May 6, 1958 R. FERWERDA ET AL 2,833,422

TELESCOPIC BOOM

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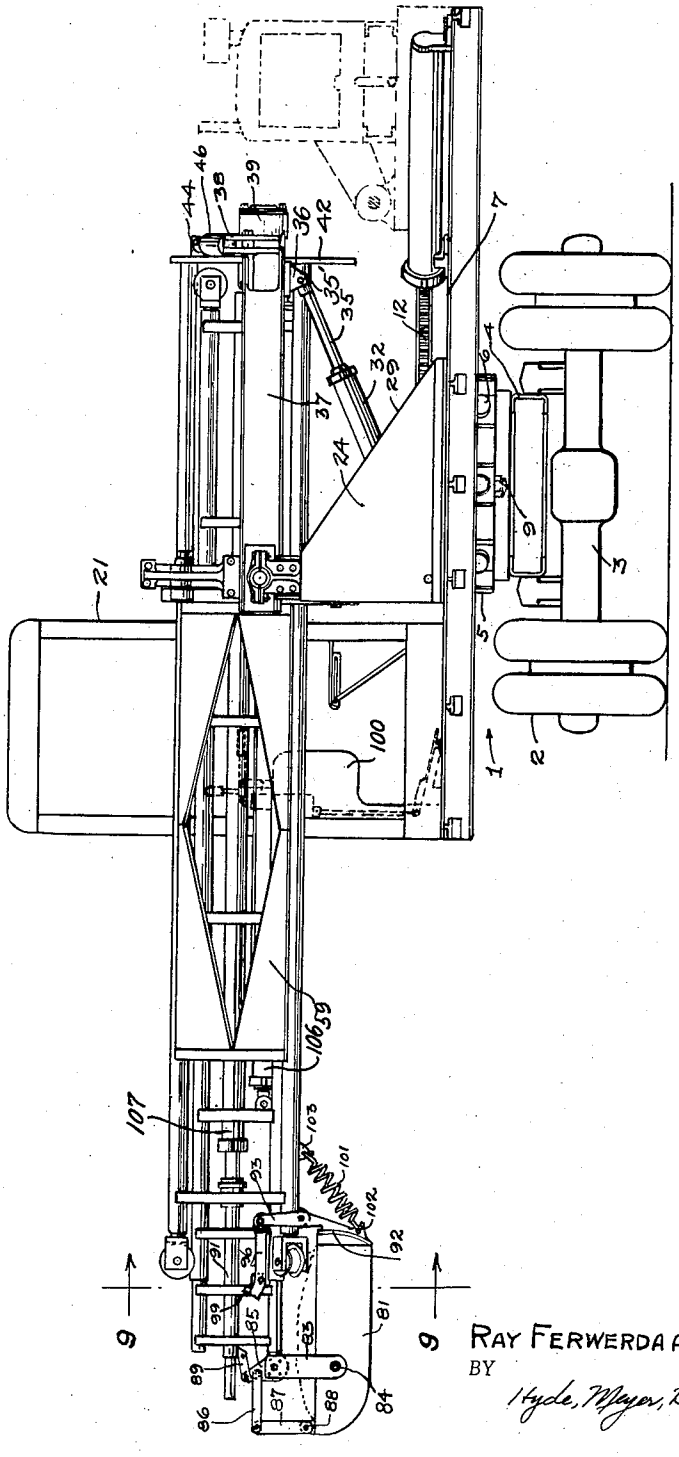


