Jan. 20, 1959 A. W. ERNESTUS 2,869,734

HOIST UNIT

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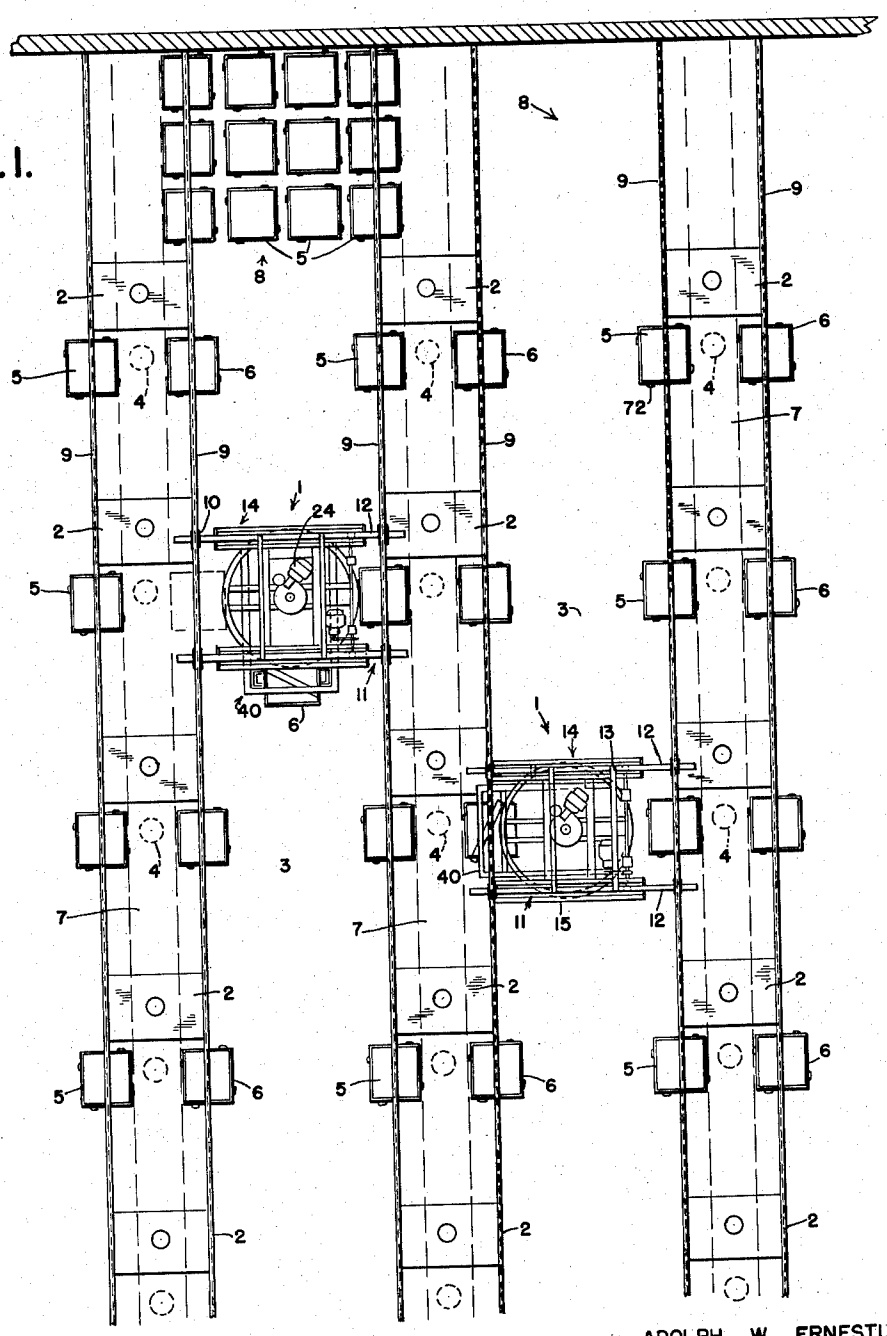
FIG. 1.



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HOIST UNIT

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FIG. 3.

