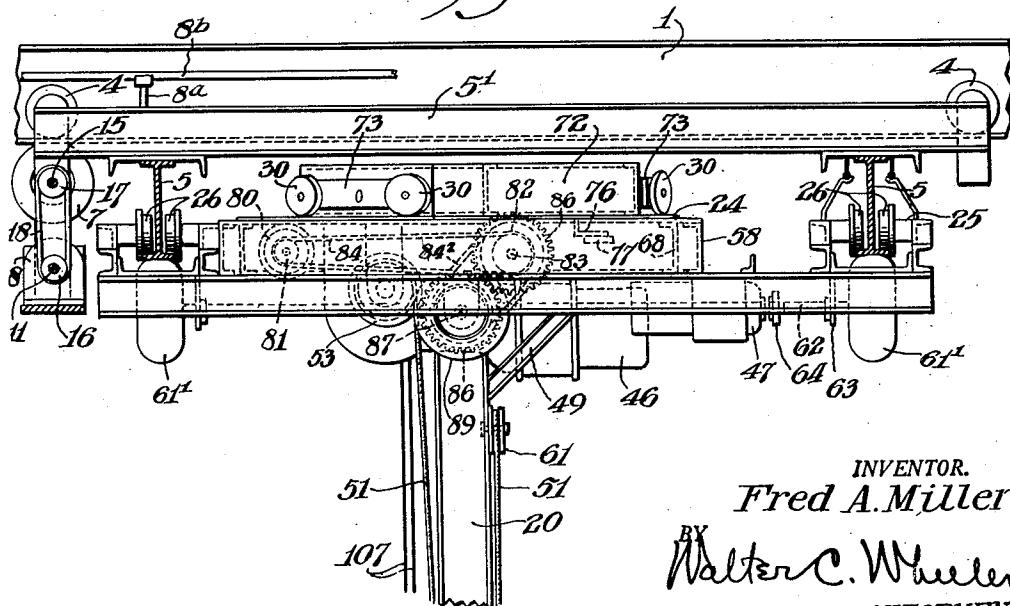


Fig. 7.



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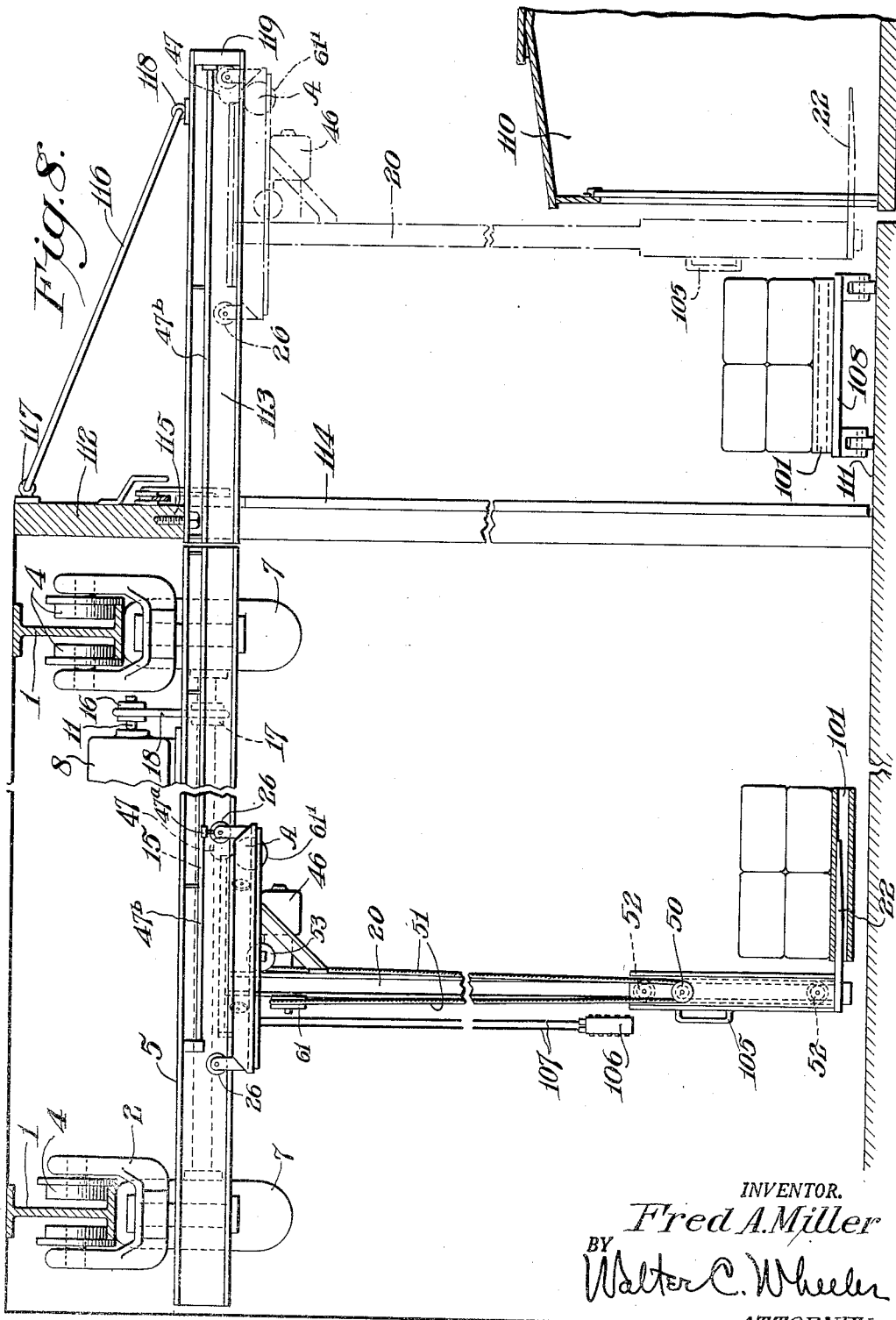
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MATERIAL HANDLING DEVICE

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4 Sheets-Sheet 4



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2,553,378

MATERIAL HANDLING DEVICE

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Application July 9, 1947, Serial No. 759,889

19 Claims. (Cl. 212-21)

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This invention relates to devices for handling articles and materials; and especially to such devices which are suitable for transporting articles from point to point and for stacking the materials in elevated positions in warehouses and the like.