FIG. 1

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TELESCOPIC BOOM

Filed Dec. 28, 1950 7 Sheets-Sheet 2

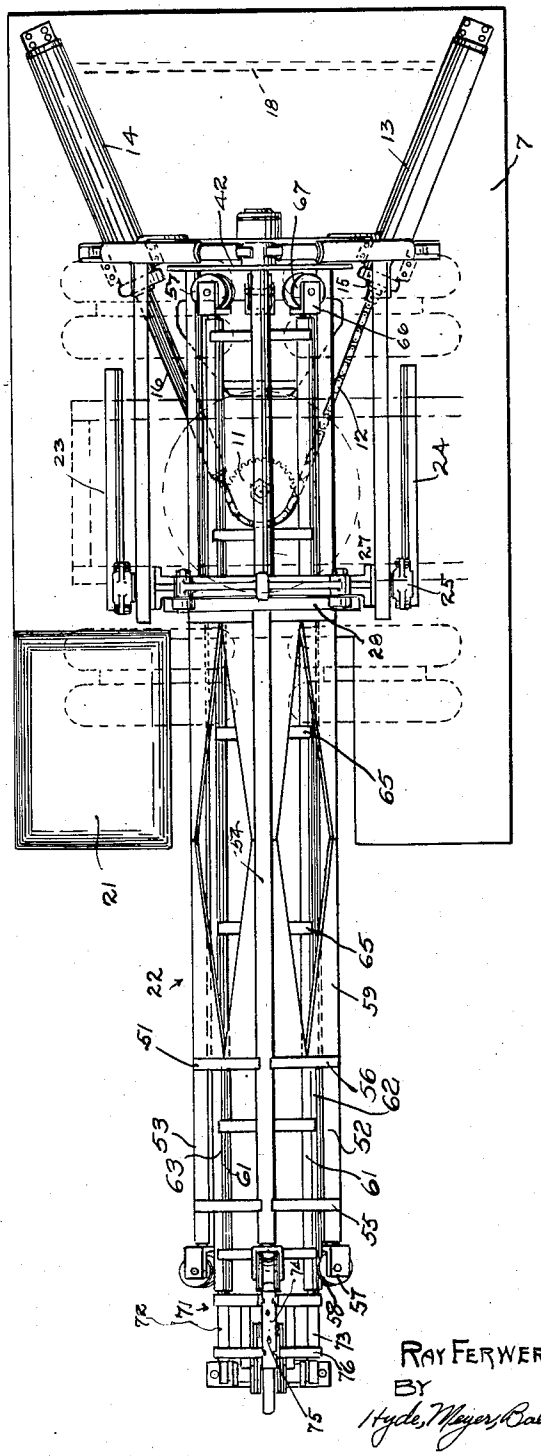


FIG. 2

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TELESCOPIC BOOM

Filed Dec. 28, 1950 7 Sheets-Sheet 3

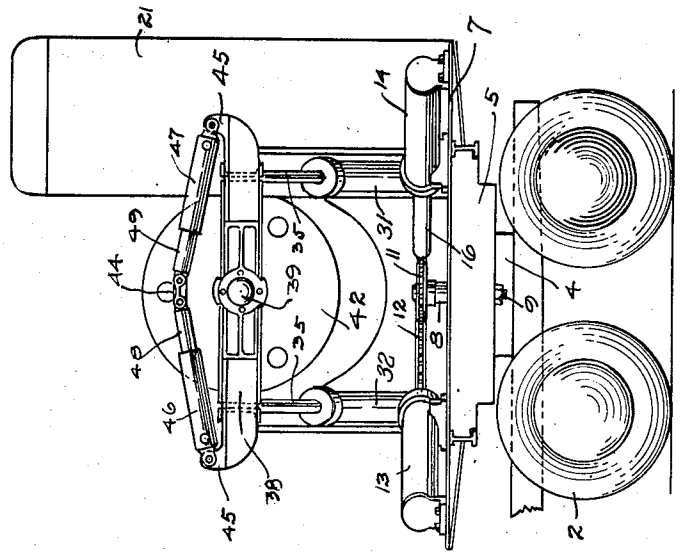


FIG. 4

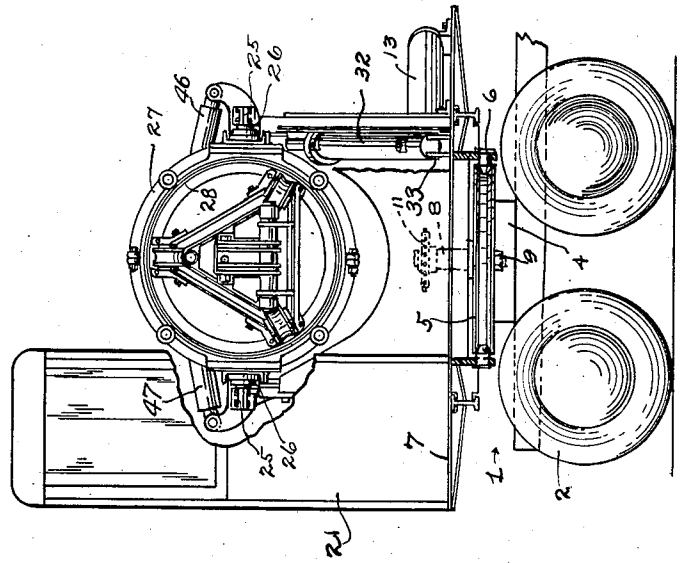


FIG. 3

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TELESCOPIC BOOM