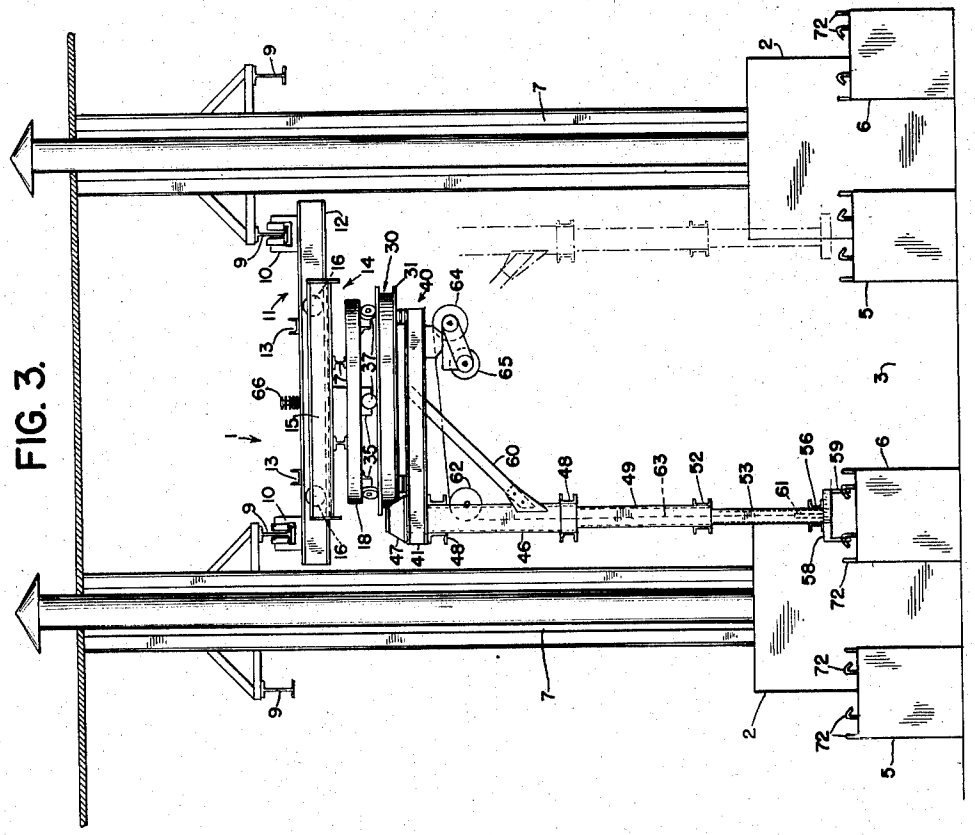
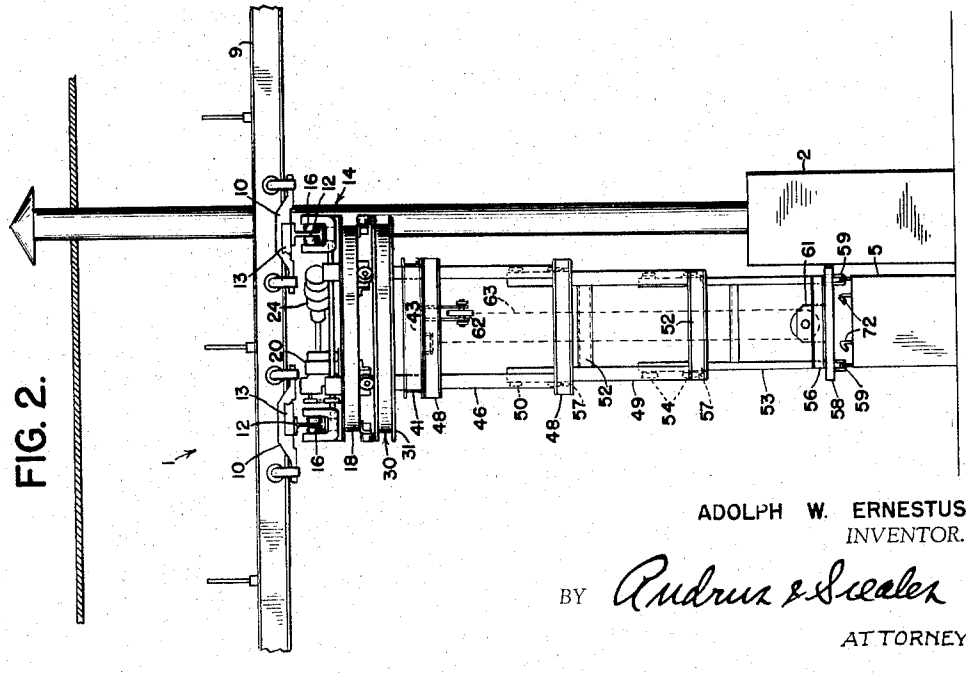


FIG. 2.



