July 4, 1967 D. F. PRZYBYLSKI ET AL 3,329,291

MATERIAL HANDLING APPARATUS

Filed Aug. 27, 1965

2 Sheets-Sheet 1

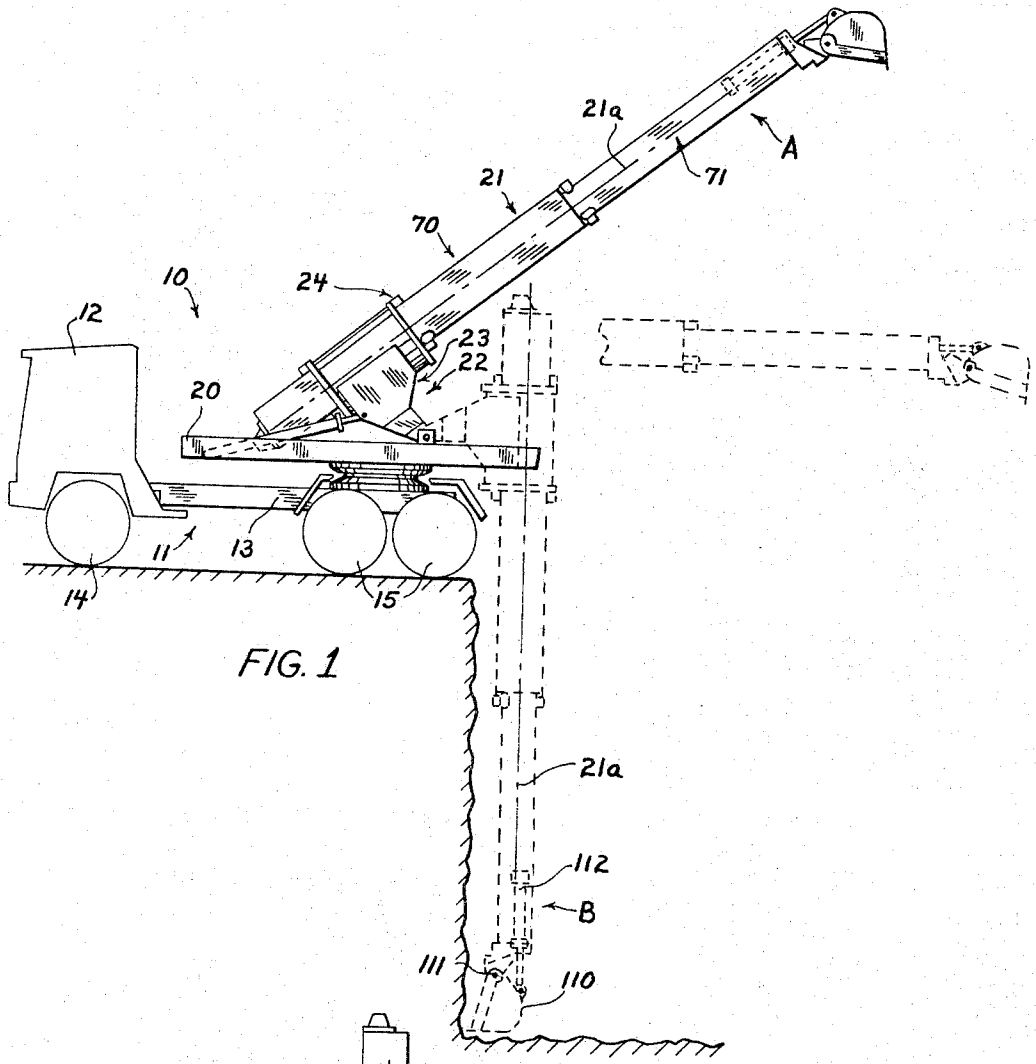

FIG. 1

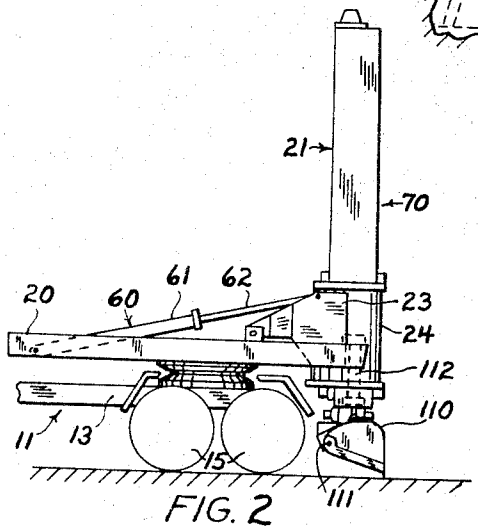

FIG. 2

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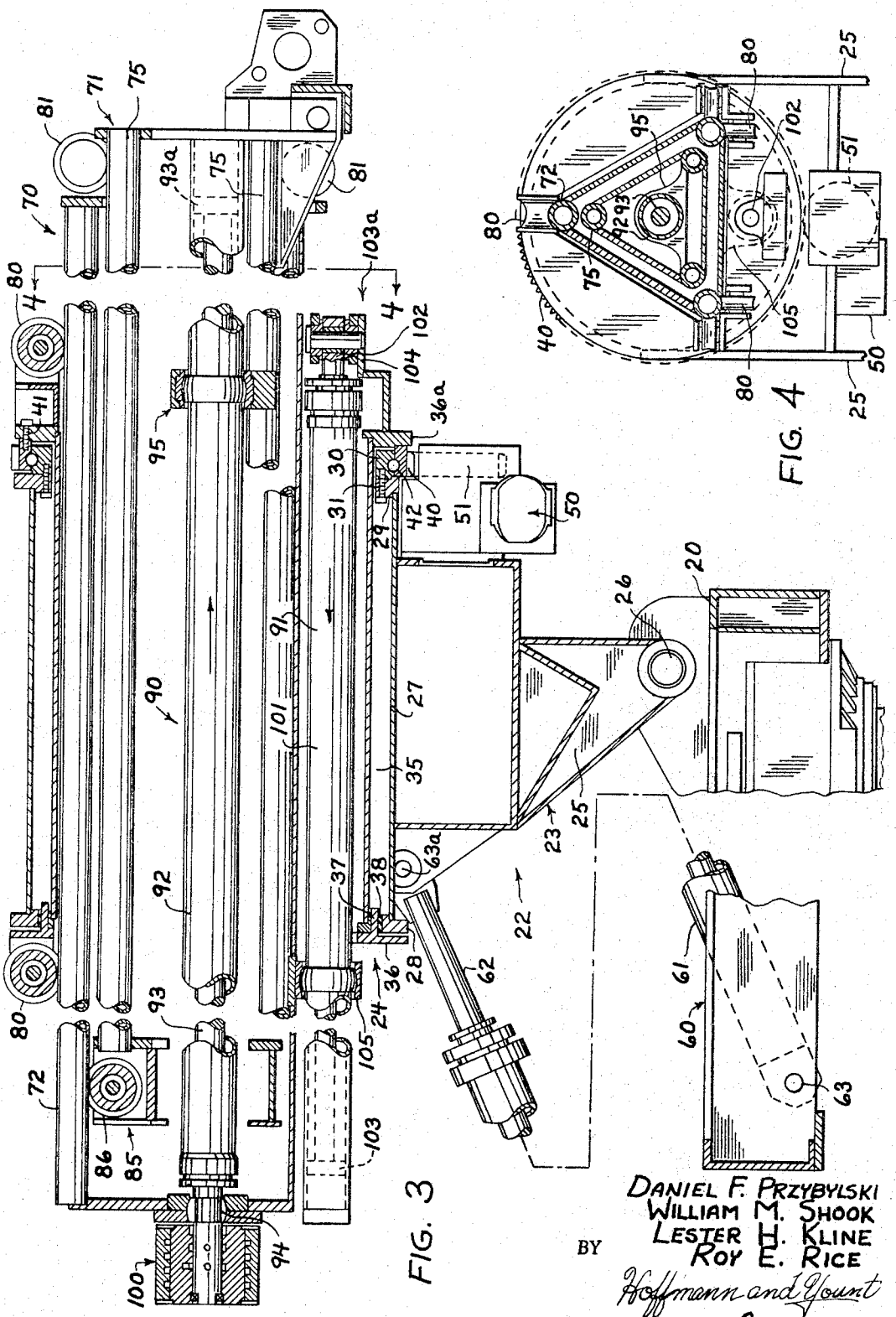

FIG. 3

FIG. 4

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MATERIAL HANDLING APPARATUS

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15 Claims. (Cl. 214—141)

The present invention relates to a material handling apparatus, and particularly to a material handling apparatus having a boom structure adapted to carry a digging tool on the outer end thereof and movable to effect digging into the ground to a predetermined maximum depth.

