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3,390,794

EXTENSIBLE AND RETRACTABLE BOOM

Filed March 9, 1967

4 Sheets-Sheet 2

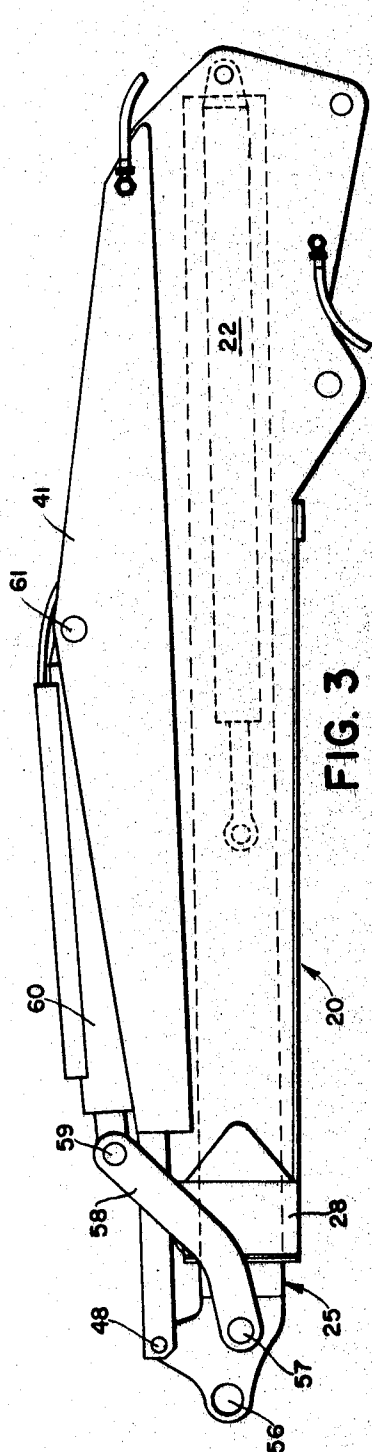


FIG. 3

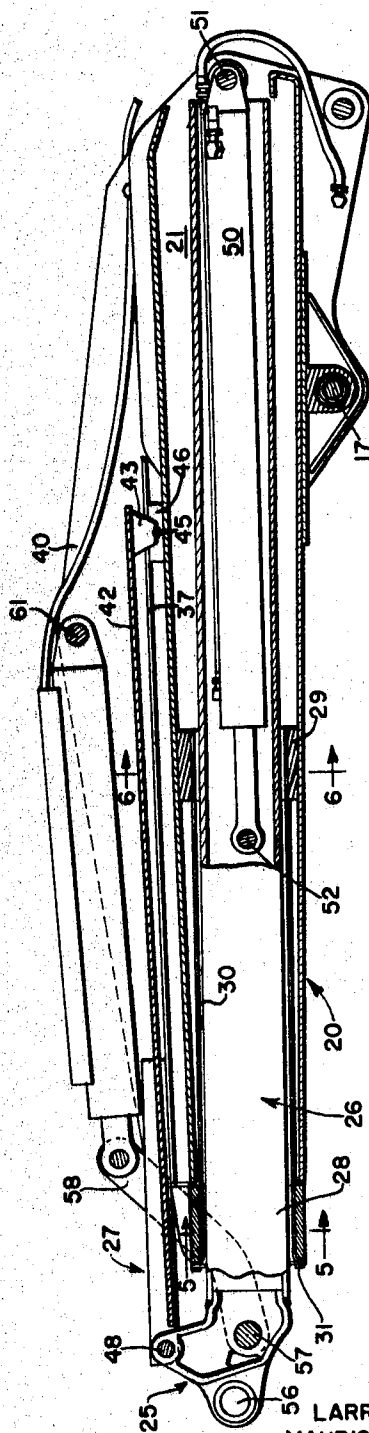


FIG. 4