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HOIST UNIT

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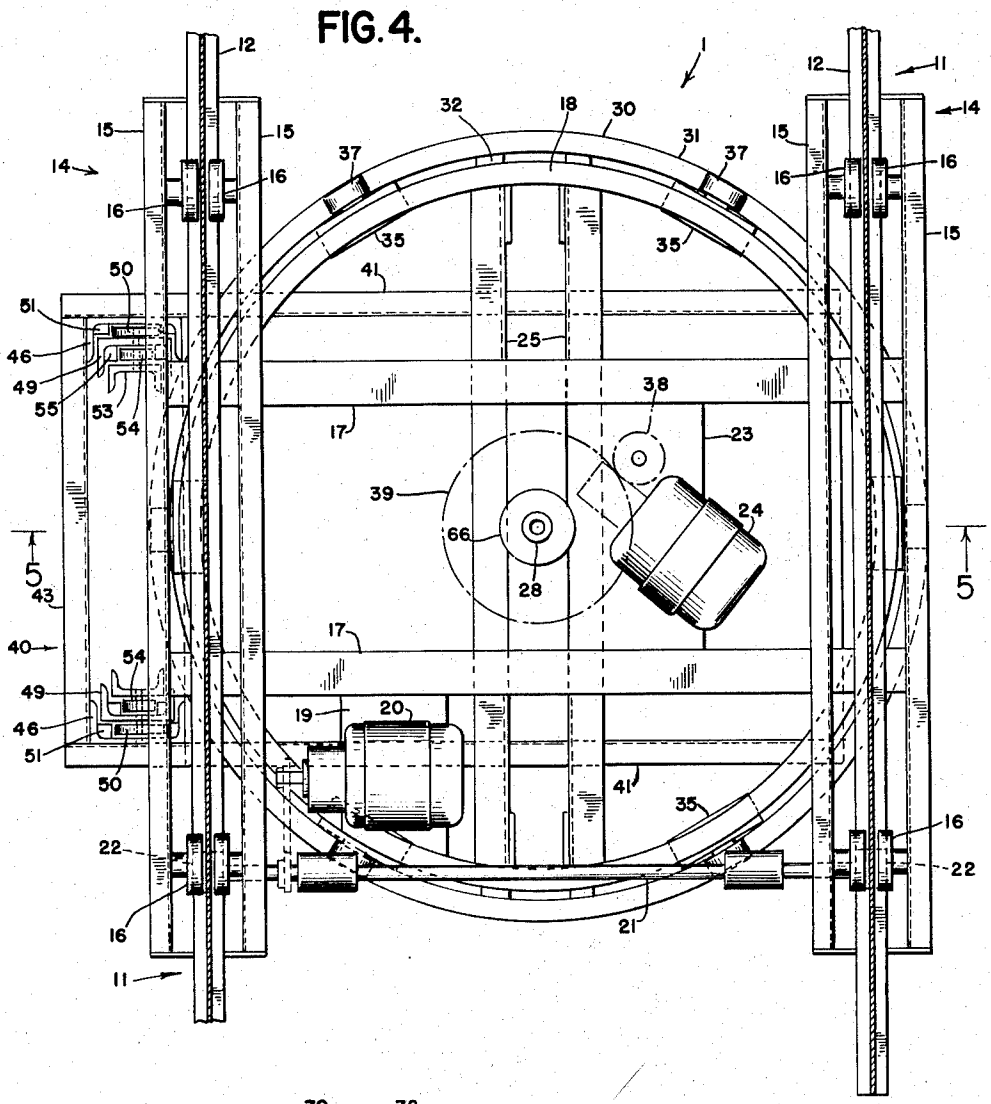
FIG. 4.



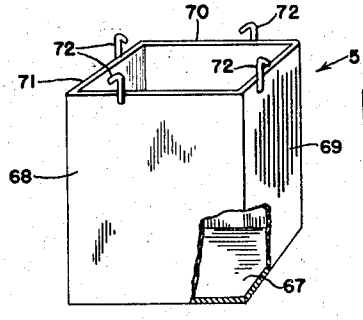


FIG. 7.

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FIG. 5.

