This invention relates to a telescoping boom construction, and more particularly to such construction in combination with the actuating mechanism for the extensible and retractable member of the boom.

The telescoping boom construction embodying the invention is that type of boom which is used in a multi-purpose construction machine capable of performing trenching, digging, grading and other similar operations, and wherein the extensible and retractable member of the boom mounts at its outer end a suitable tool for the particular operation being performed.

Furthermore in booms of this type longitudinal movements have been imparted to the extensible and retractable boom member by a power mechanism, such as a hydraulic motor of the reciprocating type and wherein the piston rod is directly connected to the extensible member of the boom. The direct connection of the piston rod to the extensible member of the boom necessitates piston movement and cylinder length coextensive with the longitudinal movement of the extensible member.

An object of the present invention is to provide a boom of the type referred to wherein the extensible member telescopes within a fixed member and has longitudinal inward and outward movements imparted thereto by a power operated actuating mechanism or device, such that the movement producing part of said mechanism or device need traverse only a fractional part of the actual travel movement of the extensible member of the boom.

Another object is to provide a boom construction wherein the power operated actuating mechanism or device for the extensible member of the boom is located internally of the boom and has an operative connection between the movement producing part of the mechanism or device and the extensible member of the boom, such that movement of said part is fractional with respect to the actual movement imparted to the extensible member of the boom.

Another object is to provide in a boom of the type referred to actuating mechanism for moving the extensible member of the boom and which mechanism is relatively short in length as compared to the length of the extensible member, whereby the amplitude of the extending movement of the extensible member may be greatly increased.

A more specific object is to provide a boom construction and actuating mechanism as referred to in the previous objects and wherein, if the actuating mechanism is of the hydraulic cylinder and piston type, the length of piston movement and the length of cylinder may be greatly shortened in relation to the extensible and retractable movements of said boom member.

Further and additional objects and advantages not hereinbefore referred to will become apparent hereinafter during the detailed description of an embodiment of the invention which is to follow and which embodiment is illustrated in the accompanying drawing, wherein,

Fig. 1 is a side elevational view of a portion of a multi-purpose construction machine showing the telescoping boom mounted thereon and with the extensible member of the boom in extended position.

Fig. 2 is a fragmentary view somewhat similar to Fig. 1 but showing the extensible member of the boom in fully retracted position.

Fig. 3 is a transverse sectional view through the extensible member of the boom taken substantially on line 3-3 of Fig. 1 looking in the direction of the arrows.

Fig. 4 is a longitudinal sectional view taken through the boom on line 4-4 of Fig. 3 looking in the direction of the arrows and showing the extensible member of the boom in fully retracted position.

Fig. 5 is a view similar to Fig. 4 but showing the extensible member of the boom in extended position and also showing both the fixed boom member and the extensible boom member broken away so as to shorten the view.

Fig. 5a is a detached detail sectional view showing the manner in which the actuating cables are connected to the inside of the extensible member of the boom, and

Fig. 6 is a transverse sectional view through the boom and is taken substantially on line 6-6 of Fig. 5 looking in the direction of the arrows, and

Fig. 7 is a detached top plan view of the actuating mechanism shown in Figs. 4 and 5, with parts broken away to shorten the view.

The multi-purpose construction machine shown in Figs. 1 and 2 comprises a supporting platform 10 which, in this instance, is illustrated as mounted upon a vehicle chassis. The platform 10 has mounted on it a turntable 11 movable to any desired angular position. The turntable 11 mounts a cab and a frame 12 provided with upstanding trunnion supports 13. The fixed boom member 14 is mounted for rotative movement on its longitudinal axis in a circular housing 15 and said housing 15 is mounted on trunnions 16 carried by the supports 13 wherefore the boom may have raising and lowering movements imparted thereto as well as said rotative movements. Inasmuch as the construction thus far explained forms no part of the present invention and is well known in the art further reference thereto is unnecessary.

The boom construction embodying the invention comprises the fixed boom member 14, previously referred to, and the extensible boom...
The cylinder 40 with the heads at the opposite ends of the cylinder fixedly secured to the bars. The cylinder 40 mounts a sliding piston 41 from the opposite sides of which project piston rods 42 and 43 of the same length, wherefore the effective pressure areas on the opposite sides of the piston are the same.