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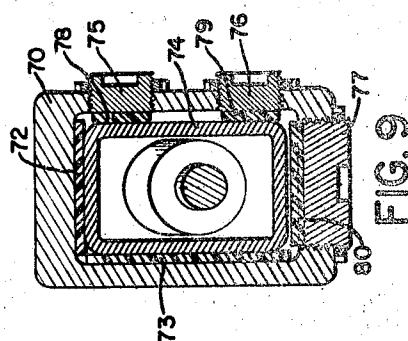
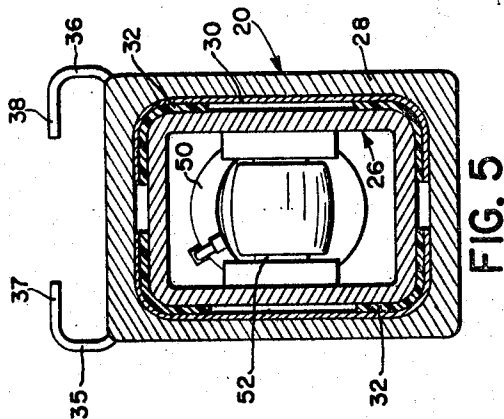
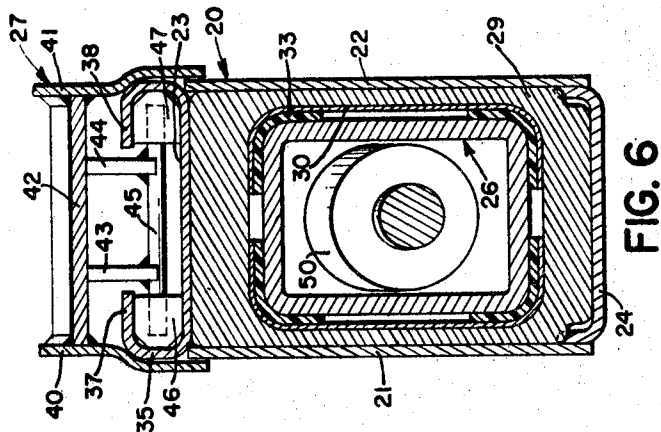
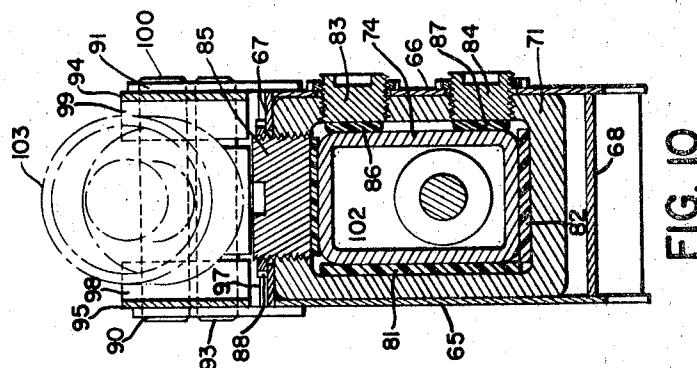
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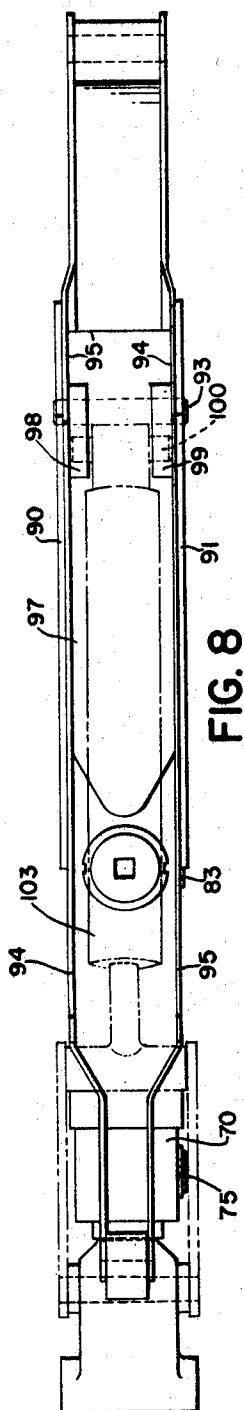