The principal object of the present invention is the provision of a new and improved material handling apparatus having a boom structure adapted to carry a digging tool on the outer end thereof and movable to effect digging to a predetermined maximum depth and which may be readily operated to dig an excavation having a vertical side wall extending the maximum digging depth of the boom and located immediately adjacent the support structure for the boom.

A still further object of the present invention is the provision of a new and improved material handling apparatus having a boom structure comprising telescoping boom sections carried by a support platform and one of which is adapted to carry a digging tool on the outer end thereof, and wherein the boom sections are movable relative to the support platform to effect digging to a predetermined maximum depth and may be readily operated to dig an excavation having a vertical wall extending to the predetermined maximum depth of digging of the boom structure and located immediately adjacent to the support platform.

Another object of the present invention is the provision of a new and improved material handling apparatus having a boom structure adapted to carry a tool on the outer end thereof and movable to effect digging to a predetermined maximum depth and wherein the boom structure may be moved to a first position wherein the longitudinal axis of the boom extends substantially vertically and the tool on the outer end thereof is above the ground and wherein the tool may be moved linearly from its position above the ground to the maximum digging depth of the boom structure.

Still another object of the present invention is the provision of a new and improved material handling apparatus, as noted in the next preceding paragraph, wherein the boom structure comprises a pair of telescoping boom sections, with one of the boom sections being movable into the other, and wherein the boom sections may be rotated about their common longitudinal axis.

Yet another object of the present invention is the provision of a new and improved material handling apparatus including a boom structure pivotally carried by a rotatable support platform for pivotal movement relative thereto, and wherein the boom structure is carried by a rotatable frame assembly which is rotated by a power means to effect rotation of the boom structure and wherein the boom structure comprises a pair of telescoping boom sections with both boom sections being movable along the longitudinal axis of the boom structure relative to the frame, and wherein the boom structure may be moved to a substantially vertical position wherein a digging tool on the outer end thereof is located above the ground and from which position the boom sections may be extended relative to the rotatable frame assembly so as to move the digging tool on the outer end thereof to a location at the maximum digging depth of the boom.

A still further object of the present invention is the provision of a new and improved material handling apparatus which includes a boom structure adapted to carry a tool on the outer end thereof and wherein the boom structure is supported by a rotatable frame which, in turn, is supported by support means pivotally carried on a support platform and wherein the boom structure comprises a pair of boom sections which are movable along the longitudinal axis of the boom structure relative to the rotatable frame with one of the boom sections telescoping into the other and wherein power means acting between the rotatable frame and the one boom section is effective to move the one boom section linearly relative to the rotatable frame and a second power means acting between the one boom section and the other boom section is effective to move the other boom section relative to the one boom section.

Further objects and advantages of the present invention will be apparent to those skilled in the art to which it relates from the following detailed description of a preferred embodiment thereof made with reference to the accompanying drawings forming a part of this specification and in which:

FIG. 1 is a schematic view of a material handling apparatus illustrating different operative positions of a boom structure forming a portion thereof;

FIG. 2 is a schematic fragmentary view of the material handling apparatus shown in FIG. 1 illustrating another position of the boom structure of the apparatus;

FIG. 3 is a sectional view of a portion of the material handling apparatus illustrated in FIG. 1; and

FIG. 4 is a sectional view of the apparatus shown in FIG. 3, taken approximately along the section line 4—4 of FIG. 3.

The present invention provides a material handling apparatus having a boom structure which is supported by a support platform. The boom structure is adapted to carry a material handling tool on the outermost end thereof and is operative to perform trenching, digging, grading, and other earth-handling operations, as well as other material-handling operations, depending on the tool carried on the outer end thereof. The material handling apparatus of the present invention is particularly adapted to perform trenching and digging operations, as will be apparent from the description hereinbelow.

