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3,135,403

MATERIAL HANDLING APPARATUS

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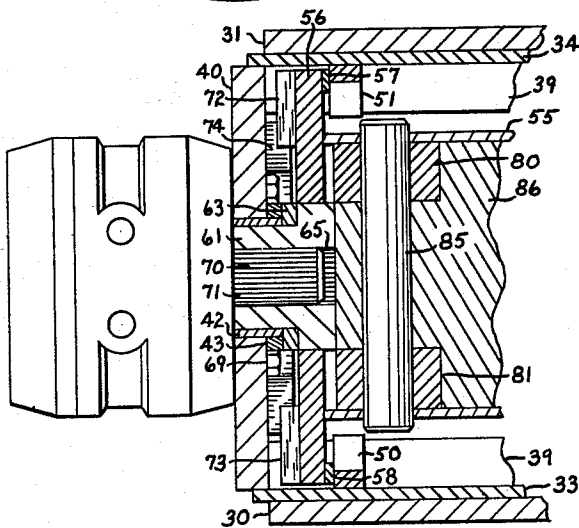
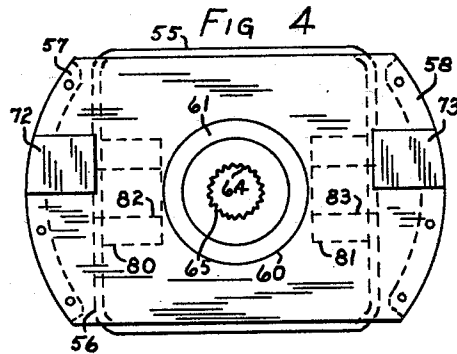
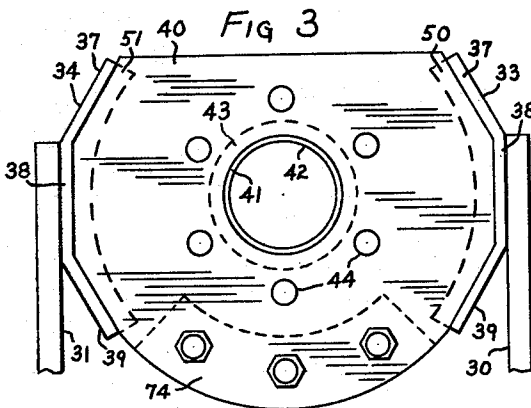
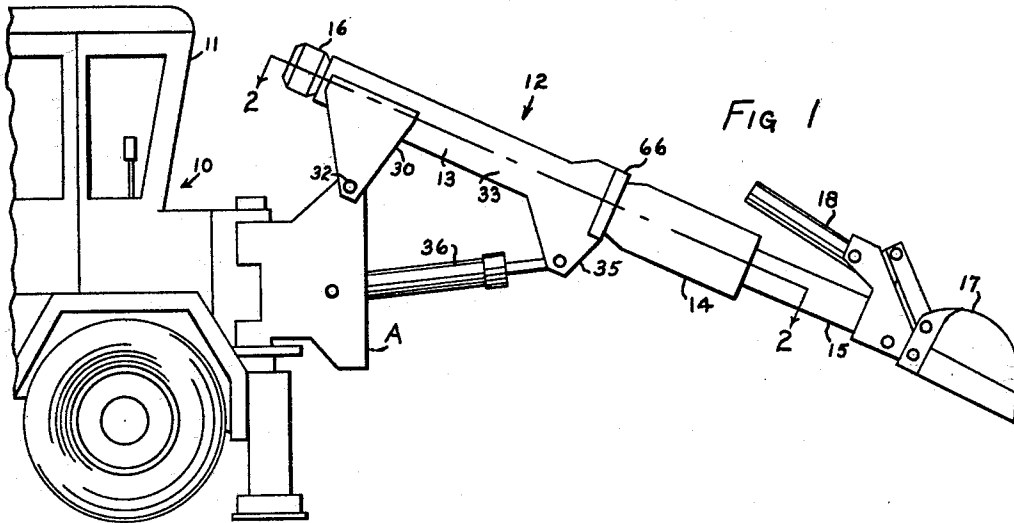