Filed Dec. 28, 1950 7 Sheets-Sheet 4

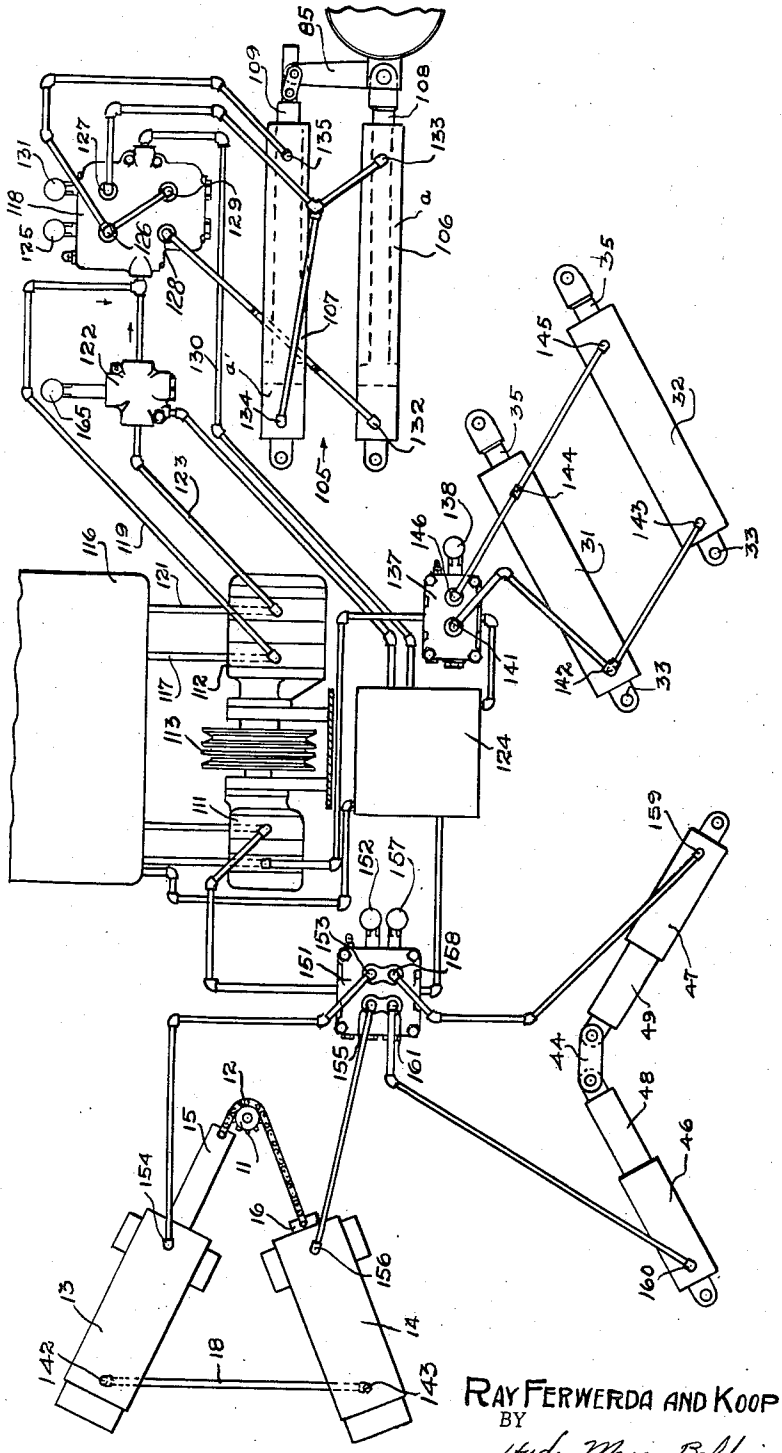


FIG. 5

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TELESCOPIC BOOM

Filed Dec. 28, 1950 7 Sheets-Sheet 5

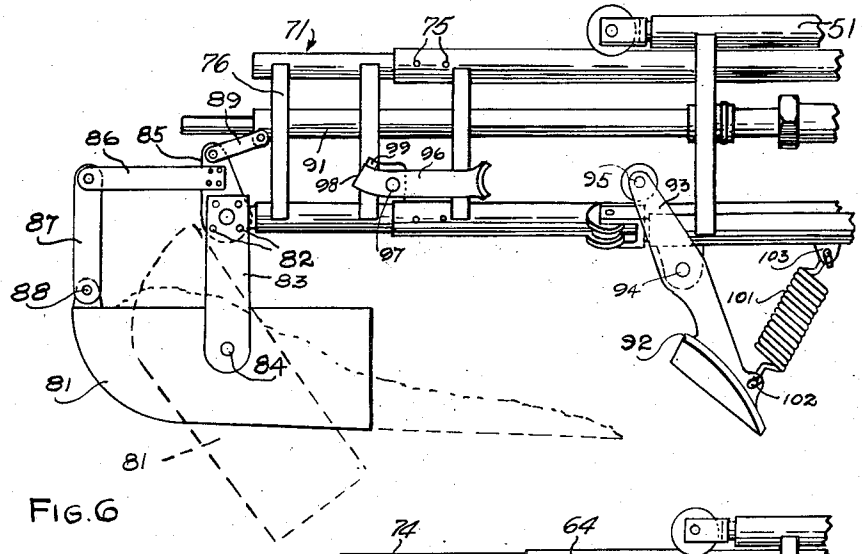


FIG. 6

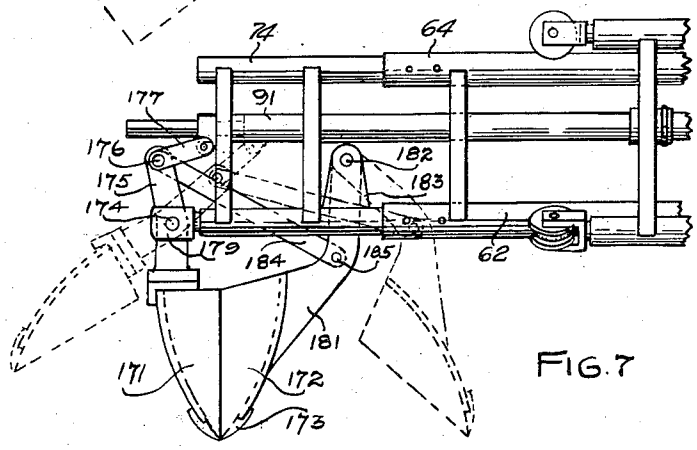


FIG. 7

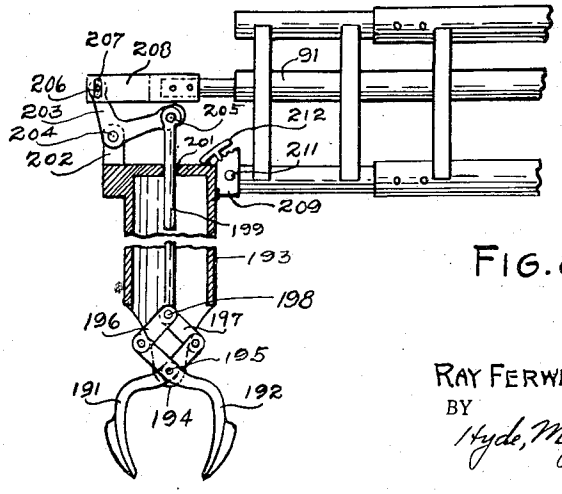


FIG. 8

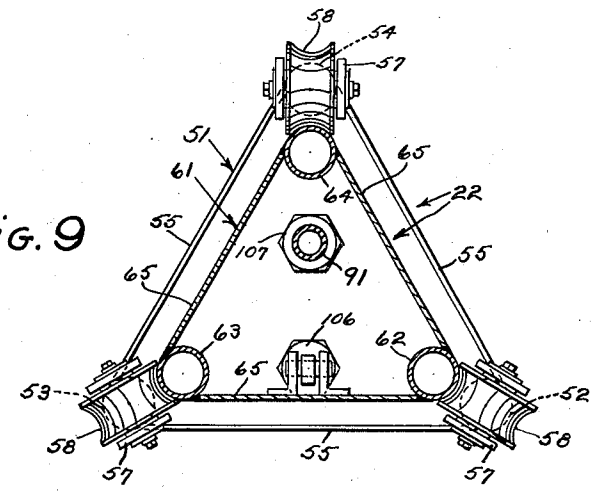
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TELESCOPIC BOOM