Heretofore it has been common practice to place materials or objects such as containers to be stored, transported or piled onto decks or pallets which are raised from the floor on legs or blocks sufficiently to permit the arms or prongs of a lifting truck to be inserted thereunder. The containers on the pallet are lifted from the floor for movement to a stacking location where they may then be raised to the desired height for stacking. The containers with the pallet are then deposited on the stack, from which they may be removed by reverse operations and with equal facility.

This practice involving the use of trucks, however, is objectionable for several reasons. The lifting trucks are constructed with lifting forks projecting from an end or a side thereof. The load is thus overhanging and the truck necessarily operates as a counterbalancing weight. The load capacity of these arrangements is limited by the moderate counterbalancing of the truck. Such arrangements are inherently top-heavy when the load is considerable. Another undesirable feature of such trucks is the necessity of allowing a relatively wide aisle space for turning or maneuvering the loaded truck at right angles across the aisle when the load is about to be discharged upon or taken from the pile. This necessary allowance for maneuvering or aisle space reduces the available storage space in a given warehouse and increases the unit cost for ground space. Power means to drive these portable devices is also costly in that they are small units of the storage battery-electric motor, gasoline engine or other individually powered type. The entire power unit must be duplicated for each truck. Installation and maintenance of such equipment is costly and additional floor space is required for its storage and servicing. From the fact that the loads are inherently top-heavy, it is further evident that such truck equipment is adapted to make only relatively low piles.

It is among the objects of the present invention to provide apparatus which avoids the disadvantages of the truck-operated transporting and stacking devices hereinabove enumerated. Another object of the invention is to provide devices which make full and efficient use of practically all of the storage space. A further object

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is to provide a device which can be manipulated with greater speed than the present "forked truck," with no increase in operating personnel. Other objects of the invention will be apparent from the following description which will be made in connection with the drawings in which

Fig. 1 is an elevational view showing one modification of my improved lifting and stacking device,

Fig. 2 is an enlarged plan and sectional view taken on the line 2-2 of Fig. 1,

Fig. 3 is an elevational and sectional view taken on the line 3-3 of Fig. 4,

Fig. 4 is a plan view of the turntable and the carriage supporting the same,

Fig. 5 is a partial end elevational view of the structure illustrated in Fig. 4,

Fig. 6 is a plan view of a modified carriage designed for heavy work wherein all moving parts of the turntable are power driven,

Fig. 7 is a partial side elevational view of the carriage shown in Fig. 6, including additionally the longitudinal trackway and the carriage mountings appended thereto, and

Fig. 8 is the end elevation of an assembly embodying the invention which is a scheme for extending the trackways beyond the loading area.

The objects of the invention are attained in general by providing an upright lifting mast mounted on an overhead horizontal turntable, both of which are carried by an overhead conveyor which is maneuverable to transport the suspended mast and turntable into any desired position in the stacking space. The upright mast is provided at its lower end with a lifting fork or equivalent device for engaging the load to be elevated. Means are provided for maintaining the mast in upright position, for rotating the mast upon its vertical axis and for elevating and lowering the lifting fork along the mast.

In general, two embodiments of my invention are shown in the drawings, one of which is designed for lifting and stacking relatively light objects or loads, wherein the turntable may be rotated about its vertical axis by hand operation as illustrated in Figs. 1 to 5, inclusive; and the other of which is designed for manipulating heavier loads, wherein the turntable may be rotated by means of a power drive as illustrated in Figs. 6 and 7. In either case, the driving means which imparts longitudinal movement of the transverse carriage along the longitudinal tracks and transverse movement of the turntable carriage along the transverse tracks will result in the placement of the turntable and

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mast in any desired position in a given horizontal plane, the movements in that plane being parallel to the respective side walls of the building in which the device is housed. This driving means, however, is not necessarily power driven, but power driven means is preferable. When electrical motors are employed, they are controlled by suitable switches or mechanisms (not shown in detail) which are positioned conveniently adjacent the operator.

Referring to Figs. 1 to 5, inclusive, the overhead trackways, I-beams or flanged structural members 1 may be arranged to extend lengthwise along the sides of the storage room, or above and parallel to the area in which the articles are to be stacked. Crane support brackets 2 extending around the edges of the trackways 1 are provided with inwardly projecting shafts 3 upon which wheels 4 are mounted to operate on the upwardly facing surfaces of the lower flanges of I-beams 1. The brackets 2 are joined together by the transverse structural members 5 which, like structural members 1, are preferably I-beams.