FIG. 8

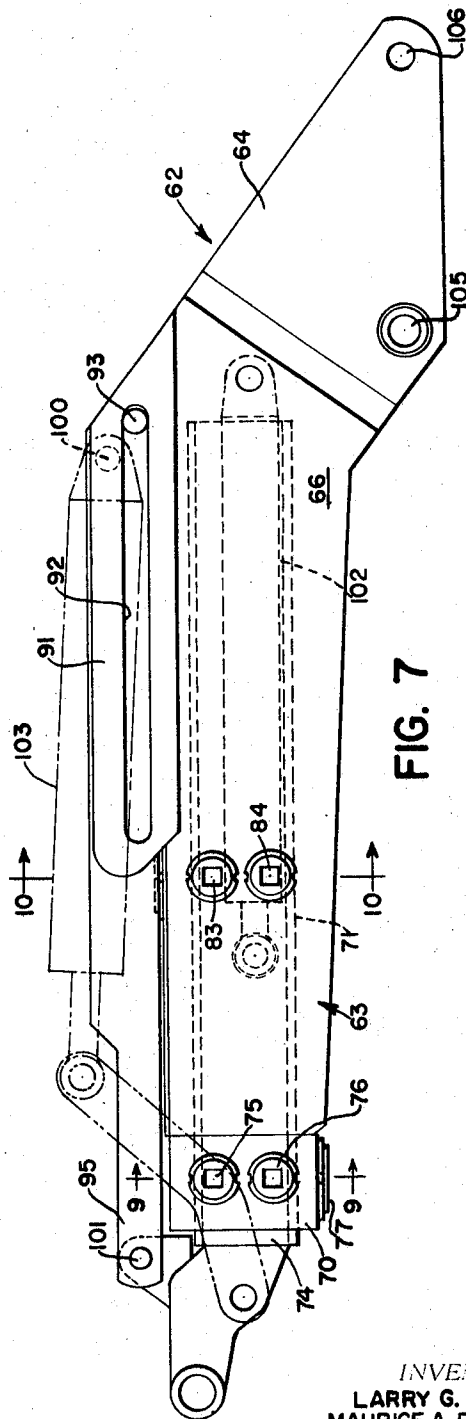


FIG. 7

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EXTENSIBLE AND RETRACTABLE BOOM

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ABSTRACT OF THE DISCLOSURE

An elongated hollow boom having an extension composed of a first part telescopically received within the boom and a second part positioned to one side of the boom and connected to the first part at an end outside of the boom. A track on the boom receiving guide means on the second part for guiding the second part longitudinally of the boom. Adjustable wear plates disposed in the gap between the inner surface of the boom and the outer surface of the first part with the adjusting means for moving the wear plates being threaded elements threadedly connected to the side of the boom and for shifting the wear plates relative to the second part.

This invention relates to an extensible and retractable boom used primarily as a dipper stick on a backhoe. In the conventional type dipper stick, there is normally provided a bucket that pivots on the outer end of the dipper stick and is controlled in its pivotal movement by a hydraulic cylinder extending between the dipper stick and bucket. The bucket may thus be rolled over for the purpose of loading or dumping as the case may be. The dipper stick is also pivotally mounted on the outer end of a boom at a midportion of the dipper stick and it also is controlled by a hydraulic cylinder extending between the boom and the opposite end of the dipper stick. It is desirable in order to obtain a longer reach or deeper cut by the backhoe to provide the dipper stick with a two-piece assembly so that the dipper stick may extend and retract as desired. Extension and retraction of the two-piece dipper stick normally occurs by inserting a hydraulic cylinder between the two pieces and extending and retracting it as desired.