Filed Dec. 28, 1950 7 Sheets-Sheet 6

Fig. 9



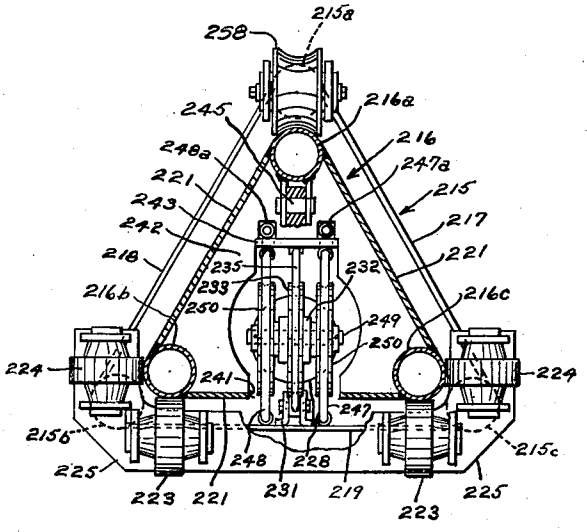


Fig. 11

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TELESCOPIC BOOM

Filed Dec. 28, 1950 7 Sheets-Sheet 7

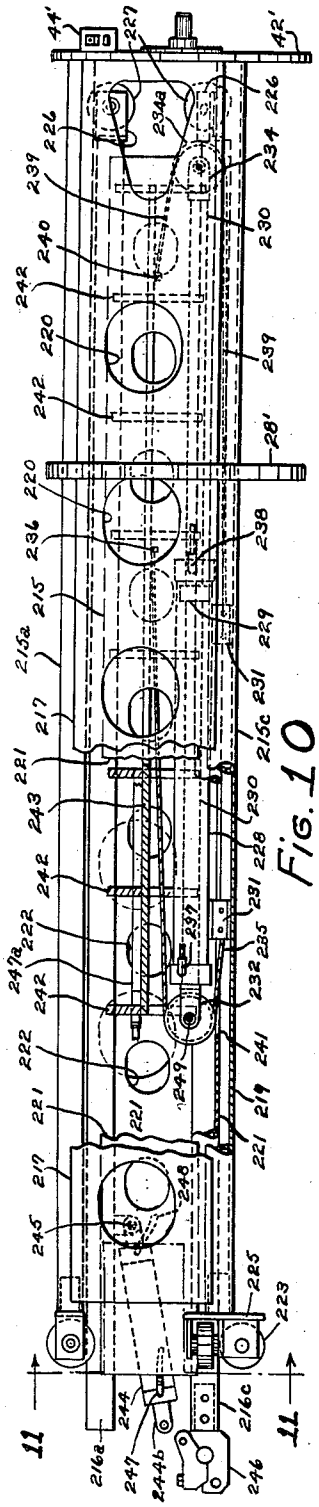


FIG. 10

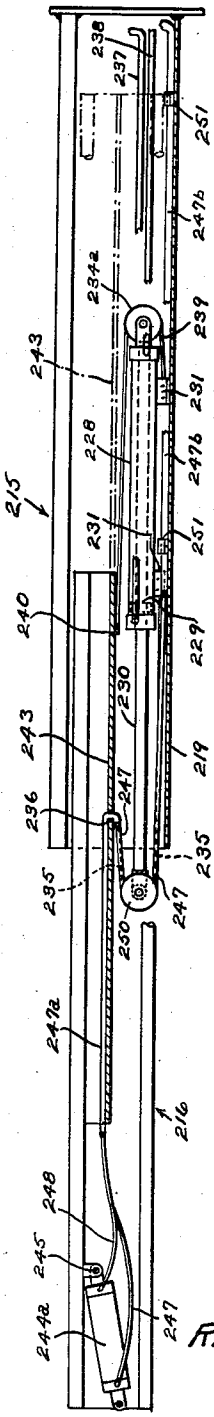


FIG. 12

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United States Patent Office 2,833,422 Patented May 6, 1958

2,833,422

TELESCOPIC BOOM

Ray Ferwerda, Chagrin Falls, Ohio, and Koop Ferwerda, Avondale Estates, Ga.; Sophia Louise Ferwerda, administratrix of the estate of said Koop Ferwerda, deceased

Application December 28, 1950, Serial No. 203,156

4 Claims. (Cl. 212—55)

This invention relates to improvements in a telescopic boom for use in any type of apparatus requiring a rigid extensible boom.

This application is a continuation in part of our copending application Serial No. 535,706, filed May 15, 1944, now United States Patent No. 2,541,045 granted February 13, 1951, wherein we show our improved boom as part of a machine used for digging, scraping, grading and the like.

One of the objects of the present invention is to provide a boom extensible to a length of twenty or thirty feet or even longer while at the same time providing a strong and rigid construction which will permit the carrying of heavy loads at the end of the boom or the exertion of great power at the free end of the boom with hardly any deflection of the boom along its length.

Another object of the present invention is to provide a telescopic boom of the type described having main and extensible boom sections, each of which is of hollow box beam form with friction reducing roller means between the two hollow box beams so as to provide a simple but rigid extensible boom.

A further object of the invention is to provide two telescopic boom sections, each of hollow beam construction of polygon section, with rigid structural members extending longitudinally of each of the boom sections at the corners of the polygon, together with rollers on one of the boom sections engaging the longitudinally extending structural members of the other boom section, there being little lateral play between the parts, whereby to provide a boom which is extensible with very little friction and yet which maintains great rigidity in all of its operating positions.

Our invention also provides a novel arrangement for extending the boom comprising a cylinder and piston motor housed within the boom and parallel to the longitudinal axis thereof together with a cable having one end attached to the fixed portion of the boom and the other end attached to the movable portion of the boom with an intermediate portion of the cable passing around a pulley which is reciprocated by the cylinder and piston motor to extend and retract the boom.