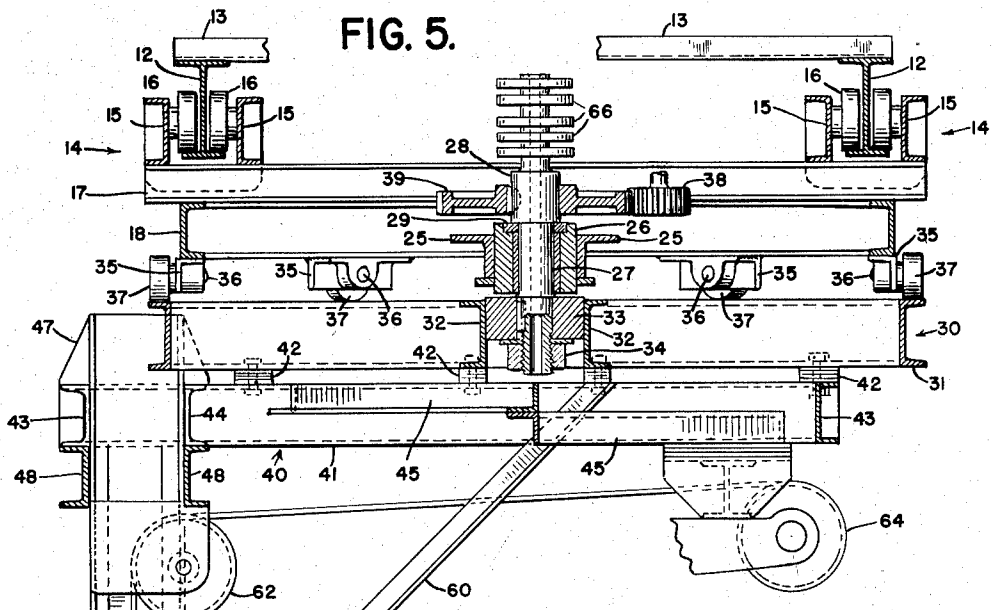
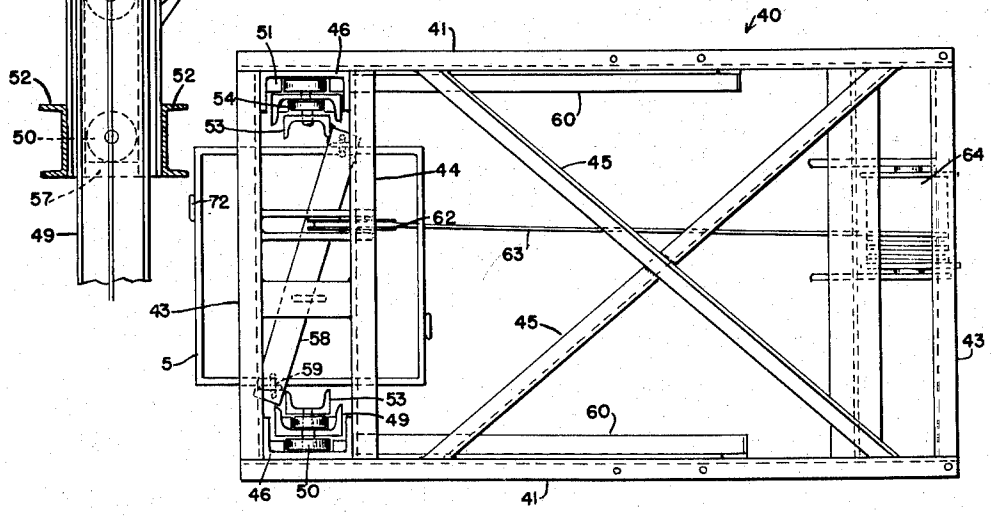


FIG. 6.



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United States Patent Office

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HOIST UNIT

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Application September 12, 1955, Serial No. 533,672

2 Claims. (Cl. 212—21)

This invention relates to a hoist unit, and more particularly to a rigid telescoping hoist for use in conjunction with an overhead crane for handling of materials on the floor below.

In the manufacture of automobile frames and the like, it is necessary to fabricate a number of small parts, such as side rail brackets, to be attached to the main body of each frame. When frames are mass produced, the total number of small parts required will be very large, necessitating the use of a plurality of presses. Each press requires the attendance of at least one man who places metal blanks in the press and removes them when they are formed. It is desirable to supply the blanks to the operator in a tote box or other suitable container adapted for easy replacement. The finished pieces are placed by the operator in another similar container for transfer to the main assembly line.