The piston rods 42 and 43 extend through the cylinder heads at the opposite ends of the cylinder and said heads are provided with ports 44 and 45 constituting inlet and exhaust ports depending upon the direction of movement of the piston in the cylinder. It will be understood that the ports 44 and 45 are suitably connected by a supply and exhaust circuit to a source of pressure fluid and that said circuit includes a suitable control valve for selectively causing the ports 44 and 45 to be inlet or exhaust ports.

The piston rods 42 and 43 have secured to their outer ends, respectively, pairs of sheaves 46 and 47, as shown in Fig. 7. The cylinder 40 on its upper side and intermediate the supporting bars 37 has secured to it a pair of longitudinally spaced sheaves 48. The supporting bars 37 and cylinder 40 extend through the fixed boom member and into the extensible boom member. The lower plate 34 of the extensible boom member has secured to its inner face an anchoring lug 49 which supports oppositely extending pairs of I-bolts 50 as shown in Fig. 5a. The I-bolts 50 are individually adjustable and may be locked in adjusted position by suitable means such as the lock nuts shown in the drawings.

An actuating cable 51 is connected to one of the left hand pair of I-bolts 50 and extends therefrom around one of the sheaves 47 from whence it passes around the left hand sheave 48 and thence around the other sheave 47 from where it extends and is secured to the other I-bolt 50 of the left hand pair of I-bolts.

An actuating cable 52 is connected to one of the I-bolts of the right hand pair and extends therefrom around one of the sheaves 48 and thence around the right hand sheave 48 as viewed in Fig. 7, from whence it passes around the other sheave 48 and returns and is secured to the other I-bolt of the right hand pair of I-bolts. It will be understood that the adjustability of the I-bolts is for the purpose of taking up slack in the actuating cables 51 and 52 and putting tension thereon.

Insamuch as the cylinder 40 is stationarily mounted within the fixed boom member 14 it will be seen that when the control is set by the operator so pressure fluid is admitted to the cylinder 40 through the port 45 and exhausted therefrom through the port 44, the piston 51 will move from the position shown in Fig. 4 toward the right to cause an extension of the piston rod 42 beyond the right hand cylinder head and to draw the piston rod 43 into the cylinder. The extension of the piston rod 42 acting through the sheave 45 on the cable 52 will cause the extensible boom member 17 to move outwardly from the fixed boom member 14 and be extended with respect thereto. This movement of the extensible boom member 17 is permitted by the movement of the piston rod 43 into the cylinder, since the actuating cable passing around the sheaves 47 plays out to allow such movement of the extensible boom member.

It will be seen that the extending movement of the boom member 17 is under the control of the cable 51 which permits the outward movement of the boom member 17 in equal proportion to the production of such movement by the cable 52.
Consequently the extensible movement of the boom member 17 is always a controlled and steady movement.

It will be understood that when it is desired to move the boom member 17 from its extended position to a retracted position within the fixed boom member 44, the control valve is set by the operator so pressure fluid is admitted to the cylinder 40 through the port 44 and exhausted therefrom through the port 45 so that the piston 41 moves toward the left in the cylinder 40 as viewed in FIG. 1 and movement of the piston, of course, causes the actuating cable 51 to produce the retracting movement of the boom member 17 while the cable 52 permits such movement.

It will be noted that the amplitude of movement of the piston 41 to extend or retract the boom member 17 is fractional as compared to the actual movement of said member. As illustrated, the movable boom member 17 has a two-to-one movement with respect to the piston 41 but it will be understood that this ratio between boom movement and piston movement can be varied by changing the arrangement of the sheaves and cables.

Although a preferred embodiment of the invention has been illustrated and described herein, it will be understood that the invention is susceptible of various modifications and adaptations within the scope of the appended claims.

Having thus described my invention, I claim:

1. In an extensible telescoping boom of the type having a fixed boom member and an extensible boom member in telescopic relationship with the fixed member, actuating mechanism for said extensible boom member and comprising a power operated device including a part located within and having fixed relationship with respect to said fixed boom member and an elongated movable member engaging part extending through said member and movable relative to said fixed part, longitudinally spaced sheaves mounted on said fixed part, sheaves carried by the opposite ends of said movement producing part, and actuating cables secured to the interior of said extensible member and reeved around said sheaves so that movement of said movement producing part imparts to said extensible boom member amplified extending or retracting movements.