Our invention also provides in combination with the apparatus described in the preceding paragraph, a second motor at the outer end of the extensible portion of the boom, a fluid pressure supply for this second motor including a flexible hose and pulleys carried by the cylinder and piston motor to pay out and take up the flexible hose as the boom is extended and retracted whereby to provide a simple but effective fluid supply means for the second motor at the end of the extensible boom.

Other objects and advantages of the present invention will be apparent from the accompanying drawings and description and the essential features thereof will be set forth in the appended claims.

In the drawings—

Fig. 1 is a rear end view of a type of vehicle base supporting apparatus with our improved boom mounted thereon and shown in side elevation;

Fig. 2 is a top plan view of the structure shown in Fig. 1;

Fig. 3 is a view of the structure shown in Fig. 1 as seen in elevation from the left hand side thereof, parts being broken away to more clearly show the construction, and the working implement of Fig. 1 being omitted;

Fig. 4 is a view of the structure shown in Fig. 1 as seen in elevation from the right hand side thereof;

Fig. 5 is a diagrammatic view of the hydraulic control system for the device of Fig. 1;

Fig. 6 is a side elevation, enlarged, of the forward end portion of the boom of Fig. 1 showing a hoe-type scoop and closure therefor in open position, and with a scraper angle adjustment shown in dotted lines;

Fig. 7 is a side elevational view similar to Fig. 6 showing a clam shell bucket type implement in closed position, with the open position shown in dotted lines;

Fig. 8 is a side elevational view similar to Fig. 6 of a deep ditching type implement with parts thereof shown in section;

Fig. 9 is a transverse sectional view enlarged taken along the line 9—9 of Fig. 1 with the digging implement omitted for clearness;

Fig. 10 is a side elevational view of a modified form of boom adapted to be mounted in the machine of Fig. 1 and with parts broken away to more clearly show the construction;

Fig. 11 is a transverse sectional view enlarged taken along the line 11—11 of Fig. 10 with the auxiliary motor omitted for the sake of clearness; while

Fig. 12 is a diagrammatic view patterned after a portion of Fig. 10 for the purpose of more clearly showing the functioning of the boom extending cable and the flexible takeup for the hose of the auxiliary motor.

As is clearly shown in Figs. 1 to 4 of the drawings, the material moving apparatus comprises a support 1, preferably in the form of a vehicle of rigid construction with heavy wheels 2 and axles 3 and a substantial frame or body member 4, on the upper side of which a circular turntable unit 5 provided with roller bearings 6 is mounted. The upper turntable member is secured to the under side of an enlarged platform 7, which is provided at a central point with an opening through which a fixed vertical standard 8 secured at its lower end 9 to the vehicle body member 4, is engaged. The standard 8 carries at its upper end a stationary sprocket 11, over which a sprocket chain 12 is engaged. The sprocket chain 12 is preferably of a length adequate to carry the platform 7 through a rotation around the turntable of at least a complete circle.

The means for rotating the platform in the full hydraulic system illustrated provides a hydraulic cylinder unit at each end of the sprocket chain 12. These cylinder units 13, 14 are preferably anchored on the platform floor along diagonal lines at each of the rearward corners. Each cylinder should be of sufficient length to permit its piston rods 15, 16 respectively, a long range of motion. A double acting valve in the valve unit 151, presently to be described, supplies oil under pressure selectively to one or the other of these cylinders according to the direction of motion desired. An air line connection 18 between the two cylinders, transfers air from one cylinder to its companion cylinder to correspond with the direction of movement.

The rotatable platform 7, at its forward portion at one side is provided with an operator's cab 21, and the valve controls are centered at such point as will later be described in detail.

Centrally of the platform 7, an extensible boom 22 is

provided, the forward portion of the main body of the boom projecting beyond the front edge of the platform, in the apparatus illustrated, approximately half its length. In order to obtain longer range of action and balanced operation the boom is pivoted on the platform at an intermediate point, in the apparatus illustrated, at a point approximately one-third the distance from its rearward end. The horizontal pivot for the boom is somewhat in advance of the turntable center and is part of a broad rigid structure supporting the boom horizontally in a plane some distance above the floor of the platform 7.

The supporting structure for the boom 22 comprises a pair of heavy plates 23, 24 securely mounted centrally of the platform 7 and spaced apart a distance somewhat greater than the turntable width. At the forward upper edges of the plates trunnion bearings 25 are mounted, within which the stub axles 26 are engaged, the stub axles being secured to the opposite sides of an annular roller bearing track 27 within which an annular roller bearing shell 28 is rotatably engaged. The plates 23, 24 are cut away on an angle at their rearward portion 29 to a point adjacent the floor of the platform and immediately inside the walls thus provided, boom raising and lowering cylinders 31, 32 are pivotally mounted on pivot bearings 33, mounted on the platform immediately below the trunnion bearings 25 of the boom. The piston rods 35 of the boom raising and lowering cylinders are pivotally engaged with pivot pins 35' mounted in brackets 36 at the lower rearward ends of a rearwardly extending frame 37 securely mounted on the rearward face of the annular roller bearing track 27 heretofore described.

The rearward portion of the frame 37 is formed of a built-up cross-member 38 having a large central bearing 39 for the main rotatable boom body 31 which terminates in a large circular end plate 42, carrying centrally a stub shaft (not shown) engaged in the bearing 39. The end plate 42 also has securely mounted thereon a bracket 44 providing two pivot pins adjacent its upper margin above the central bearing 39.

The cross-member 38 has upturned end members providing spaced brackets 45 within which are mounted the axially rotating tilting cylinders 46, 47. The pistons 48, 49 of said cylinders are connected to the respective pivot pins of the bracket 44, and oil pressure selectively directed into one of these cylinders produces axial rotation of the entire boom structure, as will be explained in detail hereinafter.