In a plant where several lines of small parts presses are installed with aisles therebetween, problems have arisen in regard to the most efficient utilization of space. It is desirable to keep the presses in any one line as close together as possible, commensurate with the space requirements of the operators and the tote boxes. The aisles should also be wide enough to permit all needed activity thereon, but not so wide as to waste floor area. In addition, space is needed in the plant for ventilation ducts, water and oil pipes, electric power conduits, catwalks, etc. Since it has been found that the area between the aisles and the roof of the building should be kept clear, a place must be provided above the presses for these things. The result is a dead space extending from each line of presses to the ceiling and at least several feet in width. No plant operations may be carried on which will interfere in any way with this dead space, which is filled with ducts, conduits, etc.

In transferring the small parts tote boxes from place to place throughout the plant, maximum flexibility is desried. It is believed that conveyor systems are not suitably flexible, and that only an overhead system of transfer is completely adequate. Such an overhead system requires cranes to pick up, transfer and set down the numerous tote boxes used in small parts fabrication.

The use of cranes in a plant such as that described above poses a number of problems, particularly in regard to interference with the dead space above the presses. The crane mechanism itself must not interfere with the dead space, and the hoist associated with the crane must be capable of positioning containers directly adjacent such space so that the floor area is utilized most efficiently. In addition, the hoist must position containers accurately and with a minimum of labor.

The present invention solves the aforementioned problems and provides a crane and hoist of maximum flexibility and great accuracy when used in a plant such as that described above. A single crane may service press lines located on both sides of an aisle, and the hoist mechanism will transfer and position containers without interfering

with the dead space. Maximum floor area is utilized, making for a more efficiently operating plant.

The accompanying drawings illustrate the best mode presently contemplated by the inventor for carrying out the invention.

In the drawings:

Figure 1 is a schematic top plan view of a small parts manufacturing plant showing the lines of presses, aisles, cranes, dead spaces and operator areas;

Fig. 2 is a schematic side elevation of a portion of a press line;

Fig. 3 is a transverse section of the line, showing a crane and hoist in position over a tote box;

Fig. 4 is a plan view of the crane and hoist mechanism with the supporting rails in section;

Fig. 5 is a vertical section through the mechanism taken on line 5—5 of Fig. 4;

Fig. 6 is a detail plan view of a hoist bracket with parts omitted; and

Fig. 7 is a detail perspective view of a tote box, partly in section.

As shown in the drawings, the crane 1 is adapted to operate in a manufacturing plant having a plurality of small parts presses 2 arranged in rows which are separated by aisles 3. Presses 2 are spaced far enough apart so that an operator 4 may stand between each pair of presses with a tote box 5 to his left and a similar box 6 to his right. Box 5 contains metal blanks which the operator feeds to the press, and box 6 is adapted to receive the finished parts. A space 7 is disposed above presses 2 and longitudinally of each line to allow for the installation of catwalks, ventilation ducts, etc. Space 7 extends vertically from the roof of the building downwardly to adjacent the top portions of presses 2, with sufficient room underneath for the operator to stand. A storage area 8 is located at one end of each aisle, and may be used to store empty tote boxes or boxes full of blanks or finished parts.

The crane 1 and its operation will now be described in detail.

A longitudinally extending rail member 9 is suitably secured a substantial distance above the floor of the building on each side of each aisle 3 and closely adjacent dead spaces 7. Each rail 9 slideably carries a yoke member 10. A bridge 11 extends transversely between a pair of rails 9 across aisle 3 and is suitably secured to yokes 10. Bridge 11 comprises a pair of transversely extending I-beam side rail members 12 joined together by reinforcing beams 13. The bridge assembly is adapted to move longitudinally the entire length of rails 9 above an aisle 3.

A carriage 14 is secured to the underside of bridge 11 and comprises a pair of laterally extending oppositely facing channel members 15 disposed adjacent each bridge rail 12. Each channel member carries suitable rollers 16 which are adapted to ride on the lower flanges of rails 12. A pair of spaced bracing members 17 extend between channels 15 and are secured to the bottom flanges thereof in any suitable manner, such as by welding. Braces 17 do not contact rails 12 because the lower flanges of channels 15 are spaced slightly below rails 12.

A circular carriage ring 18 of large diameter is secured by bolts, rivets or welds to the underside of braces 17. Ring 18 is of channel section, has its outer periphery disposed substantially beneath transverse rails 12, and has its center point on the vertical center line of the carriage.

A motor support plate 19 is disposed adjacent one corner of carriage 14, with one edge secured to the lower flanges of a brace 17 and another edge secured to the lower flange of ring 18. Plate 19 is adapted to support a lateral drive motor 20 which is connected through suitable gearing to drive shaft 21 having a pair of rollers 22 contacting the rails 12 opposite rollers 16 to thereby drive carriage 14 laterally along bridge 11.