2. In an extensible telescoping boom of the type having a fixed boom member and an extensible boom member in telescopic relationship with the fixed member, actuating mechanism for said extensible boom member and comprising a cylinder fixedly mounted in said fixed boom member and extending into said extensible boom member, a piston movable in said cylinder and having piston rods projecting from its opposite sides and extending beyond the opposite ends of said cylinder, sheaves mounted on said cylinder, sheaves carried by the ends of said piston rods, and actuating cables secured to the interior of said extensible boom member and reeved around said sheaves to cause piston movement to impart to the extensible boom member amplified extending and retracting movements.

3. In an extensible telescoping boom of the type having a fixed boom member and an extensible boom member telescoping relative to the fixed member, parallel supporting members fixedly mounted within the fixed boom member, a cylinder located between and secured to said supporting members, a piston movable in said cylinder, and having piston rods projecting from the opposite sides thereof and extending beyond the ends of said cylinder and located between said supporting members, a pair of longitudinally spaced sheaves secured to said cylinder, a pair of spaced sheaves mounted on the end of each piston rod, and a pair of actuating cables each having its ends secured interiorly to the extensible boom member, said actuating cables being reeved respectively around the spaced sheaves at the end of one of the piston rods and around one of the sheaves carried by the cylinder, whereupon piston movement in either direction is imparted to said extensible boom member in an amplified ratio of two-to-one.

4. In an extensible telescoping boom of the type having a fixed boom member and an extensible boom member telescoping within the fixed member, parallel supporting members fixedly mounted within the fixed boom member, a cylinder located between and secured to said supporting members, a piston movable in said cylinder and having piston rods of equal diameter projecting from the opposite sides thereof and extending beyond the ends of said cylinder and located between said supporting members, a pair of longitudinally spaced sheaves secured to said cylinder, a pair of spaced sheaves mounted on the end of each piston rod, a pair of actuating cables reeved respectively around the spaced sheaves at the end of one of the piston rods and around one of the sheaves carried by the cylinder, and adjustable means for connecting the ends of said cables to the interior of the extensible boom member wherefore piston movement in either direction is imparted to said extensible boom member in an amplified ratio while said adjustable means provides for the taking up of slack or play in said cables.

5. In an extensible telescoping boom of the type having a fixed boom member and an extensible boom member in telescopic relationship with the fixed member, actuating mechanism for said extensible boom member and comprising a cylinder fixedly mounted in said fixed boom member and extending into said extensible boom member, a piston movable in said cylinder and having piston rods projecting from its opposite sides and extending beyond the opposite ends of said cylinder, said piston rods having the same diameters wherefore equal lengths of said rods will displace equal volumes of fluid in said cylinder, sheaves mounted on said cylinder, sheaves carried by the ends of said piston rods, and actuating cables secured to the interior of said extensible boom member and reeved around said sheaves to cause piston movement to impart to the extensible boom member amplified extending and retracting movements.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>326,336</td>
<td>Sandberg et al.</td>
<td>Sept. 15, 1885</td>
</tr>
<tr>
<td>484,064</td>
<td>Mesta</td>
<td>Oct. 18, 1892</td>
</tr>
<tr>
<td>1,345,304</td>
<td>Zied</td>
<td>June 29, 1920</td>
</tr>
<tr>
<td>1,380,637</td>
<td>Stubble</td>
<td>Sept. 13, 1921</td>
</tr>
<tr>
<td>1,389,209</td>
<td>Hofmann</td>
<td>Sept. 21, 1922</td>
</tr>
<tr>
<td>2,106,649</td>
<td>Waite</td>
<td>Apr. 9, 1940</td>
</tr>
<tr>
<td>2,261,930</td>
<td>Abbe</td>
<td>Nov. 11, 1941</td>
</tr>
<tr>
<td>2,382,399</td>
<td>Detters</td>
<td>Aug. 14, 1945</td>
</tr>
<tr>
<td>2,510,636</td>
<td>Johnson</td>
<td>June 6, 1950</td>
</tr>
<tr>
<td>2,541,046</td>
<td>Ferwerda et al.</td>
<td>Feb. 13, 1951</td>
</tr>
</tbody>
</table>