The crane may be power driven by a reversible driving motor 8 which is suitably connected to a source of power through the wires 8c and 8d, the trolleys 8a and trolley wires 8b. The wires 8b are conductors connected to a two wire metallic circuit system of known construction, a partial side elevational view of which is included in Fig. 7. The wires 8b are connected to bus bars to which are also connected the overhead horizontally disposed leads 47b (Figs. 1, 5 and 8) which are suitably connected through shoes 47a to the motors carried by the transversely movable carriage, such as motors 46, 47 and 80. The connections to all motors are made through switches mounted in the control station 106. For example, motor 8 is connected to one side of the power line through lead 8c and to the other side through lead 8d which is a part of a loop including the switches in the control station 106. These connections are of well known design and are not shown in detail. The driving wheels 7 operably connected with the motor 8 are carried by suitable journals supported by the beam 5. The motor 8 (Fig. 1) mounted on a bed plate 9 on the I-beam 5 has a shaft 11 upon which the driven wheel 16 is mounted. Bearings 12 and 13 near either end of the beam 5 provide support for the axle 15 upon which the traction wheels 7 (preferably having inflated rubber tires) are mounted to bear upon the lower surfaces 14 of the structural members 1, and thereby provide traction for driving the overhead crane along the storage room. The axle 15 is driven by a belt or chain 18 which is driven by the motor pulley 16 and spans the pulley 17 on the shaft 15. The reversible motor 8 is connected to a source of power and as mentioned above, suitable connections and switches of known conventional design are provided for controlling the movements of the motor.

Suspended from the supporting members 5 is a carriage or turntable structure from which an upright mast comprising beam members 20, together with a lifting hoist housing 21 and prongs 22, or a platform extending to one side of the hoist housing, are suspended. The turntable designated generally as A (Fig. 1) is a structure having a bed plate 24 (Figs. 1 and 3 to 5) which is hung from upwardly extending brackets 25. Rollers, wheels or casters 26 suitable for traversing along the upper surfaces 27 of the lower

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flanges of the transverse beam members 5, or other top surfaces of these beams, are mounted to turn on pins or shafts 28 in the brackets 25 and to roll along these upper surfaces. Two sides of the bed plate 24 rest upon and are attached to the opposite rails 24' of the frame to which the brackets 25 are directly secured by the bolts 25'.

The turntable comprises a rotating member, such as the circular bed plate 29 (Fig. 3), to which the mast structure is directly attached. The circular rotatable bed plate 29 is maintained in proper spaced relation to the fixed bedplate 24 by a plurality of rollers 30 and 31 (Fig. 4) suitably supported in brackets 32, and arranged to bear both upon the upper and lower faces of plate 24 at or near the edge of the plate 24 and in a circle which is concentric with the turntable 29. The bed plate 24 is provided with a circular opening to permit the element 29 to be disposed therein with small clearance at the edges for turning. Upright bracket members 33 support a cross channel member 34 which is spaced above the plate 24 and turntable 29. The channel member 34 carries a thrust bearing 35 in an axis passing through the center of the turntable. The turntable is also provided with a thrust bearing 35' at its center and these bearings are held in operative position by the king pin 36. This mounting serves both to center the turntable in the circular opening in the bed plate and to maintain the turntable horizontally when a load is borne by the fingers 22.

The turntable may be, and preferably is, provided with a stop or locking device for retaining it in predetermined loading and unloading positions. As shown in Fig. 4, the motors for longitudinal and transverse movement are also made inoperative when the turntable is unlocked for turning. For this purpose, notched locking plates 37 are located on the fixed plate 24 at desirable points, such as 90° points of the turntable, and are provided with notches 38 to fit a retractable spring biased latch 39 which is mounted at the edge of the turntable. When the turntable is rotated to the desired position, the latch 39 is forced by the spring to enter the notch 38 in fixed plate 37. This retains the mast and its suspended load in the desired angular position while the loaded pallet is being transported or deposited in the stack. The latch 39 is mounted to slide radially in a channel formed at the edge of the turntable within a guide 40 which is affixed to the circular plate 29. The latch may be provided with means, such as a spring (not shown) to retain it normally in an outward or locking position so that locking will take place whenever it encounters the notched plate 37. A manually operated withdrawing or unlocking device may be provided. However, the latch 39 is preferably attached for operation to electrically operated armatures 41 of a solenoid 42 which is spring loaded to hold the latch 39 in locking position when the solenoid is deenergized. The armatures 41 carry an abutment 43 which engages an arm 44 of a power control switch 45 which makes and breaks the control switch in a power circuit for both the motor 8 for longitudinal movement and the transverse carriage motor 47. The solenoid is energized by closing a hand operated switch which is located within reaching distance of the floor in the control box 106 and connects the solenoid with a suitable source of power, such as a battery or rectifier (not shown). The connections are desirably arranged

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so that upon energization of the solenoid the latch 39 will be disengaged from the bracket 37, when the turntable may then be rotated manually as illustrated in Figs. 1 to 5 or electrically as illustrated in Figs. 6 and 7, and the control switch arm 44 will be operated to open position so that power motors 47 and 8 cannot be operated for operating the crane. When the solenoid 42 is deenergized, the latch or bolt 39 and switch arm 44 are returned to closed position by a biasing spring (not shown), and motors 47 and 8 may then be operated. Positive means for preventing the return of the solenoid operated bolt to a locking position while the turntable is being turned from one station to the next comprises arcuate stop members 59 extending between locking stations. The arcuate members 59 are mounted on the fixed bed plate 24 on brackets 60. The arcuate stop members are interrupted so that they do not interfere with the free movement of the latch 39 at the locking stations. Between locking stations the outer end of latch 39 may slide on the arcuate stop members and retain the latch 39 and switch arm 44 in their unlocking position. Additional locking stations intermediately positioned between those shown in Fig. 4 can be provided for locking the turntable and load arms in any desired angular position for providing a greater variety of stacking positions for disposing the load fingers 22.