The extensible axially rotatable boom structure comprises the rearward section 51, preferably formed of a skeletonized frame of three tubular members 52, 53, 54 of extended length secured in the rearward end plate 42, preferably arranged in triangular relation to provide two lower parallel track-ways 52, 53, and a central upper track-way 54.

The rearward boom section 51 is securely engaged within the annular roller bearing shell 28 which, as stated, rotates within the annular roller bearing track-way heretofore described. Adjacent its forward end the boom section 51 is provided with a triangular bracing member 55, and it may also have one or more similar intermediate bracing members, such as shown at 56.

At the extreme forward ends of the tubular members 52, 53, 54, brackets 57 carrying grooved rollers 58 are provided for cooperation with the extensible or telescopic inner boom section 61. The boom section 51 is preferably made very rigid and its central portion may be provided with reinforcing webs or gusset plates of sheet metal 59 welded to the tubular members 52, 53, 54 on their outer surfaces or to the brace bars secured thereto.

The inner boom section 61 is very similar in construction to the outer boom section 51 having three triangularly related tubular members 62, 63, 64, with bracing members 65 at intervals of their length. At their rearward ends the tubular members 62, 63 and 64 each carry a bracket 66 carrying a grooved roller 67 similar to the rollers 58 on the boom section 51. It will be noted that the tubular members of the inner boom section bear against the rollers 58 at the forward end of the boom section 51, and that the rollers 67 on the rearward end of the section 61 bear against the tubular members of the boom section 51. The structure thus has very little friction to overcome when the boom extension moves outwardly or in the reverse direction.

The two boom sections 51 and 61 just described provide all the range of action usually required by the work in hand, but occasionally a somewhat greater extension is necessary where otherwise inaccessible areas are to be covered. Such additional range is provided by a manually adjustable telescopic section mounted on the forward end of the inner boom section 61.

This auxiliary boom section 71 is provided with tubular members 72, 73, 74, formed of tubes of a diameter to slidingly engage within the tubular members 62, 63, 64. The auxiliary boom section 71 may be adjusted to several different lengths of extension, being held by locking pins 75 engaged in alined apertures through the tubular members. The forward portions of such tubular members have bracing members 76.

Our above mentioned copending application shows several types of implements adapted to be mounted on the outer end of the extensible portion of the boom, three forms of which are shown in Figs. 6, 7 and 8. It will be noted that the implement, in each case, when in normal working position, is mounted at the two lower corners of the triangular extension boom, and the third corner of the triangle points upward. Angular adjustment of these implements or opening and closing motion thereof is provided in the said parent application by means of a link connected with a sleeve 91 adapted to be secured to the piston rod of the control cylinder 107 and reference may be had to the parent application for a more complete description of these tools and their method of operation.

As is shown in Figs. 1 and 5, the boom extension and blade or implement control cylinders are an operative unit 105 comprising the main cylinder 106 and the positioning cylinder 107, which provide equal areas *a* and *a'* within the respective cylinders causing pistons 108 and 109 to move in unison when the boom is to be elongated. When the blade 81 or other implement is to be turned to a different angle to the line of operation, the differential action of the valves is made use of and the desired angular adjustment brought about. When so adjusted the angular relation set up is maintained due to certain of the valve passageways being closed and a fluid lock thus established.

The fluid pressure is provided by a closed hydraulic system wherein two oil pumps are driven by a gas engine which may be mounted on the platform 7 as shown in dotted lines in Fig. 1.

The operation of the various elements embodied in the apparatus will best be understood by reference to Fig. 5 which shows diagrammatically the complete hydraulic system with the actuating cylinders and pistons and their associated mechanism. In the closed hydraulic system just referred to two oil pumps 111, 112 are provided with an intermediate pulley drive 113 which, as indicated in Fig. 1, is connected by means of suitable belts with a gas engine. The mechanism for operating the boom extension and blade or scoop position will next be described.

One pump member of the dual pump 112 draws oil from the reservoir 116 through the pipe 117 and supplies it to the valve 118 through the pipe 119. The companion pump member of the dual pump 112 supplies oil from the reservoir 116 through the pipe 121 to the valve 122 through the pipe 123. The valve 122 is a

single acting valve that diverts the flow from the pump to either the valve 118 or to the manifold tank 124.

When oil is diverted through the valve 122 into the valve 118 it will double the volume and thereby double the speed of the boom movement. When the plunger 125 of the valve 118 is in neutral position the ports 126 and 128 are blocked off and the oil passes freely through the valve 118 and through the pipe 130 to the manifold 124. When the plunger 131 is in neutral position the ports 127 and 129 are also blocked off. When the plunger 125 for operating the boom extension is pulled out the oil flows from the valve port 128 to the cylinder port 132. As the boom is extended the oil flows from the cylinder port 133 of the cylinder 106 to the cylinder port 134 of the cylinder 107. At such time the oil cannot flow to the valve port 127 because this port is blocked off by the plunger 131 when the handle is in neutral position. The oil flows from the cylinder port 135 into the valve port 126 and through to the manifold tank 124. When the plunger 125 is pushed in the oil flow is reversed. The oil leaves the valve port 126 and flows into the cylinder port 135 and out of the cylinder port 134 into the cylinder port 133, out of the cylinder port 132 into the valve port 128, and back into the manifold tank 124.

Other details of the hydraulic system shown diagrammatically in Fig. 5 are explained in detail in our above mentioned pending application and it would appear to be unnecessary to repeat the same here.