A second support plate 23 is disposed adjacent the center of carriage 14 and extends between the lower flanges of the two braces 17 and is attached thereto. Plate 23 is adapted to support a motor 24 which operates in a manner to be described.

A pair of long angle iron supports 25 extend across carriage ring 18. Supports 25 are positioned so that their horizontal flanges are on top and face outwardly of the ring, the ends of supports 25 being suitably secured to ring 18. The vertical flanges of supports 25 are adapted to receive a bearing block 26 therebetween which has a vertical opening 27 therein which is located on the vertical center line of the carriage. Block 26 is suitably secured to supports 25, and opening 27 is adapted to receive a vertical hollow shaft 28.

Shaft 28 extends upwardly from block 26 to a point above braces 17 for purposes to be described. A suitable thrust bearing 29 is secured to shaft 28 above bearing block 26. Bearing 29 rests on the top of block 26 and serves to secure shaft 28 in place and take the downward load of the hoist.

The lower end of shaft 28 carries a horizontal turntable 30 adapted to rotate about the vertical center of carriage 14. Turntable 30 comprises a channel section ring 31 having a pair of channel support members 32 which extend through the ring to which they are secured. A bearing block 33, similar to block 26, is secured between channel members 32 and has an opening therein to receive the lower portion of shaft 28. Shaft 28 is suitably keyed to block 33 so that rotation of the shaft will rotate block 33, members 32 and ring 31.

The lower end of shaft 28 is threaded to receive a large nut 34 which is tightened on the bottom portion of block 33 and welded thereto if desired to firmly secure turntable 30 to shaft 28.

Ring 18, supports 25 and shaft 28 take the full load of turntable 30.

Peripheral and horizontal stability of ring 31 is accomplished by a plurality of short angle iron members 35 which are suitably secured in spaced relationship to the underside of carriage ring 18. The vertical flange of each member 35 extends outwardly and downwardly from ring 18, and is adapted to carry a pin 36 to which a roller 37 is secured. Turntable ring 31 bears upwardly against rollers 37 which enhance the rotation and stability of the ring, and which relieve shaft 28 of bending moments.

Turntable 30 is rotated by motor 24 which is connected through a pinion 38 and gear 39 and keyed to shaft 28 to rotate the same.

A hoist frame 40 is disposed beneath turntable ring 31 and comprises a pair of parallel channel section side rails 41 which extend transverse to supports 32 and with a rail disposed on each side of the center of ring 31 and approximately midway between the center and outer periphery thereof. The inner ends of rails 41 are disposed directly beneath ring 31, and extend outwardly therefrom chordwise beneath supports 32 to a point beyond the outer portion of the ring 31, as best seen in Fig. 4. Rails 41 are spaced slightly beneath ring 31 at their points of intersection and are spaced beneath supports 32 by rubber shims 42 or the like, and are bolted to the lower flanges of ring 31 and supports 32.

Parallel channel section brace members 43 are disposed between the ends of side rails 41 and are secured thereto. In addition, a similar brace member 44 is secured between side rails 41 and inwardly of their outer ends, brace 44 being disposed approximately below the outer circumferential edge of turntable ring 31.

Side rails 41 and braces 43 and 44 are positioned with their webs vertically located. The flanges of side rails 41 and braces 43 all face outwardly of ring 31, while the flanges of brace 44 face inwardly toward the center. These channels together form frame 40 to which the hoist is secured. If desired, frame 40 may be additionally strengthened by cross beams 45 or the like.

A pair of channel section upper hoist members 46 are disposed adjacent the outer end of frame member 40 and extend from a point above member 40 to substantially below the turntable. The webs of hoist members 46 are suitably secured to the webs of side rails 41 and the flanges of members 46 are secured to the webs of outer brace 43 and inner brace 44. Suitable brackets 47 are secured to the upper flange of side rails 41 and the webs of members 46. Suitable reinforcing beams 48 are secured between the flanges of upper hoist members 46 to tie them together.

Intermediate channel section hoist members 49 of smaller cross section than upper members 46 are adapted to fit within members 46. A plurality of rollers 50 are rotatably secured to the outer face of the web of each intermediate hoist member 49. Rollers 50 are adapted to ride on vertically disposed machine ways 51 which are suitably secured to the web and flange portions of upper hoist member 46.