It has heretofore been known to provide an extensible and retractable dipper stick in which the portion that is connected to the main boom is smaller and telescopes within the outer section. The advantage of such a construction is that the hydraulic cylinder that operates the bucket may be connected directly to the larger outer section. However, a primary problem with this type of extensible and retractable dipper stick is that the outer section may telescope only to the connection between the dipper stick and the main boom thereby limiting the amount of extension of the dipper stick. It has also been known to provide an outer extension that is telescoped within the main dipper stick that is connected to the main boom. To accommodate the hydraulic cylinder that operates the bucket, there is provided a slot in the upper side of the main dipper stick portion so that the hydraulic cylinder may be connected to and move with the extension. The problem with such a construction is that the slot in the upper side of the main portion weakens the entire dipper stick thereby making it necessary to reduce the load capacity of the dipper stick or to build the main dipper stick portion of such heavy material that it is both costly and inefficient to operate due to its weight.

With the above in mind, it is the primary object of the present invention to provide an extensible and retractable type boom that may be used as a dipper stick that includes a main boom portion and an inner telescoping

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part that may extend and retract. A hydraulic cylinder within the boom and part operates to extend and retract the part relative to the boom. A second part of the extension is connected to the outer or forward end of the first part and extends above and alongside the upper side of the boom. The boom has tracks adjacent its upper sides that receives the opposite end of the second part and guides the part in longitudinal movement relative to the boom. The hydraulic cylinder for operating the bucket on the end of the extension is connected to the second part and consequently will move with the extension.

It is a further object of the invention to provide wear plates in the gap between the inner surface of the boom and the outer surface of the first part. It is desirable in one form of the invention to provide adjustments for the wear plates so that the wear plates may be moved toward or away from the outer surface of the first part to thereby insure a smooth and snug operation of the first part in its movement relative to the boom portion of the dipper stick.

FIG. 1 is a side view of a backhoe and a portion of the rear end of a tractor.

FIG. 2 is a view similar to FIG. 1 but showing the dipper stick of the backhoe in the extended position.

FIG. 3 is a side view of the backhoe.

FIG. 4 is a view similar to FIG. 3 with portions broken away to show internal mechanism of the dipper stick.

FIG. 5 is a vertical sectional view taken substantially along the line 5—5 of FIG. 4.

FIG. 6 is a vertical sectional view taken substantially along the line 6—6 of FIG. 4.

FIG. 7 is a side view of a modified form of dipper stick.

FIG. 8 is a plan view of the dipper stick shown in FIG. 7.

FIG. 9 is a sectional view taken substantially along the line 9—9 of FIG. 7.

FIG. 10 is a sectional view taken substantially along the line 10—10 of FIG. 7.

Referring now to FIGS. 1 and 2, the backhoe is supported on the rear end of a tractor shown only partially by its rear wheels 10 and includes an upright supporting stand 11 having downwardly projecting stabilizer leg structures 12. The backhoe includes an upright swivel structure, indicated in its entirety by the reference numeral 13, that swings a main boom 14 laterally. A hydraulic cylinder 15 extends from the swing structure to the boom and operates to raise and lower the boom 14. At the end of the boom 14 there is a dipper stick structure, indicated in its entirety by the reference numeral 16 that is pivoted on the boom at 17 and controlled for movement on the pivot by an extensible and retractable hydraulic cylinder 18.

In the preferred form of the invention, the dipper stick structure is composed of a basic boom 20 that is rectangular in cross section with opposite vertical side walls 21, 22, an upper horizontal top wall 23, and a lower horizontal bottom wall 24. The boom 20 tapers slightly from the outer end to the inner end and carries the pivot pin 17 that connects the dipper stick structure 16 to the main boom 14 and also the pivot that connects to the hydraulic cylinder 18.