As illustrating a preferred embodiment of the present invention, a mobile material handling apparatus is illustrated in FIG. 1 and designated generally by the reference numeral **10**. The material handling apparatus **10** illustrated in FIG. 1 includes a carrier or truck structure **11**. The carrier **11**, in the preferred embodiment, is powered by a suitable motor and may be driven along highways or roads, etc. The carrier **11** includes a driver's cab **12** and a bed **13** and has front wheels **14** and rear wheels **15** located on opposite sides of the bed **13**. A support platform **20** is carried by the bed **13** and, specifically, is supported thereby for rotation about a vertical axis. The support platform **20** is rotated about the vertical axis by well-known structure including hydraulic motors, not shown.

The material handling apparatus **10** also includes a boom structure, generally designated **21**. The boom structure **21** is an elongated structure having a longitudinal axis **21***a* and is adapted to carry a working tool on the outer end thereof, as will be apparent from the description hereinbelow. The boom structure **21** is movable from a position such as that designated A in FIG. 1 wherein the boom structure extends upwardly from the support platform **20** to a position designated B wherein the boom structure extends vertically. The boom structure **21** is supported by a boom support means **22** carried by the support platform **20**. The boom support means **22** comprises a support structure **23** carried by the support platform **20** for pivotal movement relative thereto about a horizontal

axis, and a rotatable frame 24 rotatable relative to the support structure 23 and carried thereby. The rotatable frame carries the boom structure 21 for rotation therewith about its longitudinal axis 21*a*.

The support structure 23 includes spaced trunnion members 25 which are pivotally carried by the support platform 20 for pivotal movement about the axis of a pivot pin 26. The trunnion members 25 at their end opposite the end connected to the support platform 20 carry a support sleeve 27 which extends axially of the boom structure 21 and which supports the rotatable frame 24. The opposite axial ends of the support sleeve 27 carry ring members 28 and 29, respectively. A suitable bearing ring 30 is secured by suitable screw-type fasteners 31 to the ring 29, as viewed at the right in FIG. 3, and for a purpose to be described hereinbelow.

The rotatable frame 24 carried by the support structure 23 includes a sleeve member 35 which extends coaxially with respect to the support sleeve 27 of the support structure 23. The sleeve member 35 at its opposite ends carries ring members 36 and 36*a*, respectively. The ring 36 has an annular flange portion 37 which extends around the sleeve member 35 and which is spaced radially inwardly of the ring member 28 carried by the sleeve member 27 of the support structure 23. A suitable bearing 38 is interposed between the ring member 28 and the flange portion 37 of the ring 36 and supports the left end of the frame 24 for rotary movement relative to the sleeve member 27 and the support structure 23.

The ring 36*a* carries a ring gear 40 which extends around the sleeve member 35 and also around the bearing ring member 30 connected with the sleeve 27. The ring gear 40 is secured to the ring 36*a* by means of a plurality of screw-type fasteners 41. A suitable bearing 42 of the ball or roller type is interposed between the ring gear 40 and the ring member 30 which forms a part of the support structure 23. The ball bearing structure 42 supports the right end of the frame 24 for rotary movement relative to the support structure 23. The bearing structure 42 also functions to prevent axial movement of the frame 24 along the axis of the boom.

The frame 24 may be rotated relative to the support structure 23 by a suitable motor 50 carried by the support structure 23. In the preferred embodiment the motor 50 comprises a rotary hydraulic motor which, when energized, effects rotation of a gear 51. The gear 51 meshes with the ring gear 40 and effects rotation of the ring gear 40 upon rotation thereof. Of course, rotation of the ring gear 40 effects rotary movement of the frame 24 about the longitudinal axis 21*a* of the boom structure 21 and within the sleeve 27 of the support structure 23.