When the load is brought to the desired longitudinal and lateral position by operation of the overhead crane and the lateral movement of the turntable carriage, the desired elevation of the load is attained by the operation of the hoist motor 46. The solenoid 42 may be energized to withdraw the bolt 39 and allow the turntable to be turned to the desired angular position. As described above, when the solenoid is thus energized and operated to unlock the turntable, the power control switch 45 is opened, thereby preventing all operation of longitudinal motor 8 and traversing motor 47. When the turntable is brought to the angular position so that the hoist with its load faces to the side where the material is to be stacked and the bolt 39 is returned to normal position, the switch 45 is closed. In the modification shown in Fig. 4, two of the diametrically disposed notched locking plates 37 are located so that the forks will be parallel to the beams 5 and 34 and perpendicular to the line of the stack when the latch 39 is in locking position, and the other two locking plates 37 are removed ninety degrees from the first ones named.

Two vertical structural members form the sides 20 of the mast, and are welded or otherwise secured at their ends to the turntable equidistantly from its center and in a line parallel to the diameter. The side members 20 are desirably I-beams with their re-entrant sides facing each other, fastened at the tops by welding to the turntable 29 and reinforced against turning by short angle bars 48. The mast members 20 are extended to give small but ample clearance above the level of the floor and they are held in upright position against loads placed on the forks 22 by oblique chords 49 which are suitably anchored to the turntable.

The hoist housing 21 (Figs. 1, 2 and 3) carries forks 22 projecting horizontally as a platform from the lower edge thereof. The housing 21 is a sleeve which is rectangular in cross section. The housing 21 is open at both ends and is adapted to slide vertically along and envelop both

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of the vertical I-beams or mast members 20. On the narrow lateral sides of the hoist housing 21 are mounted sheaves 50 and the hoisting cable 51 is passed around these sheaves for elevating the hoist housing. Four idler rolls 52 are mounted on the inner wall of the housing to turn on pins at the top and bottom of the hoist housing and to track along the vertical outer channel of the I-beams for guiding the housing and reducing friction while the housing is being elevated and lowered. Two cable drums 53 are mounted on shaft 54 (Figs. 3, 4 and 5) directly under the turntable. The shaft 54 is mounted to turn in bearings 55 which are mounted on and secured to the bottom of the turntable 29. A suitable worm reduction drive is housed in casing 57 and is driven by the motor 46 supplying motive power to the shaft 54 and to the drums 53. For hoisting the housing 21, one end of cable 51 is fastened to one of the cable drums 53 and the other end is fastened to the other drum. A number of turns of the cable are wound upon each of the drums, and the intervening cable from one of the drums passes over a hoist sheave 61 at the top of the hoist, and from the other drum over a corresponding sheaf 61 also at the top thereof, resulting in two endless loops which are in turn run down on the outside of the housing 21 and caught under their respective hoist sheaves 50. This arrangement of cable 51 provides an equalizing effect upon housing 21 when it is to be raised or lowered. The motor 46 is adapted to drive forwardly and in reverse so that the hoist may be elevated by propelling the drums 53 in one direction and lowered by reversing the direction of drive. In lowering the hoist or any load which it may be carrying, the weight of the hoist housing is sufficient to lower it when the motor is reversed and to maintain the cable in operative position on the various sheaves.

The turntable in the modification shown in Figs. 1 to 5 and 8 is turned manually for angular positioning by the handles 105 mounted on the hoist housing 21. The electrical switches for controlling the motors 8, 46 and 47 and the solenoids 42 are enclosed in a housing 106 which is suspended conveniently to the operator on cables 107 from the turntable plate 29. The leads from the control switches in housing 106 are carried in the cables 107 and they are suitably connected in the well known manner for operation with the coils of solenoids 42 and the various motors. The leads to the motors in the cables 107 lead to separate switches in housing 106. Instead of a two wire metallic circuit, a standard three wire system can be used if desired and the connections made thereto in the well known manner. In the modification shown in Figs. 6 and 7 the cables carry an additional lead from a fourth switch in the housing 106 which connects with the motor 80 for turning the turntable. Thus, the operations of transporting the load longitudinally along the beams 1 or transversely along the beams 5 and the operations of unlocking the turntable or unlocking the turntable and motor, and rotating it into position for unloading or loading, are controlled from the switch housing 106.

In the modification shown in Figs. 4 and 5, means are provided for hoisting by power and for moving the turntable along the longitudinal and transverse beams by power. For the transverse movement, the motor 47 mounted on the turntable carriage is provided with a pulley 64

which is connected with a second pulley 65 keyed to axle 62 thru a suitable chain or belt 66. The axle 62 is journaled in bearings 63 carried by the carriage. Power is transmitted from the motor 47 thru these pulley connections to axle 62 for turning the friction wheels 61' which may carry inflated rubber tires. The motor 47 is of reversible type, and is electrically connected through the cables 107 to suitable controls as described hereinabove whereby the operator can regulate the direction of rotation of the motor and the direction in which the bed plate structure is propelled along the I-beams 5. The longitudinal movement of the structure along the I-beams 1 has already been described as being driven by the reversible motor 8 which is mounted on the transverse structural members or carriage 5 and which is not shown in Fig. 4.

The lifting fingers 22 may be shaped so as to cooperate with conventional supports for the material to be stacked, such as the skid support 100 shown in Fig. 1 or the pallet 101 shown in Fig. 8.