Hoist members 49 are connected together by reinforcing beams 52, similar to beams 48, and provide a vertically slidable member adapted to telescope within members 46.

Lower channel section hoist members 53 of smaller cross section than intermediate members 49 are adapted to fit within members 49. A plurality of rollers 54 are rotatably secured to the outer face of the web of each lower member 53. Rollers 54 are adapted to ride on vertically disposed machine ways 55 which are suitably secured to the web and flange portions of intermediate hoist member 49. Lower hoist members 53 are connected together by reinforcing beams 56, similar to beams 49 and 52, and provide a vertically slidable member adapted to telescope within members 49.

Members 46, 49 and 53 provide a rigid telescoping hoist utilized to pick up, transfer and deposit tote boxes or other containers within the plant. Suitable stops 57 are secured to the hoist members to limit the maximum extended and retracted positions. Sufficient clearance is left between rollers 50 and 54 and their respective machine ways 51 and 55 so that each roller will contact only one of a pair of machine ways at any one time depending upon the twisting and bending forces incident on the hoist.

A horizontal channel section support arm 58 is welded or otherwise secured adjacent its ends to the lower portions of beams 56 and to the lower end portions of diagonally opposite flanges of lower hoist members 53. A downwardly extending U-shaped hook 59 is suitably secured adjacent each end of arm 58 and outwardly from hoist members 53. Hooks 59 are thus angularly disposed from the horizontal center line between hoist members 53 and are adapted to engage open end hooks disposed on the tote boxes, as will be described.

To provide vertical stability of the hoist, a brace 60 is bracketed to the midportion of each upper hoist member 46 and extends diagonally upwardly at an angle of approximately 45° to frame 40 where it is secured.

The hoist is given a vertical telescoping motion by means of a system of sheaves and cables. A lower sheave 61 is secured by suitable brackets and a pin to the web surface of reinforcing beam 56. Sheave 61 is disposed parallel to and at the midpoint of the horizontal center line between hoist members 53. An upper sheave 62 is similarly bracketed to a horizontal reinforcing beam 48 on upper hoist member 46. The hoist is raised and lowered by a cable 63 which is attached at one end to beam 48 adjacent sheave 62. Cable 63 passes downwardly from beam 48, under and up from lower sheave 61, over upper sheave 62 and hence horizontally to a windup drum 64 which is rotatably driven by a motor 65 mounted beneath hoist frame 40. Actuation of motor 65 will revolve drum 64 and either wind up or let out cable 63 to raise or lower the hoist.

Electrical connection to hoist motor 65 is accom-

plished by a plurality of collector rings **66** suitably mounted on the upper portion of shaft **28** above carriage **14**. Outside power is fed to rings **66** by means of sliding contacts, not shown. Wires, not shown, are led from rings **66** through shaft **28** and to motor **65**. Each ring controls a different phase of motor operation, such as speed or direction.

The tote boxes **5** and **6** which the crane and hoist are adapted to transfer may be made of wood or other suitable material, and comprise a rectangular bottom member **67** with four vertical side walls **68**, **69**, **70** and **71**, respectively, secured thereto. The top of each tote box is open to allow for easy access by an operator. A 45° angle hook **72** is secured to the upper edge of each side wall and extends upwardly therefrom. Hooks **72** on walls **68** and **71** face in a clockwise direction while hooks **72** on walls **69** and **70** face counterclockwise. All hooks **72** are disposed clockwise from the center point of their respective side wall edges, and approximately midway between the center and corner edge of the sides. This off-center positioning of the hooks allows more free space which will not interfere with the press operator who may stand centrally of a tote box side.

Operation of the crane and hoist will now be described in relation to the plant operation. Assume that the rows of presses are operating and that one of the tote boxes **6** designed to hold the completed parts at the right of an operator is full. Box **6** is disposed closely adjacent dead space **7** and press **2** and extends partially out into aisle **3**.

The crane operator, not shown, moves the crane down rails **9** until the machine is adjacent a tote box to be removed and near a press **2**. Carriage **14** is then rolled along bridge **11** until the outer periphery of turntable ring **31** is disposed above and inwardly of press **2**. Turntable **30** is then rotated so that the hoist swings eccentrically about the vertical axis of carriage **14** until the hoist is positioned directly above box **6**. The hoist is then telescopically extended by means of the sheave and cable system until hooks **59** on lower hoist member **53** engage a pair of opposite hooks **72** on tote box **6**. No attendant is needed to engage the hooks, for the hoist is rigid and is accurately maneuvered by adjusting its length and moving the crane, carriage and/or turntable. The labor saved in a plant utilizing a number of such cranes is substantial.