FIG 5

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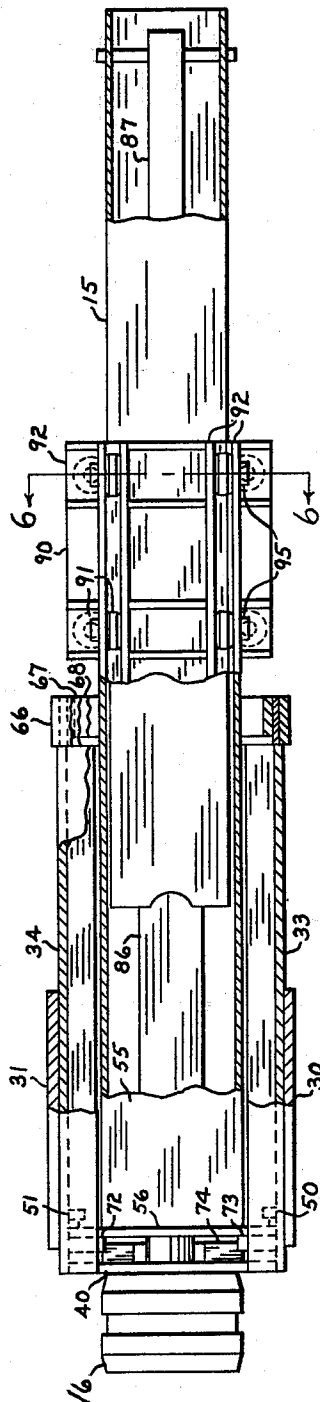


Fig 2

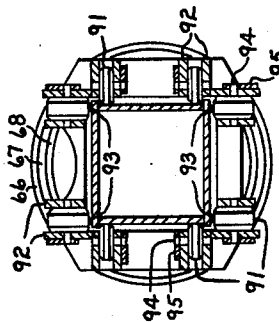


Fig 6

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MATERIAL HANDLING APPARATUS

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This invention relates to material handling apparatus of the type having a boom structure which includes a boom section adapted to support a suitable material handling tool and a pivoted support section therefor and, more particularly, the invention relates to a boom structure having means for rotating the boom section relative to the support section to tilt or rock the tool about the axis of the boom structure.

The principal object of the present invention is the provision of a new and improved material handling apparatus of the above type, wherein the rotatable boom section may be easily and reliably assembled with the support section.

Another object of the present invention is the provision of a new and improved material handling apparatus of the above type, wherein the power means for rotating the boom section relative to its support section is located on an end of the support section and may be readily and dependably associated with the boom section to rotate the boom section.

Another object of the present invention is the provision of a new and improved material handling apparatus of the above noted type, wherein the boom section is assembled to the support section by inserting the boom section into the support section and rotating the boom section.

Further and additional objects and advantages of the present invention will become apparent from the following detailed description of the invention made with reference to the accompanying drawings, forming a part of this specification, and wherein:

FIG. 1 is a partial side elevational view of a material handling apparatus embodying the present invention;

FIG. 2 is a cross-sectional view, partially in elevation, of the apparatus of FIG. 1 taken approximately on the section line 2-2 thereof;

FIG. 3 is an end elevational view of an element forming a part of the boom structure of the apparatus of FIG. 1;

FIG. 4 is an end elevational view of another element forming a part of the boom structure of the apparatus shown in FIG. 1;

FIG. 5 is an enlarged sectional view partially in elevation of the left end of the boom structure shown in FIG. 2; and

FIG. 6 is a sectional view taken approximately on the section line 6-6 of FIG. 2.

The preferred and illustrated embodiment of the present invention comprises a motor vehicle 10 provided with an operator's cab 11. A boom structure 12 is supported by a sluing support A on the motor vehicle 10. It is to be understood, of course, that the boom structure disclosed can be used on numerous types of vehicles and is not necessarily limited for use with the specific vehicle shown in the drawings.

The boom structure 12 includes a base member or cradle 13 and a boom section rotatably supported by the cradle. The rotatable boom section comprises a non-extensible boom member 14 and an extensible boom member 15 and is rotated by a suitable power means 16 supported on the extreme left end of the cradle 13 as viewed in the drawings. The extensible boom member 15 is adapted to support a material handling tool on the

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end thereof remote from motor 16. The material handling tool shown in FIG. 1 is a bucket 17 provided with a conventional mechanism 18 for pivoting the bucket about an axis transversely of the boom. A variety of material handling tools may be mounted on the extensible boom member 15 and the bucket 17 is merely exemplary of the various types which may be used.