The embodiment of my invention illustrated in Figs. 6 and 7 is similar to that shown in Figs. 1 to 5, but the modified form shown in Figs. 6 and 7 is of heavier design to accommodate greater loads, and means are provided for turning the rotatable turntable by power, thereby providing power drive for all movements. The turntable is also of modified construction. The movement of the turntable structure along the I-beam supports 1, the hoisting and the transverse movement along I-beams 5 are similarly controlled and driven by the motors 8, 46 and 47, respectively. Inflated pneumatic tires on the wheels 61' mounted on the axle 62 frictionally engage the under faces of the lower flange of each I-beam 5 for moving the turntable supporting carriage back and forth transversely between the longitudinally extending track members 1.

In the modification shown in Figs. 6 and 7, the turntable supporting carriage is built up of six structural members or beams placed on edge and welded together end to end forming a frame 72 having three longer sides of one length constituting the three fragmentary sides of a triangle and three shorter sides of equal length constituting three fragmentary sides of another triangle. The three short sides provide upright members upon which are mounted brackets or trunnions 73 carrying pairs of rollers or casters 30. The bed plate 24 upon which the rollers 30 travel is finally mounted on the top edges of six other structural members or channels 53, and the plate 24 is fixedly supported at the sides by the rectangular frame which is suspended from the transverse I-beams 5 by the brackets 25, the ends of I-beams 5 being fixed to the frame members 5' (Fig. 7) carrying the casters or wheels 4. The six sided structure composing frame 72 rests upon and is integrally secured to the circular plate 69 which is maintained in rotatable relation within a circular opening in fixed bed plate 24. On the lower face of plate 69 are fastened a plurality of bearing brackets 76 (Fig. 7) each supporting a wheel or roller 77. These wheels 77 are arranged with their axes vertical and to roll along the inner surface of circular guide or channel 68, the upper web of which is fastened to the lower surface of the fixed plate 24 along the margin of the circular opening. The cylindrical web portion of the channel 68 is thus concentric with the edges of the turntable and the opening in plate 24 and it serves with the rollers 77 as a guide to retain the

turntable in centered operative position. The lower web of the channel 68 serves as a circular track upon which the power driven traction wheels 89 travel. The wheels 89 and turntable motor 80 are supported from the turntable, as will be hereinafter described and the wheels 89 rolling along the lower horizontal surface of the circular channel 68 serve as traction means for turning the turntable and as means for preventing tilting of the turntable. The brackets 76 engage the upper flange of the circular flange 68 and also prevent undue upward movement of the turntable. The wheels 30 mounted on the trucks or trunnions 73 serve to maintain the turntable in its correct horizontal position and permit axial rotation of the mast 20, and the wheels 77 rolling on the circular inner surface of channel 68 maintain the proper centering of the mast 20 and the turntable with relation to its supporting carriage while the engagement of wheels 89 with the lower circular flange of the channel 68 provides traction for turning.

Similar to the modifications of Figs. 1 to 4, the supporting mast 20 of Figs. 6 and 7 is carried by the turntable proper and turns therewith. In this modification, however, the turning is accomplished by a reversible type motor 80 mounted on the under side of turntable frame 72. The turntable is driven by the reversible motor 80 in either direction through the pulley 81 keyed on the motor shaft, belt or drive chain 84 and pulley 82 keyed on shaft 83 mounted in brackets 85 on the under side of plate 69. The meshing gear wheels 86, one of which is mounted on shaft 83 and the other of which is mounted on the axle 87, drive the first wheel 89 in one direction on the under side of channel 68. At the other end of shaft 83 is mounted a sprocket wheel 88 carrying a chain 84' which passes over the sprocket wheel 84' keyed to the axle 87 of the other or second friction drive wheel 89, thus driving this friction wheel in the opposite direction to the diametrically located gear driven friction wheel. The pair of gear wheels 86 and the sprocket wheels 88 and 84' are similarly proportioned so that the speed of the friction wheels 89 will be alike. Suitable electrical connections including a control switch in the control switch housing 106 are connected to the motor 80 and the traction wheels 89 are caused to rotate in one direction or the other by the motor 80 for rotating the turntable, mast 20 and fingers 22 into the desired angular position.

The hoisting motor 46 is suspended from the frame members 72 of the turntable in the modification of Figs. 6 and 7 and the drive for the cable drums 53 and cable 51 is similar to those of the above described modifications. The mast 20 is arranged like the other described modification and the actuating rigging is similar. A locking device similar to that illustrated in Figs. 1 to 5 may be used by mounting the solenoid operated latch on the turntable plate 69 and the fixed latch receptacle on the fixed plate 24. A solenoid actuated switch corresponding to switch 45 of Fig. 4 may be used which renders the longitudinal and transverse motors inoperative when the turntable is unlocked, but a preferable arrangement in the switch corresponding to switch 45 comprises solenoid operated circuit interrupters in the circuits of all the motors, except the hoisting motor 46, arranged so that the motors 8 and 47 will be made inoperative when the solenoid operated latch is in the unlocking position and so that the circuit to the turntable motor 80

(Figs. 6 and 7) may be operated in that position of the latch and inoperative in the locked position of the latch. This arrangement in the circuit of the turntable motor constitutes a safety device whereby the motor for turning the turntable may not be operated unless the turntable lock is in its unlocking position.