It has been found that a 45° angle on hooks **72** is highly suitable in this operation. If the angle is more than 45°, hooks **59** might tend to slip out of hooks **72**. If the angle is less, difficulty might be experienced in making the proper engagement, even though the hoist may easily be raised or lowered.

The fact that hooks **72** are disposed clockwise from the center line of boxes **6** poses no problem, since the hoist hooks **59** are disposed to coincide with box hooks **72**.

After box **6** has been engaged, the hoist is retracted to lift the box high above the floor. Turntable **30** is again rotated to swing the hoist and box **6** outwardly away from press **2**, carriage **14** is moved away from the press to a point centrally above aisle **3**, and the crane is then moved down the length of the aisle to a storage area **8**. Carriage **14** and turntable **30** are again positioned and box **6** is lowered to the floor.

Transfer of containers between presses or any other stations adjacent an aisle is also possible. Where more than one crane and hoist unit is utilized within a plant, as shown in Figure 1, and where no dead space is necessary, adjacent hoist units can be so arranged that they overlap in operation, thus utilizing the entire plant area.

Extremely accurate positioning of the crane on rails **9** is, of course, possible. Likewise, carriage **14** may be accurately positioned on bridge **11**. These factors, coupled with precision angular control of turntable **30** and a rigid hoist member, produce a device capable of placing containers in very cramped space without error. The high measure of control permits materials handling utilizing only a single operator.

The turntable allows the actual lifting and lowering unit to be placed substantially outward from the bridge and carriage mechanisms, thereby providing a degree of flexibility and utilization of floor space not possible with prior structures. The bridge and carriage need not interfere with the dead space **7**, and yet the hoist may be extended outwardly and moved eccentrically through any angle of rotation to adjacent the space so that containers may be positioned very close thereto.

The invention provides a novel hoist arrangement used in conjunction with a crane for transfer of material within a building where efficient utilization of space is important. The mechanism is designed so that it does not interfere with some portions of the plant which are reserved for other structures, and yet material handling directly adjacent such restricted areas is made possible.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims which particularly point out and distinctly claim the subject matter which is regarded as the invention.

I claim:

1. Material handling apparatus for use in a manufacturing plant or the like, comprising an overhead crane adapted to move longitudinally of the plant, a plurality of transversely extending rails secured beneath said crane, a transversely movable carriage adapted to ride on said rails, a circular ring secured beneath said carriage and with the outer periphery thereof disposed substantially beneath said rails, a pair of supports secured to said ring and extending thereacross and having a bearing secured centrally thereof, a rotatable shaft disposed within said bearing and extending downwardly therefrom, a turntable mounted on the lower portion of said shaft and rotatable therewith; said shaft, supports and ring taking the full load of the turntable; a hoist frame secured to the lower side of the turntable and having a portion extending outwardly of the periphery thereof, a rigid downwardly extending telescoping hoist secured at its upper end to said outwardly extending portion of said frame, said hoist having means disposed on its lower end for engagement with material to be handled, means to telescope said hoist to raise or lower said material during handling, means to rotate said shaft and turntable to revolve said hoist about the axis of the shaft to allow accurate positioning of the material, and roller means disposed between said ring and said turntable to facilitate turning of the turntable and to relieve said shaft of bending moments during material handling.

2. Material handling apparatus for use in a manufacturing plant or the like, comprising an overhead crane adapted to move longitudinally of the plant, a plurality of transversely extending rails secured beneath said crane, a transversely movable carriage adapted to ride on said rails, a circular ring secured beneath said carriage, support means secured within said ring and having a bearing secured centrally thereof, a rotatable shaft disposed within said bearing and extending downwardly therefrom, a turntable mounted on the lower portion of said shaft and rotatable therewith; said shaft, support means and ring taking the full load of the turntable; a hoist frame secured to the lower side of the turntable and having a portion extending outwardly of the periphery thereof, a rigid downwardly extending telescoping hoist secured at its upper end to said outwardly extending portion of said frame, said hoist having means disposed on its lower end for engagement with material to be handled, means to telescope said hoist to raise or lower said material during handling, means to rotate said shaft and turntable to revolve said hoist about the axis of the shaft to allow accurate positioning of the material, and means disposed between said ring and said turntable to facilitate turning

of the turntable and to relieve said shaft of bending moments during material handling.

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