As noted hereinabove, the boom structure 21 of the material handling apparatus 10 may be moved about a horizontal axis through a relatively great range of movement of about 120° from a position extending upwardly, as indicated at A in FIG. 1, to a position wherein its longitudinal axis 21*a* extends substantially vertically, as shown in FIGS. 1 and 2. In the preferred embodiment, the boom structure is moved to this vertical position by a suitable power means which, in the preferred embodiment, includes a pair of motors, one of which is shown in the drawings and designated 60. Each of the motors 60 is a conventional reciprocating hydraulic motor including a cylinder 61 and a rod member 62 movable relative to the cylinder 61. The cylinder 61 is pivotally connected at 63 to the support platform 20 of the material handling apparatus 10 and the rod 62 is pivotally connected at 63*a* with the support structure 23 for the boom structure 21. Energization of the motor 60, of course, effects movement of the rod member 62 outwardly of the cylinder 61 and effects pivoting movement of the support structure 23 on the pivot axis 26. This pivoting movement, of course, causes the boom structure 21 to pivot relative to the support platform 20. The extent of this pivoting movement is about 120°, providing a wide range of boom movement.

The support platform 20 is constructed so as to permit the vertical positioning of the boom structure 21, and is provided with a suitable opening so that the frame 24 and boom structure 21 may extend therethrough when vertically positioned. This particular arrangement and the extent of pivoting movement of the boom structure 21 are such as to provide for movement of the boom structure between its postions designated A and B in FIG. 1.

In the preferred embodiment of the present invention, the boom structure 21 comprises a pair of boom sections, generally designated 70 and 71, which will be referred to as the "base" boom section and the "tool-supporting" boom section, respectively. The base boom section 70 has a generally triangular cross-sectional shape and is constructed of a plurality of tubular beam members 72 located at the apexes of the triangle. The boom 70 is substantially hollow in construction, with the beam members 72 spaced apart and secured together by suitable supporting structure. The tool-carrying boom section 71 is similar in construction to the base boom section 70 and is also substantially triangular in shape and is constructed of a plurality of tubular beam members 75 located at the apexes of the angles forming the triangular shape and which are suitably connected together by a suitable supporting structure. The boom section 71 is also hollow.

As noted hereinabove, the boom structure 21 is rotatable about its longitudinal axis upon rotation of the frame 24 by the hydraulic motor 50. This rotation is effected by a suitable connection between the frame 24 and the boom structure 21. This connection, in the preferred embodiment, is through a plurality of guide wheels 80 located at opposite ends of the frame 24 and supported for rotation relative to the frame 24. The guide wheels 80 engage the tubular beam members 72 of the base boom section 70 and effect rotation of the base boom section 70 upon rotation of the frame 24. The base boom section 70 also carries a plurality of wheels 81 at its outermost end which run in engagement with the beam members 75 of the tool-carrying boom section 71 and which are effective to transmit rotation from the base boom section 70 to the tool-carrying boom section 71. The tool-carrying boom section 71 at its left end, as viewed in FIG. 3, has a support structure 85 thereon which carries a plurality of guide wheel members 86 which run in engagement with the inner side of the beam members 72 and which also transmit the rotary motion of the base boom section 70 to the tool-carrying boom section 71. From the above description, it should be readily apparent that upon energization of the motor 50 and rotation of the frame member 24, the base boom section 70 and the tool-carrying boom section 71 are also rotated about the longitudinal axis 21*a* of the boom structure 21.

As noted hereinabove, the boom structure 21 is movable in a direction parallel to its longitudinal axis and linearly with respect to the support structure 23 and, specifically, with respect to the rotatable frame 24. This linear movement of the boom structure 21 is effected through suitable power means and in the preferred embodiment, the power means comprises a pair of hydraulic motors, designated 90 and 91. The hydraulic motor 90 is operable to effect linear movement of the tool-carrying boom section 71 relative to the base boom section 70, while the hydraulic motor 91 is operable to effect movement of the base boom section 70 relative to the frame 24. The hydraulic motor 90 comprises a cylinder member 92 and a rod member 93 connected with a piston member 93*a*. The rod member 93 is fixedly connected at 94 to the base boom section 70 and the hydraulic motor 90 is fixedly connected by means of a pillow-block type connection 95 to the tool-carrying boom section 71. The hydraulic motor 90 is located within the boom section

71 and the connection 95 is between the cylinder 92 and a portion of the boom section 71 intermediate the beam members 75. From the above description, it should be apparent that upon the application of hydraulic fluid to the right side of the piston member 93*a* of the hydraulic motor 90, as viewed in FIG. 3, the cylinder member 92 moves relative to the rod 93, in the direction of the arrow shown in FIG. 3, and causes the tool-carrying boom section 71 to move linearly outwardly relative to the base boom section 70. It should also be apparent that upon the application of fluid pressure to the left of the piston 93*a*, the cylinder member 92 of the hydraulic motor 90 moves in a direction opposite to the direction of the arrow and causes movement of the tool-carrying boom section 71 into telescoping relation with the base boom section 70, in which position the boom sections are shown in FIG. 3. The application of fluid pressure to the hydraulic motor 90 is controlled through a suitable gland structure, generally designated 100, and carried on the end of the base boom section 70.