The device is especially suitable for stacking and storing cartons containing supplies or manufactured commodities which have been made ready to ship. In manufacturing operations the cartons, boxes, drums or the like in which the commodities are packed, are placed in tiers upon platforms or pallets which are raised above the floor level on skids, wheels or frames a sufficient distance to permit the prongs 22 to be freely inserted thereunder in order to engage the under surface of the loaded pallet. The pallet 101 is then lifted from its support, such as a truck 108 (Fig. 8) or from the floor, and maneuvered by the above described crane mechanism to the loading position. At the loading position, an alley only wide enough to admit the loaded pallet 101 (Fig. 8) and the suspended mast is essential since it is not necessary with proper maneuvering to turn the pallet to bring it into position to be deposited in the stack. Only elevation of the load and lateral movement into the open stacking space is necessary. This avoids allowance of valuable floor space which is necessary for turning trucks bearing pallets to loading position. Inasmuch as my improved lift arrangement requires no allowance for truck handling, a saving of 50% or more of the space formerly given over to maneuvering of the trucks can now be utilized for storage. Somewhat higher stacks of containers can also be built up with the novel stacking arrangement than are possible with the top-heavy trucks formerly used since the height of the stack is limited only by the amount of head room provided by the height at which the supporting beams, such as girders, are mounted. This feature contributes to greater stacking volume per unit of floor space.

The crane structure carried on I-beams 4 is installed preferably thru the length of the storage building, while the transverse moving portion thereof movable along I-beams 5, operates across the stacking area. This permits the mast to be moved into any selected location in the storage area so that the operator is thereby enabled to select the most desirable areas for stacking purposes and those which are most desirable. It is also possible with this lifting mechanism to solidly stack the entire floor space with pallets but the desirability of chronologically moving the stacked material from storage in the order that it is stored and other storage requirements make the use of aisles desirable.

Figure 8 is illustrative of a device adaptable for use where an extension of an overhead trackway is desirable. Power connections are omitted in this view, except lead 47b and the shoe 47a, inasmuch as it is evident that a lengthening of the power supply lines connected to the motor or motors mounted on the turntable is the only essential variation in the power means. The illustration shows a partial view of a freight car 110 placed beside the loading platform 111 of a warehouse. On the warehouse wall 112 and extending outwardly therefrom is mounted a fixed I-beam section 113 of the kind used for the transverse overhead trackway 5 of the loading crane. The fixed I-beam 113 is

preferably located in the middle of a doorway which may be closed by the sliding door 114. The I-beam is secured to the wall at one end by the bolts 115, which are passed through the upper flanges and secured in the wall 112 with the lower flange on the same level as the overhead longitudinal or transverse (as shown) trackway of the loading device, and the inner end of the beam sufficiently close to the open end of the trackway to constitute an extension of the trackway, so that the turntable mast and hoisting support can be wheeled onto the outwardly extending beam 113 as illustrated in broken lines. The outer end of beam 113 is supported from above by the chord 116 attached at one end to the eye-bolt 117 in the wall of the building and at the other end to the eye 118 which is attached to the upper surface of the beam near the outer end. A stop member 119 at the outer end of the beam prevents the turntable carriage from rolling off the end. The beam may be extended as far as the edge of the platform but where regulations will permit it may well be extended somewhat farther so that the mast 20 will reach about to the door as illustrated in broken lines. The farthest extension permits the lifting of pallets from the floor of a box car while, with a shorter beam, the loaded pallets may be lifted as from a truck 108 which may be loaded in the car and wheeled to the platform. Where beams such as 113 are mounted to extend the longitudinal tracks 1, they may be similarly constructed and provided with power extensions:

In operation, a number of commodities to be stacked are arranged on pallets 101. The overhead crane is moved into place so that the depending mast is in position and the forks 22 are advanced under the pallet. The appropriate controls at the control station 106 are now manipulated to cause motor 46 to start rotation in the appropriate direction to hoist the pallet above obstructions on the floor. This motor operates drums 53 and the cable and pulley connections 50, 51 and 61. The control switch or circuit breaker 45 for motors 47 and 8 being closed, appropriate circuit control switches in the control station 106 are then operated to put motors 8, 47, or 80 in circuit for turning the load in the direction for transportation or for transporting the load to the desired point for stacking. The load, mast and turntable can then be turned into position, if need be, for stacking by operating the turntable latch to release position and rotating the turntable manually (Figs. 1 to 5), or by appropriately energizing the turntable motor 80 (Figs. 6 and 7), depending upon whether or not motor operation is provided. When the load is properly positioned and the turntable is locked, the appropriate motor circuit for the hoist motor 46 is closed for elevating the load. When properly elevated, the load is then appropriately moved laterally or longitudinally along the transversely or longitudinally extending tracks to the desired position in the stack and finally lowered onto the stack. The lifting forks thus being disengaged, the device can be returned for a new load by appropriate reverse movements.

The lowering of the mast housing and forks is accomplished by reversing the direction of rotation of motor 46 (Fig. 3) causing the cable 51 to unwind from drums 53, and permitting the housing 21 to lower on the mast structure 20 by gravity. When the loaded pallet has been placed, the motor 46 is stopped, and motor 47 is energized

to cause the bed plate 24 to move in a direction to withdraw the fork prongs from beneath the pallet and then, by manipulating controls for reverse movements of either motors 47 or 8, cause the crane to move the mast to a position for re-enactment of the cycle.