The cradle 13 is an open top and bottom cradle, and comprises horizontally spaced plate support members 30, 31 which are connected to the sluing support A of the vehicle 10 for swinging movement about the horizontal axis of a pivot shaft 32. One end of a first elongated side member 33 is secured to plate 30 and one end of a second elongated side member 34 is secured to plate 31. The elongated side members 33, 34 are spaced apart and extend from plate members 30, 31, respectively, in the same direction. The ends of the side members 33, 34 opposite the ends secured to plates 30, 31, respectively, are provided with downwardly extending ear members 35 connected to the piston rod of hydraulic motor 36 which when actuated pivots the cradle 13 and structure supported thereby in a vertical direction about the axis of shaft 32.

Each of the side members 33, 34 includes three integral elongated plate portions including an upper portion 37, a central portion 38 and a lower portion 39 extending coextensively. The central plate portions 38 are welded to the members 30, 31, respectively, and lie in parallel vertical planes. The plate portions 37, 39 form an obtuse angle with the portions 38 and extend therefrom at an angle of approximately 145° into the space between the plate members 30, 31. As viewed in FIG. 3, the upper plate portion 37 of member 34 and the lower plate portion 39 of member 33 lie in parallel planes, while lower plate portion 39 of member 34 and upper plate portion 37 of member 33 also lie in parallel planes. The distances between the aforementioned parallel plate portions are substantially equal.

The cradle 13 has an end or back plate 40 secured to the extreme left end of the side members 33, 34, as viewed in the drawings. The plate 40 has a central opening 41 therethrough and a suitable bearing sleeve member 42 is positioned in the opening 41. The bearing sleeve 42, as shown in FIG. 5, projects slightly beyond the plate 40 and into the space between the side members 33, 34. A suitable abutment means comprising a ring member 43 is secured to the side of plate 40 from which the bearing sleeve 42 extends, namely, the right side of plate 40 as viewed in FIG. 5, and is positioned so that it encircles the projecting portion of the bearing sleeve 42. The plate 40 is also provided with a series of bolt holes 44 which extend through the plate 40 and have their centers located on a circle having the center of opening 41 as a center.

The cradle 13 is also provided with abutment means or shoulder members 50, 51 extending transverse to the elongation of the side members 33, 34, respectively, and suitably secured to the elongated side members 33, 34, respectively. The shoulder members 50, 51 are substantially equal in length to the width of the elongated members and are spaced equal distances from the end plate 40 and extend a short distance into the space between the elongated side members 33, 34, thereby forming a channel between each shoulder member 50, 51 and the end plate 40. It is apparent that these channels are located on opposite sides of the cradle 13 and have an open end facing the space between the members 33, 34.

The boom section which is rotatably supported by the cradle 13 includes the extensible boom member 15 and the nonextensible boom member 14, as aforementioned.

The nonextensible boom member 14 comprises a tubular member 55 which is square in cross section. It is to be understood that the tubular member 55 may have a cross section which is other than square. A plate 56 is secured to one end of the tubular member 55. As shown in FIG. 4, the plate 56 has a height slightly less than the height of the tubular member 55. The length of the plate 56 is substantially greater than the width of the tubular member 55 and the plate is secured thereon with the opposite ends of the plate 56 extending beyond opposite sides of the tubular member 55. The extending ends of the plate 56 are convex in shape. The left edge of the surface of the plate 56, which is secured to tubular member 55, as viewed in FIG. 4, has a bearing plate 57 secured thereto and the right edge of the same surface has a bearing plate 58 secured thereto. The length of the plate 56 at its longest point is slightly less than the aforementioned distance between the parallel extending plate portions of the elongated members 33, 34.

The plate 56 is provided with a central circular opening 60. A drive connecting boss member 61 is suitably secured to the plate member 56 in the opening and has a portion projecting away from the plate member 56 from the side thereof opposite the side on which the bearing plates 57 and 58 are mounted. The outer diameter of the projecting portion of the boss member 61 is substantially equal to the diameter of the opening through the bearing sleeve 42 located in the plate 40 on the cradle member 13. A bearing ring 63 encircles the projecting portion of the boss member 61. The boss member 61 has a passageway 64 therethrough having drive means or keyways 65 on one side thereof.