The base boom section 70 is linearly movable relative to the frame 24 by the hydraulic motor 91, as noted above. The hydraulic motor 91 is similar in construction and operation to the hydraulic motor 90 described hereinabove. The hydraulic motor 91 comprises a cylinder member 101 and a rod member 102 which carries a piston 103 on the end theerof located in the cylinder member 101. The rod member 102 is fixedly connected with the rotatable frame 24 of the support structure 23. The connection of the rod 102 to the frame 24 is by a suitable connecting structure 103*a* which connects the right end of the rod 102, as viewed in FIG. 3, to a projecting portion 104 of the frame 24. The cylinder member 101 is connected with a portion of the base boom section 70 intermediate a pair of beams 72 by means of a connection 105 similar to the connection 95 for connecting the cylinder 92 of the hydraulic motor 90 with the boom section 71.

As described hereinabove, the frame 24 is held against linear movement relative to the sleeve 27 in a direction parallel to the longitudinal axis of the boom by the ball-bearing structure 42. Thus, the rod member 102 is fixed at its right end, as viewed in FIG. 3, from longitudinal movement with respect to the boom structure. Upon the application of fluid pressure to the hydraulic motor 91 to the left of the piston member 103, as viewed in FIG. 3, the cylinder 101 will move in the direction of the arrow shown in FIG. 3 and cause movement of the base boom section 70 to the left, as viewed in FIG. 3. The tool-carrying boom section 71 which is carried by the base boom section 70 wil likewise be moved to the left. The base boom section may be moved to the right upon application of fluid pressure to the right of the piston member 103 causing the cylinder member 101 to move to the right, as viewed in FIG. 3, causing the base boom section 70 likewise to be moved to the right.

As shown in FIG. 1, the boom sections 70 and 71 are in their extended positions with the boom section 71 extended outwardly of the boom section 70 and the boom section 70 extended outwardly of the frame 24. As shown in FIG. 2, the boom sections 70, 71 are in their retracted positions with the base boom section 70 moved to its retracted position and with the boom section 71 also retracted relative to the frame 24. In this position, the outermost end of the boom section 71 is located above the ground.

As illustrated in the drawings, a digging tool in the form of a bucket 110 is mounted on the outer end of the boom section 71. The bucket 110 is pivotable relative thereto about a pivot axis 111, and is moved about the pivot axis 111 to effect a digging operation upon actuation of a hydraulic motor 112 carried by the boom section 71. The bucket 110 mounted on the end of the boom section 71, as shown in FIG. 2, is located above ground. The boom sections 71 and 70 may then be moved linearly relative to the frame 24 in a vertical direction by actuation of the motors 90, 91, and the bucket may be pivoted by motor 112 to effect digging into the ground. The combination of the extensible movement of the boom and the actuation of the bucket permits digging by the boom structure into the ground to the maximum digging depth of the boom structure, and the tool on the end of the boom may be moved by linear movement from a position above the ground to the maximum digging depth of the boom structure. The tool on the outer end of the boom may, as shown in FIG. 2, be positioned above a plane in which the lower surface of the rear wheels is contained. Thus, the boom structure may readily be utilized for trenching or digging so that a wall of the excavation extends vertically for the maximum digging depth of the boom.

It should be apparent from the above that the various motors described for operating parts of the apparatus effect movement and hold the parts in the position to which they are moved. Moreover, these motors are controlled by an operator from an operator's station at which control levers and pedals are located for controlling the motors.

It should be apparent from the above-detailed description that applicant has provided an improved material handling apparatus and it should be further apparent that certain modifications, adaptations, and changes may be made therein by those skilled in the art to which it relates, and it is hereby intended to cover all such modifications, adaptations, and changes which come within the scope of the appended claims.