For eliminating manual operations, especially where heavy loads are to be handled which are too heavy for manually operating the equipment, I provide means for motor operation as illustrated in Figs. 6 and 7 wherein all the movements are operated by electric motors. The longitudinal operation of the device is identical with the modification shown in Figs. 1 to 5, but the rotation of circular bed plate 29 is here motor controlled by the reversible motor 80. In another modification, instead of bringing only the power leads of the transverse motor through the circuit breaker 45, the circuit breaker 45 may comprise multiple connections for breaking the supply circuits of any one or any combination of the motors 2, 47 and 80, so that only one or a variety of combinations of motors can be made inoperative when the turntable latch is open to permit turning of the turntable. For example, the power leads for both transporting motors 8 and 47 can be brought through the circuit breaker 45 and switches in control box 106, or the power leads for motors 8, 47 and 80 may be brought through the circuit breaker 45, or only one of them, such as the power leads for the hoist motor 46, can be arranged to be broken when the latch is in position to permit turning. Alternatively, the power leads for the turntable motor may be brought through the circuit breaker 45 and this circuit opened when the latch 39 is advanced to prevent turning of the turntable and closed when the solenoid withdraws the latch to permit turning of the turntable. Thus any of the motor controlled operations can be interlocked with the operation of solenoid-operated latch 39.

From the foregoing disclosure it will be recognized that the invention is susceptible of modification without departing from the spirit and scope thereof and it is to be understood that the invention is not restricted to the specific illustrations thereof herein set forth.

I claim:

1. A conveying and stacking device comprising an upright mast having a guideway disposed lengthwise thereof; lifting means appended at one end of the mast including means for guiding the same along said guideway; a horizontal turntable, said mast being fixedly secured at its upper end to said horizontal turntable for turning the lifting means integrally with said turntable into various angular positions in horizontal planes; a transverse carriage for supporting the mast, turntable and lifting means; an elongated longitudinal support for supporting said transverse carriage, said transverse carriage and said longitudinal support comprising tracks for carrying the supported parts therealong; means carried by said transverse carriage for propelling the suspended parts along said longitudinal support; and means supported by the turntable for hoisting the lifting means.

2. A device in accordance with claim 1 in which the lifting means comprises a hoist motor mounted on said turntable; and reeling means connecting the motor and said lifting means for elevating the same.

3. A conveying and stacking device comprising an upright mast having a guideway disposed lengthwise thereof; a hoist including an

appendage for engaging objects to be stacked; a support for said engaging means and guide members for guiding the support along the guideway of said mast; a horizontal turntable; said mast being fixedly secured at its upper end to said turntable for turning the hoist and appendage integrally with said turntable into various angular positions in horizontal planes; a carriage upon which said turntable is mounted; a transverse support including track means for supporting said carriage, said carriage having means for carrying the same along said transverse support; an elongated longitudinal support for supporting said transverse support, said transverse support having means for carrying the same along the longitudinal support; and means supported by said turntable for elevating and lowering said hoist along said mast.

4. A conveying and stacking device comprising an upright mast having a guideway disposed lengthwise thereof; a hoist including an appendage for engaging objects to be stacked; a support for said engaging means and guide members for guiding the support along the guideway of said mast; a horizontal turntable; said mast being fixedly secured at its upper end to said turntable for turning the hoist and appendage integrally with said turntable into various angular positions in horizontal planes; a carriage upon which said turntable is mounted; a transverse support including track means for supporting said carriage, said carriage having means for carrying the same along said transverse support; an elongated longitudinal support for supporting said transverse support, said transverse support having means for carrying the same along the longitudinal support; a reeling means rotatably mounted on said turntable; cable means connecting said reeling means with said hoist; and means for rotating said reeling means for elevating and lowering said hoist along said mast.

5. A conveying and stacking device comprising an upright mast having a guideway disposed lengthwise thereof; a hoist including an appendage for engaging objects to be stacked; a support for said appendage and guide members for guiding the support along the guideway of said mast; a horizontal turntable; said mast being fixedly secured at its upper end to said turntable for turning the hoist and appendage integrally with said turntable into various angular positions in horizontal planes; a carriage upon which said turntable is mounted; a transverse support including track means for supporting said carriage, said carriage having means for carrying the same along said support; means supported by said turntable for elevating and lowering said hoist including a power driven motor; and means for controlling the supply of power to said motor.

6. A device in accordance with claim 4 in which the turntable comprises means for preventing tilting of the turntable and means for preventing axial displacement of the turntable; said means for preventing tilting comprising a bedplate on the carriage, and roller means mounted on the turntable and arranged to roll along a circular path on the bedplate when the turntable is turned.

7. A device in accordance with claim 4 in which the turntable comprises means for preventing tilting of the turntable and means for preventing axial displacement of the turntable; said

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means for preventing axial displacement of the turntable comprising a circular track member secured to one side of the bedplate having an upright circular track member concentric with the turntable; and roller means mounted on the turntable and arranged to roll along said upright track member when the turntable is turned.

8. A conveying and stacking device comprising in combination, longitudinal support members, a transverse support member movably mounted at each end upon said longitudinal support members, a carriage movably mounted on said transverse support member, a turntable mounted on said carriage, said turntable supporting a downwardly disposed mast member carrying a load-engaging member movable up and down said mast member, powered means supported by said turntable for elevating and lowering said load-engaging member, and at least one additional powered means for effecting movement of said turntable with respect to said carriage, for effecting movement of said carriage with respect to said transverse support member, and for effecting movement of said transverse support member with respect to said longitudinal support members.

9. A conveying and stacking device comprising an upright mast having a guideway disposed lengthwise thereof; a hoist including an appendage for engaging objects to be stacked and guide members for guiding the hoist along the guideway of said mast; a horizontal turntable; said mast being fixedly secured at its upper end to said turntable for turning the hoist and said appendage integrally with said turntable into various angular positions in horizontal planes; a transverse support having a manipulative carriage upon which said turntable is mounted and including track means for carrying said carriage, said carriage having means for transporting the same along said track means; means on said turntable for raising and lowering said hoist; an elongated longitudinal support including track means and manipulative means for carrying said transverse support therealong; a locking means for retaining the turntable in predetermined angular positions; power driven means operatively connected to at least one of said manipulative means for propelling the same; power delivery means for supplying power to said power driven means including means for controlling said power delivery; and means responsive to said locking means for discontinuing the power delivery to said power driven means when the locking means is in unlocked position.