The boss member 61 is positioned in the opening in the bearing sleeve 42 which supports the left end of the boom section comprising boom members 14, 15, as viewed in the drawings. As best seen in FIG. 5, the plate 56, when the boom section is so positioned, is located so that its projecting edge portions are in the channels formed by the shoulders 50, 51 and the end plate 40. Specifically, these parts are so sized that the bearing plates 57 and 58 engage the surfaces of the shoulder members 50 and 51 which face the end plate 40, and the bearing ring 63 engages the ring member 43. The shoulders 50 and 51 and plate 56 serve as cooperating abutment means when operatively engaged for preventing movement of the boom member 14 along the longitudinal axis of the boom structure in a direction toward the right, as viewed in FIG. 5. The bearing ring 63 mounted on the boom member 14 and the ring member 43 mounted on the cradle 13 serve as cooperating abutment members which prevent movement of the boom member 14 along the longitudinal axis of the boom structure in a direction toward the left, as viewed in FIG. 5.

The right end portion of the boom member 14, as viewed in the drawings, is rotatably supported by a bearing ring 66 secured to the right end of the cradle 13, as viewed in the drawings. The inner surface portion of the bearing ring 66 facing the boom member 14 is provided with suitable bearing material 67. The boom member 14 is provided with a complementary bearing ring member 68 which is adapted to be snugly received in the bearing ring 66 and supported therein.

The boom member 14, as above mentioned, is rotated relative to the cradle 13 by motor 16. The motor 16 is preferably a hydraulic motor and is preferably secured to the end plate 40 of the cradle 13 by bolts 69 which extend through the openings 44 in the end plate 40. The motor 16 includes a drive shaft 70 provided with drive means or projecting keys 71 on a portion of the surface thereof which are complementary to the keyways in the passageway 64 in boss member 61. The drive shaft 70 of the motor 16 extends into the passageway 64 when the boom structure is assembled and the keys 71 drivingly engage the keyways 65 so that rotation of the shaft 70 causes the boom section to rotate, thereby rotating the project-

ing portions of the plate 56 in the channels formed by the shoulder members 50, 51 and the end plate 40.

Rotation of the boom member 14 is limited by stop members 72, 73, which are secured to the projecting portion of plate 56. The stop members 72 and 73 are adapted to engage an abutment member 74 which is suitably bolted to plate 40. When the boom member 14 is rotated in a clockwise direction as viewed in FIG. 4, stop member 73 engages abutment 74 to limit the rotation of the boom member to approximately 45°. When the boom member 14 is rotated in a counterclockwise direction as viewed in FIG. 4, stop member 72 engages abutment 74 to limit rotation of the boom member to approximately 45° in that direction.

Rotation of the boom member 14 causes rotation of boom member 15 which is supported thereby. The boom member 15 is square in cross section and is located between the sides of the tubular member 55 and telescopes therein upon extension and retraction. The opposite sides of the tubular member 55 of boom member 14 beyond which the projecting ends of plate 56 extend are provided with sleeves 80 and 81. The sleeve 80 is suitably secured to the left side of the tubular member 55, as viewed in FIG. 4, and projects inwardly into the space between the sides of the tubular member, and the sleeve member 81 is secured to the right side of the tubular member 55, as viewed in FIG. 4, and extends inwardly toward the sleeve member 80. The sleeve members 80 and 81 have openings 82 and 83, respectively, therethrough and these openings are in alignment with openings in the side portions of the tubular member 55 to which the sleeve members are attached.

A pin 85 extends through the openings in the side walls of the tubular member 55 and through the openings 82, 83 in the sleeve members. The pin 85 serves as an anchor for a hydraulic cylinder 86 which is positioned in the interior of the tubular member 55. The hydraulic cylinder 86 has a piston rod 87 which extends and retracts upon actuation of the hydraulic cylinder 86. The extreme right end portion of the piston rod 87, as viewed in FIG. 2, is secured to the extensible boom member 15. The hydraulic cylinder 86 is positioned in the interior of tubular member 55 in such a manner that the boom member 15 when in its retracted position encompasses the cylinder 86. It should be apparent that upon actuation of the hydraulic cylinder 86 the boom member 15 will be moved along the longitudinal axis of the boom structure to extend or retract the tool 17 mounted thereon.