In the modified form of boom shown in Figs. 10, 11 and 12, the same principles have been followed with respect to the boom as those previously described. The view of Fig. 10 is a side elevational view of the boom taken in a position similar to Fig. 1. The end plate 42' and the bracket 44' perform the same functions as the plate 42 and bracket 44 of the first described form. The ring 28' is adapted to coact with the ring 27 of the previously described apparatus so as to mount the boom for oscillation about its endwise axis. Here again, the main boom section 215 and the extensible boom section 216 are of polygon section, a triangle being chosen as in the previous form. At the apexes of the triangle, the section 215 has longitudinally extending structural members, tubes being used in the present case as indicated at 215*a*, 215*b* and 215*c*. Stiff side plates 217, 218 and 219 are rigidly welded to the three tubes just mentioned so as to form the three sides of the triangular hollow box beam which forms the main boom section. Portions of these plates may be cut away as shown at 220 so as to save weight without losing any essential rigidity. The inner or extensible boom 216 is constructed in a like manner. At the corners of the triangle the longitudinally extending tubes 216*a*, 216*b* and 216*c* are rigidly connected together by plates 221 which are welded tangentially to the tubes 216*a*, 216*b* and 216*c* so as to expose the three longitudinally extending tubes on their outer surfaces to provide tracks for the guide rollers about to be described. Portions of the plates 221 may be cut away as indicated at 222 so as to reduce the weight without sacrifice of rigidity.

Rollers mounted on one of the boom sections and engaging against the other boom section reduce the friction as the boom is extended and retracted. In the first described form as clearly shown in Fig. 9, the rollers 58 are mounted on extensions of the tubes 52, 53 and 54 with the axes of the rollers at right angles to a line bisecting the apex angle at each corner of the triangle. It will be noted that rollers 58 engaging tubes 52 and 53 are arranged to withstand vertical load and lateral thrust. The rollers 67 at the inner end of the extensible portion of the boom, in the first described form, are mounted on extensions of the tubes 62, 63, 64 in a similar manner so as to engage against the exposed inner surfaces of the tubes 52, 53 and 54. In the modification of Fig. 11, the roller 258 is mounted similarly to the roller 58 seen at the top of Fig. 9. It will be noted that the groove of roller 258 hugs the tubular member 216*a* of the extensible boom section so as to prevent relative movement between the boom sections at this point. At the two lower corners of Fig. 11, the single rollers of Fig. 9 have been substituted by rollers 223 mounted on horizontal axes and engaging the bottom surfaces of tubes 216*b* and 216*c* to take the vertical load, together with rollers 224 mounted on vertical axes and engaging the side surfaces of the same tubes to take the side thrust. Combination brackets 225 mounted on the ends of tubes 215*b* and 215*c* support the rollers 223 and 224. At its inner end the extensible boom section 216 is provided with brackets 226 mounted on tubes 216*a*, 216*b* and 216*c*, and these carry three grooved rollers 227 which engage the inner surfaces of the tubes 215*a*, 215*b* and 215*c* to perform exactly the same functions as the rollers 67 of the first described form. In both forms of our invention, namely, that shown in Figs. 1 and 9, and that shown in Figs. 10 and 11, there is very little play between the rollers mounted on one boom section and the longitudinally extending tubes of the other boom section engaged by said rollers. Thus, because of the rollers mounted on one end of the main boom engaging the extensible boom, and the rollers mounted on the opposite end of the extensible boom engaging the main boom, in the manner shown in the drawings, a very rigid structure is formed which can be extended to a considerable length with great pressure exerted at the outer end of the boom and with very little deflection of the boom from a straight line.

Power means mounted within the boom itself is provided for extending and retarding the same. A double acting cylinder and piston motor comprises a cylinder 228 fitted with a reciprocating piston 229 and having a piston rod 230 extending out opposite ends of the cylinder. The cylinder is mounted parallel to the longitudinal dimension of the boom by means of two brackets 231 rigidly fastened to the bottom plate 219 of the main boom and to the cylinder 228. In a bifurcated bracket 232 there is rotatably mounted a pulley 233 at the outer end of piston rod 230. In a similar bracket 234, there is rotatably mounted a pulley not seen in the drawings but in a location similar to that of 233, this pulley being at the inner end of piston rod 230. A cable 235 has one end fixed to the main boom section as for instance at the outer bracket 231, this cable then passing around the pulley 233 and back to a point 236 on the extensible boom. Pressure fluid supply and exhaust is provided for the cylinder and piston motor 228, 229 by means of the pipe connections 237 and 238. When piston 229 is moved toward the left as viewed in Figs. 10 and 12, to the position of Fig. 12, by proper supply of pressure fluid, it is obvious that the movement of the extensible boom 216 relative to the main boom 215 from the position of Fig. 10 to the position of Fig. 12 is twice the movement of the piston 229 in its cylinder 228 because there are two movable parts of the cable. Obviously, this multiplication of movement might be increased by increasing the number of pulleys and reeving the cable so as to have a greater number of movable parts thereof. Another cable 239 has one end fixed at the bracket 231 nearer the base of the boom. This cable then passes around the pulley in the bracket 234 at the inner end of the boom as previously described and has the other end of the cable fixed to the extensible boom at the point 240. When pressure fluid is supplied to drive the piston 229 from the position of 212 to the position of Fig. 10, the cable 239 is extended to pull the extensible section of the boom 216 back into the main boom 215.

Referring to Figs. 10 and 11, in order to permit the relative movement between the boom sections 215 and 216 as just described, a portion of plate 221 must be cut away as indicated at 241 to prevent plate 221 striking the cable 235 and the brackets 231. The extensible boom 216 is strengthened to overcome possible weakness be-

cause of this cutting away of the plate **221**. To this end, a plurality of gusset plates **242** are provided extending transversely of the box beam **216** and spaced a couple of feet apart along the length thereof. These gusset plates are rigidly welded to the plates **221** and to the tubes **216***a*, **216***b* and **216***c*. Each gusset plate **242** provides an arch effect around the cylinder and piston motor **228**, **229** and the parts attached thereto so that the extensible boom portion **216** is quite rigid and will not spread. To further strengthen this structure, a reinforcing plate **243** is provided in the upper portion of boom section 216 parallel to the bottom plate **221**. This reinforcing plate 243 is welded to all of the gusset plates **242**. The means for fixing cables **235** and **239** at the points **236** and **240** respectively are mounted on this plate **243**.