10. A device in accordance with claim 9 wherein the carriage carries rollers for rolling along the transverse support, an electric motor operatively connected to said rollers for effecting movement along said transverse support, and an electric motor for moving said transverse support longitudinally; and the turntable carries an electric motor for raising and lowering said hoist; conductors connecting said motors to a source of power; and means for controlling the supply of current to said motors, which means are located at a central control station.

11. A device in accordance with claim 1 which comprises an electrical hoisting motor carried by the turntable; an electrical driving motor carried by the transverse support; propelling means driven by the latter of said motors for engaging the longitudinal support for propelling said suspended parts longitudinally; locking

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means engaging the turntable for retaining the same in a predetermined angular position and electrically operated solenoid means for actuating the locking means; leads for connecting said driving motor to a source of power having circuit interrupting means therein for opening and closing the circuit; and means actuated by said solenoid means for actuating said circuit interrupting means to open circuit position when said locking means is actuated to unlocked position by the solenoid.

12. The combination with a traversing conveying and stacking device having spaced beams adapted to transporting articles from point to point and stacking the material in elevated positions, of a wheel supported lifting carriage mounted on the beams, trackways on the beams along which the wheels of said lifting carriage travel, said carriage being provided with a floor structure and a driving motor movable therewith, a circular opening or recess in said floor structure for accommodating a turntable, a turntable mounted to operate freely in said recess, rotatable means operating between said carriage floor structure and said turntable for stabilizing said turntable during rotation, a lifting mast and a hoisting motor carried by said turntable, and a lifting fork housing carried by the mast and movable vertically thereon.

13. A device in accordance with claim 9 which comprises means for retaining said locking means in unlocked position while said turntable is being turned from one of said predetermined angular positions to another.

14. A conveying and stacking device comprising an upright mast having a guideway disposed lengthwise thereof; a hoist including an appendage for engaging objects to be stacked and guide members for guiding the hoist along the guideway of said mast; a horizontal turntable; said mast being fixedly secured at its upper end to said turntable for turning the hoist and said appendage integrally with said turntable into various angular positions in horizontal planes; a transverse support having a manipulative carriage upon which said turntable is mounted, including track means for supporting said carriage, said carriage having means for transporting the same along said track means; hoist operating means including a reel supported by said turntable for elevating and lowering said hoist; an elongated longitudinal support including track means and manipulative means for carrying said transverse support therealong; a locking means for retaining said turntable in predetermined angular positions; electric motors having power supply circuits, said motors being operatively connected for manipulating said hoist elevating means and at least one of said manipulative means; and a circuit opener responsive to open said power supply circuit to at least one of the motors connected to said manipulative means when said turntable is in unlocked position.

15. A device in accordance with claim 8 including means for effecting movement of the load-engaging member, the turntable and at least one of the relative displacements of the several support members, including the displacement of the carriage, which comprises electrically powered motors; a plurality of stop members; a locking device engageable with said stop members for locking the turntable in predetermined angularly disposed positions; power connections for supplying power to said motors; circuit interrupting means in each of said power

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connections; a first actuating means on said locking device operative to open the circuit interrupting means of the turntable motor when said locking device is engaged with said stop members; and a second actuating means interlocking the circuit interrupting means of each displacement effecting motor with the circuit interrupting means of the turntable motor, but in reverse relationship.

16. The combination with a traversing conveying and stacking device having spaced beams adapted to transporting articles from point to point and stacking the material in elevated positions, of a wheel-supported lifting carriage mounted on the beams, trackways on the beams along which the wheels of said lifting carriage travel, said carriage being provided with a floor structure and a driving motor movable therewith, a circular opening or recess in said floor structure for accommodating a turntable, a turntable mounted to operate freely in said recess, a lifting mast and a hoisting motor carried by said turntable, and a lifting fork housing carried by the mast and movable vertically thereon.

17. A device in accordance with claim 1 in which the transverse support comprises a bedplate from which the turntable is suspended and the turntable comprises roller means bearing on the bed plate, said roller means being arranged to follow a circular path on the bed plate; and means on the turntable for preventing axial and tilting movements thereof.

18. A device in accordance with claim 1 in which the transverse carriage carries a circular turntable member and a bedplate having a circular opening therein, the margins of which are closely spaced from the edges of the turntable; circular tracks on the upper and lower surfaces of the bedplate; casters mounted on the upper

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and lower surfaces of the turntable for rolling along said tracks; a king bolt; means centrally positioned on the turntable for mounting the king bolt; and means on the bedplate for mounting the king bolt whereby the turntable is centrally suspended in said circular opening.

19. A device in accordance with claim 1 in which the transverse support comprises a bedplate from which the turntable is supported; wheels mounted on the turntable engaging said bedplate; a circular track on the bedplate which is traversed by said wheel means; a circular channel member mounted with its upper channel secured to the lower surface of the bedplate, the web portion of said channel forming an upright circular track underneath the bedplate and concentric with the turntable, and the lower web of the channel forming a downwardly facing circular track; wheel means supported by the turntable for engaging the web portion of the channel for centering the turntable; a motor mounted on the turntable; and traction means operably connected to the motor, said traction means being mounted to engage said downwardly facing circular track thereby to turn the turntable and prevent tilting thereof.

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