The boom member 15 is supported and guided when moved by a supporting and guiding means 90 secured to the tubular member 55 and forming a part of boom member 14. The supporting and guiding means 90 comprises a plurality of rollers 91. The rollers 91 are mounted between flange members 92 which are secured to the right end of the tubular member 55, as viewed in the drawings, that being the end opposite the end on which plate 56 is mounted. The flange members 92 are secured to the sides of the tubular member 55 and extend therefrom at an angle of approximately 90°. Four flange members 92 are positioned to extend substantially perpendicular to each side of the tubular member 55. Rollers 91 are positioned between adjacent flange members 92 and extend through apertures in the tubular member 55 into the area within the tubular member 55 a sufficient distance to engage the sides of the extensible boom member 15 adjacent the corners thereof to thereby support and guide the movement of the boom member 15. There are in fact sixteen rollers, four of which engage each side surface of the boom member 15. The rollers 91 which support and guide the top and bottom surfaces of the boom member 15 engage and ride on rails 93 formed on these surfaces of the boom member 15.

The rollers 91 are rotatably mounted on eccentric pins 94 which extend between adjacent flange members 92 and are rotatable relative thereto. The pins 94 are rotated

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manually by means of plate members 95 which are secured thereto. The plate members 95 may be secured in the position to which they are rotated by means of a bolt which extends through an opening in the plate member 95 and an opening in an adjacent flange member 92. Rotation of each eccentric pin causes the roller 91 mounted thereon to move inwardly or outwardly of the longitudinal axis of the boom structure. These pins are used to move the rollers into engagement with the extensible boom member 15 during assembly, and may be used to adjust for wear and varying tolerances in the event of a change in the boom member 15.

The boom section comprising the nonextensible boom member 14 and the extensible boom member 15 may be easily assembled in the cradle or base member 13. This assembly may be accomplished by placing the boom section in the space between the side members 33, 34 of the cradle 13 and rotating the boom section. The boom section is inserted in the space between side members 33, 34 through the opening in the bearing ring 66 longitudinally of the axis of the boom member 14 with the projecting portions of plate 56 extending vertically, and the boss member 61 is positioned in the bearing sleeve 42 while the bearing ring 68 on the boom member 14 is positioned in the bearing ring 66 on the cradle 13. When so positioned the boom member 14 is rotatably supported by the bearing sleeve 42 and bearing ring 66. The boom section is rotated while supported in this position about its longitudinal axis to cause the opposite projecting ends of the plate 56 to move into the channels between the shoulder members 50 and 51 and the plate 40 on the cradle 13, respectively. The shoulders 50 and 51 will hold the plate 56 and the boom section comprising the extensible and nonextensible boom members from moving lengthwise of the boom section along the longitudinal axis thereof. The motor 16 is then bolted onto the back plate 40 with the keys 71 operatively associated with keyways 65. If the space between the back plate 40 and the plate 56 when assembled, as shown in FIG. 5, is too small to position the bolts 69 in the openings 44 these bolts may be placed loosely therein before the boom section is placed in the cradle. The abutment member 74 is then bolted in position on plate 40. Disassembly, of course, would be equally easy and would be the reverse of the assembly operation.

It should be apparent that the amount of rotation which the fluid motor 16 can give to the rotatable boom section is controlled by the stop members 73, 74. These members limit the amount of rotation so that the shoulders 50 and 51 on the cradle 13 are always in operative engagement with a sufficient portion of the surface of bearing plates 57 and 58, respectively, to properly support the boom section. Otherwise, of course, the boom section may slide off of the shaft 70 and become disassembled. In the present embodiment the motor 16 can rotate the boom section through 90° which consists of forty-five degrees of rotation in a clockwise direction and in a counterclockwise direction from its position wherein the projecting ends of plate 56 extend horizontally.

It should be understood that while the preferred embodiment of the present invention has been described in considerable detail it is my intention to cover hereby all constructions, modifications and arrangements which fall within the spirit and scope of the present invention and of the appended claims.

Having described my invention, I claim:

1. In a material handling device having a boom structure including a base member and an elongated boom member supported on said base member in a predetermined position for rotation about a longitudinal axis therethrough and adapted to carry a material handling tool, cooperating means mounted on said base member and said boom member for supporting said boom member for rotation about said longitudinal axis and engageable by movement of said boom member to said position, co-operating abutment means on said base member and

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said boom member for preventing movement of said boom member longitudinally of the axis thereof when operatively engaged, said abutment means being operatively engaged during assembly by rotation of said boom member while supported in said position, and means for rotating said boom member when operatively associated with said base member and when said abutment means is operatively engaged and while in said position for rotating a tool mounted on the end thereof.

2. A material handling device as defined in claim 1 wherein said co-operating abutment means includes shoulder member secured to said base member and plate means secured to said boom member engageable with a surface of said shoulder members, said boom member having an angular position when operatively associated with said base member in which said plate means and shoulder members overlap and an angular position for assembly in which said plate means and shoulder members are clear of each other.