Having described our invention, we claim:

1. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said suport platform, a boom structure adapted to carry a digging tool on the outer end thereof, said boom structure being supported by said boom support means for linear movement relative thereto in a direction parallel to the extent of said boom structure and operable to effect digging at a predetermined maximum digging depth, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other being movable into said one boom section, power means to effect movement of said boom structure to a vertical position wherein the longitudinal axis of the boom structure extends vertically relative to said support platform, and means for moving said boom structure linearly relative to said boom support means when said boom structure is in its vertical position between a position wherein the tool on the outer end thereof is above ground to a position wherein the tool on the outer end thereof is located at said predetermined maximum digging depth including power means for moving said other boom section into and from said one boom section.

2. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom structure adapted to carry a tool on the outer end thereof, a digging tool pivotally carried on the outer end of said boom structure, power means for pivoting said digging tool relative to said boom structure to effect digging thereby, said boom structure being supported by said boom support means for linear movement relative thereto in a direction parallel to the extent of said boom structure and operable to effect digging at a predetermined maximum digging depth, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other being movable into said one boom section, power means for pivoting said boom support means relative to said suppivoting said digging tool relative to said boom structure to a vertical position wherein the longitudinal axis of the boom structure extends vertically relative to said support platform, and means for moving said boom struc-

ture linearly relative to said boom support means when said boom structure is in its said vertical position from a position wherein the tool on the outer end thereof is above ground to a position wherein the tool on the outer end thereof is located at said predetermined maximum digging depth including power means for moving said other boom section into and from said one boom section.

3. A material handling apparatus as defined in claim 2 wherein said one of said boom sections is supported by said boom support means for linear movement relative thereto and said other boom section is supported by said one boom section for movement into and out of said one boom section, and including power means for moving said one boom section relative to said support means.

4. A material handling apparatus as defined in claim 3 wherein said support means for supporting said boom structure comprises a support section pivotally connected with said support platform and a rotatable frame fixed in said support section against axial movement and rotatable relative thereto, said one boom section being supported in said rotatable frame, and connecting means connecting said rotatable frame with said one boom section to effect rotation of said one boom section upon rotation of said rotatable frame.

5. A material handling apparatus as defined in claim 4 wherein said power means for extending said one boom section comprises a first hydraulic reciprocating type motor acting between said rotatable frame and said one boom section, and said power means for moving said other boom section comprises a second hydraulic reciprocating type motor acting between said one boom section and said other boom section.

6. A material handling apparatus as defined in claim 5 wherein said first motor includes a cylinder member connected with said one boom section and movable therewith and a piston rod having one end fixed to said rotatable frame and the other end located in said cylinder and carrying a piston head.

7. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom structure adapted to carry a tool on the outer end thereof, said boom support means comprising a boom support structure pivotally carried by said support platform and a frame rotatably carried by said boom support structure and carrying said boom structure, means for preventing movement of said frame relative to said boom support structure axially of said boom support structure, means for rotating said frame and said boom structure, said boom structure comprising a first boom section supported by said frame and a second boom section carried by said first boom section for telescoping movement relative thereto, means supporting said first boom section in said frame for linear movement relative thereto and for rotary movement upon rotation of said frame, means for linearly moving said first boom section relative to said frame, and means for moving said second boom section relative to said first boom section and said frame along the longitudinal axis thereof.

8. A material handling apparatus as defined in claim 7 wherein said means for linearly moving said first boom section comprises a first hydraulic reciprocating type motor operatively connected between said frame and said first boom section and is rotatable therewith and said means for moving said second boom section relative to said first boom section comprises a second hydraulic reciprocating type motor operatively connected between said boom sections and located within said first boom section.

9. A material handling apparatus as defined in claim 8 wherein said first and second motors each include a cylinder member connected with said first and second boom sections, respecively, and movable therewith.

10. In a material handling apparatus, a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom

structure adapted to carry a tool on the outer end thereof, a digging tool pivotally carried on the outer end of said boom structure, power means for pivoting said digging tool relative to said boom structure about an axis extending transversely of the longitudinal axis of the boom structure, said boom structure being supported by said boom support means for linear movement relative thereto in a direction parallel to the longitudinal axis of said boom structure and operable to effect digging to a predetermined maximum depth, power means for pivoting said boom support means relative to said support platform through an angular distance greater than 90° and operable to effect movement of said boom structure to a vertical position wherein the longitudinal axis of the boom structure extends substantially vertically, and power means for moving said boom structure linearly relative to said boom support means when said boom structure is in its said vertical position with the tool on the outer end thereof above ground to a position wherein the tool on the outer end thereof is located at said maximum digging depth.

11. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom structure adapted to carry a tool on the outer end thereof, a digging tool pivotally carried on the outer end of said boom structure, power means for pivoting said digging tool relative to said boom structure to effect digging thereby, said boom structure being supported by said boom support for linear movement relative thereto in a direction parallel to the extent of said boom structure and for rotational movement about its longitudinal axis and operable to effect digging at a predetermined maximum digging depth, power means for rotating said boom structure about its longitudinal axis, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other being movable into said one boom section, power means for pivoting said boom support means relative to said support platform to effect movement of said boom structure to a vertical position wherein the longitudinal axis of the boom structure extends vertically relative to said support platform, and means for moving said boom structure linearly relative to said boom support means when said boom structure is in its said vertical position from a position wherein the tool on the outer end thereof is above ground to a position wherein the tool on the outer end thereof is located at said predetermined maximum digging depth including power means for moving said other boom section into and from said one boom section.

12. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom structure supported by said boom support means and adapted to carry a tool on the outer end thereof, a digging tool pivotally carried on the outer end of said boom structure, power means for pivoting said digging tool relative to said boom structure to effect digging thereby, said boom structure being supported by said boom support means for linear movement relative thereto in a direction parallel to the extent of said boom structure and held against pivotal movement relative thereto, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other boom section being movable into said one boom section, power means for pivoting said boom support means relative to support platform to effect movement of said boom structure to a vertical position disposed immediately adjacent said support platform wherein the longitudinal axis of the boom structure extends vertically relative to said support platform including only hydraulic power means connected between said boom support means and said support platform, and means for moving said boom sections linearly relative to said boom support means when said boom structure is in its said vertical position including

power means for moving said other boom section into and from said one boom section.

13. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom structure supported by said boom support means and adapted to carry a tool on the outer end thereof, a digging tool pivotally carried on the outer end of said boom structure, power means for pivoting said digging tool relative to said boom structure to effect digging thereby, said boom structure being supported by said boom support means for linear movement relative thereto in a direction parallel to the extent of said boom structure, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other boom section being movable into said one boom section, power means for pivoting said boom support means relative to said support platform to effect movement of said boom structure to a vertical position disposed immediately adjacent said support platform wherein the longitudinal axis of the boom structure extends vertically relative to said support platform, and means for moving said boom sections linearly relative to said boom support means when said boom structure is in its said vertical position including power means for moving said other boom section into and from said one boom section.

14. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform, a boom structure supported by said boom support means and adapted to carry a tool on the outer end thereof, a digging tool pivotally carried on the outer end of said boom structure, power means for pivoting said digging tool relative to said boom structure to effect digging thereby, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other boom section being movable into said one boom section, means for moving said one boom section relative to said boom support means from a retracted position wherein a portion of said one boom section extends beyond one side of said boom support means remote from said digging tool to an extended position wherein said portion of said one boom section extends beyond the opposite side of said boom support means, power means for moving said other boom section into and from said one boom section, and power means for pivoting said boom support means relative to said support platform to effect movement of said boom structure to a vertical position wherein the longitudinal axis of the boom structure extends vertically relative to said support platform.

15. A material handling apparatus comprising a support platform rotatable about a vertical axis, a boom support means pivotally carried by said support platform for pivotal movement relative thereto about a generally horizontal axis, an elongated boom structure adapted to carry a digging tool on the outer end thereof, said boom structure being supported by said boom support means, said boom structure comprising a pair of telescoping boom sections with one boom section being hollow and the other boom section being movable into said one boom section, means for effecting a telescoping movement of said other boom section relative to said one boom section, power means for rotating said boom sections about the longitudinal axis thereof to effect rotation of the tool on the outer end of said boom structure, and power means for effecting pivoting movement of said boom support means and said boom structure about said substantially horizontal axis through an angular distance of greater than 90° and to a vertical position wherein the longitudinal axis of the boom structure extends vertically relative to said support platform.

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