In the modified form of our device shown in Figs. 10, 11 and 12, we provide a cylinder and piston motor 244 at the outer end of extensible boom section **216** for manipulating digging and scraping tools at the end of the boom. This motor **244** is analogous in function to the motor **107** shown in the first described form. The cylinder **244***a* is provided with a trunnion mounting at 245 on the tube 216*a*. The piston of this motor is provided with a piston rod **244***b* which may be attached to a tool to be operated. A clamp **246** is mounted on each of the tubes **216***b* and **216***c* for mounting one of the tools of Figs. 6, 7, 8 or other suitable tool. Motor **244** is preferably of the double acting type and is supplied by pressure fluid through hoses **247** and **248** connected to opposite ends of the cylinder **244***a*. Our invention contemplates a novel way of taking up the slack in these hoses as the boom is extended and retracted.

This arrangement will be best understood from Fig. 11. The shaft **249** upon which pulley **233** rotates is mounted in bracket **232** previously described. On the ends of this shaft, on opposite sides of pulley **233** are mounted two pulleys **250**. These pulleys are grooved to receive the hoses **247** and **248**. Since a portion of each hose runs along the top of plate **243** for a portion of its length, these portions may be made of fixed tubing mounted on plate **243** as shown at **247***a* and **248***a*. Obviously this could be hose also if desired. Each hose runs from motor **244** backward along the top of plate **243** to approximately the point **236** where the hoses pass through suitable openings in plate **243** and then forwardly over the pulleys **250** and then toward the right as viewed in Fig. 12 to approximately the location of the outermost bracket **231**. From here on back to the base of the boom, the hoses may connect with pipes such as shown at **247***b* fastened to the bottom plate **219** of the main boom by means of clamps **251**. At the inner end of the boom the hose connections **247** and **248** and also **237** and **238** are led away to suitable control valves. It will thus be noted that the hoses for supplying the motor **244** at the free end of the extensible boom are payed out and pulled in along with the extension and retraction of the boom. It will be obvious to those skilled in the art that the hoses **247** and **248** might pass over pulleys mounted alongside of pulley **234***a* at the right hand end of cylinder **228** as viewed in Figs. 10 and 12 instead of at the left hand end thereof and still produce the same result.

We have thus provided a novel extension and retraction means for this extensible boom mounted entirely within the boom itself in a simple and efficient manner and protected against damage. At the same time, the secondary motor 244 has been supplied with pressure fluid by means of flexible hoses which are extended and taken up again as the boom is extended and retracted in a simple but effective manner by hoses which are located in a protected spot inside the boom.

What we claim is:

1. In a telescopic boom, a base, a hollow box beam main boom section mounted on said base, a hollow box beam extensible boom section of a cross-section to fit telescopingly within said main boom section, roller means mounted on one of said sections and engaging the other of said sections to reduce friction between them upon relative telescopic movement of one section relative to the other, means for moving said extensible boom section into and out of said main boom section, said last named means comprising an expansible chamber motor rigidly secured to one of said boom sections parallel to the longitudinally extending axis of said section, said motor having a cylinder and a piston reciprocable therein and a piston rod, a sheave rotatably mounted on the end of said rod, a cable having one end connected to said main section and its other end connected to said extensible section and the intermediate portion of said cable reeved around said sheave, and a supply of pressure fluid for said motor.

2. In a telescopic boom, a base, a hollow box beam main boom section mounted on said base, a hollow box beam extensible boom section of a cross-section to fit telescopingly within said main boom section, roller means mounted on one of said sections and engaging the other of said sections to reduce friction between them upon relative telescopic movement of one section relative to the other, means for moving said extensible boom section into and out of said main boom section, said last named means comprising a cylinder and means rigidly securing it to one side wall of said hollow beam main boom section and parallel to the longitudinally extending axis of said section, the side wall of said hollow beam extensible boom section adjacent the said one side wall of the main section having a longitudinally extending slot adapted to pass over said cylinder and its securing means, internal bracing means in said extensible boom section to prevent lateral deformation thereof due to said slot, said cylinder having a piston reciprocable therein and a piston rod, a sheave rotatably mounted on the end of said rod, a cable having one end connected to said main section and its other end connected to said extensible section and the intermediate portion of said cable reeved around said sheave, and a supply of pressure fluid for said motor.

3. In a telescopic boom, a base, a hollow box beam main boom section mounted on said base, a hollow box beam extensible boom section of a cross-section to fit telescopingly within said main boom section, roller means mounted on one of said sections and engaging the other of said sections to reduce friction between them upon relative telescopic movement of one section relative to the other, means for moving said extensible boom section into and out of said main boom section, said last named means comprising an expansible chamber motor rigidly secured to one of said boom sections parallel to the longitudinally extending axis of said section, said motor having a cylinder and a piston reciprocable therein and a piston rod, a sheave rotatably mounted on the end of said rod, a cable having one end connected to said main section and its other end connected to said extensible section and the intermediate portion of said cable reeved around said sheave, a supply of pressure fluid for said motor, a pressure fluid actuated motor mounted at the outer end of said extensible boom section for manipulating a tool or the like there, a pressure fluid supply connection for said last named motor including a flexible hose, a second sheave rotatably mounted on said piston rod, and said hose reeved around said sheave to be payed out and taken up respectively as said extensible boom section is extended and retracted.

4. The combination of claim 3 wherein said flexible hose is completely housed inside of said main boom section.

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