3. In a material handling device having a boom structure including a base member comprising horizontally spaced plate members and a back plate secured to said spaced plates and extending therebetween, and an elongated boom member supported on said base member in a predetermined position between said plates for rotation about a longitudinal axis therethrough and adapted to carry a material handling tool; co-operating means mounted on said base member and said boom member for supporting said boom member for rotation about said longitudinal axis and engageable by longitudinal movement of said boom member to said position including a bearing sleeve member positioned in an opening in said back plate; a boss member secured to said boom member and adapted to be positioned in said bearing sleeve; co-operating abutment means on said base member and said boom member for preventing movement of said boom member longitudinally of the axis thereof when operatively engaged, said abutment means being operatively engaged during assembly by rotation of said boom member while supported in said position; power means secured to said back plate for rotating said boom member when operatively associated with said base member and when said abutment means is operatively engaged and while in said position including a drive shaft drivingly associated with said boss member to rotate said boom member; and stop means for limiting rotation of the boom member by said power means to an amount so that said abutment means remain in operative engagement during rotation of said boom member by said power means.

4. In a material handling device having a boom structure including a base member and an elongated boom member supported on said base member in a predetermined position for rotation about a longitudinal axis therethrough, co-operating means mounted on said base member and said boom member for supporting said boom member for rotation about said longitudinal axis and engageable by movement of said boom member to said position, co-operating abutment means on said base member and said boom member for preventing movement of said boom member longitudinally of the axis thereof when operatively engaged, said abutment means being operatively engaged by rotation of said boom member while supported in said position and adapted to remain in engagement to prevent said movement of said boom member during a first predetermined amount of revolution of said boom member, power means for rotating said boom member a second predetermined amount, and stop means for limiting said second predetermined amount of revolution to an amount less than said first predetermined amount so that said abutment means remain in operative engagement during rotation of said boom member by said power means.

5. A material handling device as defined in claim 4 wherein said co-operating abutment means includes shoulder members secured to said base member and plate

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means secured to said boom member for engaging a surface of said shoulder members.

6. A device of the class described comprising; a cradle including a pair of horizontally spaced, elongated side plates, a back plate secured to adjacent ends of the horizontal plates and extending therebetween, and a shoulder member secured to each of said spaced elongated plates extending into the space between said elongated plates and spaced substantially equally from said back plate thereby forming channels therebetween; a boom member adapted to be inserted in the space between said elongated side plates; co-operating bearing means secured to said cradle and said boom member for rotatably supporting said boom member in a predetermined position between said elongated side plates for rotation about a longitudinal axis therethrough and engageable by movement of said boom member to said position; and plate means secured adjacent one end of said boom member and having projecting portions which are adapted to be rotated into said channels while said boom member is supported in said position.

7. A device of the class described in claim 6 further comprising motor means mounted on said back plate and having a drive shaft extending therethrough and a drive connecting means secured to said rotatable boom member and adapted to be operatively associated with said drive shaft to rotate said boom member upon rotation of said drive shaft.

8. In a material handling device having a boom structure including a base member and an elongated boom member supported on said base member in a predetermined position for rotation about a longitudinal axis therethrough and adapted to carry a material handling tool, co-operating means mounted on said base member and said boom member for supporting said boom member for rotation about said longitudinal axis including a

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bearing ring member mounted on said base member and having an opening therethrough, co-operating abutment means on said base member and said boom member for preventing movement of said boom member longitudinally of the axis thereof when operatively engaged including a plate member secured to said boom member having a projecting portion extending beyond the periphery of said boom member and having a length less than the diameter of said opening in said bearing ring, said co-operating means being engageable by longitudinal movement of said boom member and said plate member through said opening in said bearing ring to said predetermined position, said abutment means being operatively engaged during assembly by rotation of said boom member while supported in said position, and means for rotating said boom member when operatively associated with said base member and when said abutment means is operatively engaged and while in said position for rotating a tool mounted on the end thereof.

9. A material handling device as defined in claim 8 wherein said co-operating means further includes a bearing sleeve mounted on said base member spaced along said longitudinal axis from said bearing ring member and a projection mounted on said elongated boom member.

10. A material handling device as defined in claim 9 wherein said projection includes first drive means and said means for rotating said boom member includes second drive means operatively engaging said first drive means.

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