A dipper stick extension 25 is provided on the dipper stick structure 16 and includes a first beam part 26 that is telescopically received within the outer boom 20 and has its forward end projecting outwardly of the boom, and a second part 27 that is pivotally connected to the end of the first part 26 and extends above and substantially parallel to the boom 20. The boom 20 has a cast iron end that is also rectangular in cross section and is

welded to the aforesaid sides 21-24 respectively and serves as a continuation of those sides. The end 28 is of heavier construction or material than the other portions of the boom since a large load or forces accumulate at that part of the boom. Midway in the length of the boom 20 is a spacer channel 29 that fits internally of and is fixed to the inner sides of the respective walls 21-24. Mounted within the outer end of the beam 20 is an elongated metal liner 30 that extends between the end 28 and spacer 29. The liner 30 has a peripheral and outwardly extending flange that bears against the end 28 and is bolted at 31 thereto. Bonded or otherwise fixed to the internal surface of the liner 30 and adjacent the spacer 29 and end 28 are wear plates 32, 33 that fit around the respective corners of the extension part 26. Such is best shown in FIGS. 5 and 6. The wear plates 32, 33 maintain the part 26 in sliding relation to the dipper stick beam 20.

Referring now to FIG. 6, the upper side 23 of the boom 20 has upwardly projecting portions 35, 36 that project upwardly from opposite edges of the beam 20 and have inwardly extending portions 37, 38 spaced vertically from the top of the beam 20 and defining with the top a pair of longitudinally extending grooves or tracks. The upper part 27 of the extension is composed of a pair of vertically disposed and transversely spaced plates 40, 41 that flare slightly outwardly at their lower ends so as to lie outwardly and closely adjacent the outer surfaces of the brackets or parts 35, 36 respectively. The plates 40, 41 are interjoined by a laterally disposed plate 42. Adjacent the rear end of the plate 42 is a pair of depending brackets 43, 44 supporting a transversely disposed rod 45 that fits into and is rigid with a pair of oppositely disposed guides 46, 47, the latter fitting in the respective grooves or tracks formed by the flanges 37, 38. The forward end of the overhead part 27 of the extension 25 is pivotally connected at 48 to the forward end of the first beam part 26 of the extension. An extensible and retractable hydraulic motor 50 is retained within the beam 26 and boom 20 and has one end pivotally connected at 51 to the boom and the opposite end pivotally connected at 52 to the beam 26. Extension and retraction of the motor 50 causes the extension structure to move longitudinally of the boom 20. The upper part is retained for longitudinal movement in respect to the boom 20 by the pivot pin 48 and the guides 46, 47 moving along the tracks beneath the flanges 37, 38.

An earth-working device or bucket 55 is supported directly on the first beam part 26 by a pivot pin 56. Rearwardly of the pin 56 is a second pivot pin 57 that pivotally supports the lower end of a link 58. The upper end of the link 58 is pivotally connected at 59 to the rod end of an extendible and retractable hydraulic cylinder 60. The 59 also supports a link 69 that extends between the pin 59 and an upper portion of the bucket 55. The linkage 56, 57, 58, 59 and 69 is conventional on backhoes and is used primarily for the purpose of giving a large angular row of the bucket 55 about its pivot 56. The plates or walls 40, 41 support a transverse pivot pin 61 that receives the cylinder end of the hydraulic motor 60.

In a modified form of the invention shown in FIGS. 7-10, the dipper stick boom 62 is angulated to have a relatively long leg portion 63 and a short leg portion 64. As in the previous form of the invention, the boom 62 is composed basically of opposite side walls 65, 66, an overhead wall 67, and an underside wall 68. The end of the leg portion 63 is composed of a cast rectangular-shaped part 70 that is welded to the ends of the walls 65-68 and extends in general continuation thereof. A spacer 71 is provided in the midportion of the leg 63. Spacer plates 72, 73 of nylon or other material are welded to the internal surface of the rectangular member 70 and bear against the upper inside walls of a rectangular-shaped extension part 74 that is disposed inwardly of the beam portion 63. On the opposite walls of the rectangular-shaped part there are provided threaded openings that receive upper and lower

threaded studs 75, 76 and a vertically disposed threaded stud 77. Fixed to the inner surface of the studs 75-77 are wear plates 78, 79 and 80 respectively. As is clearly evident, the latter plates may be adjusted laterally and vertically respectively so that take-up may be applied as the wear plates wear due to sliding of the internal beam 74 in respect to the rectangular-shaped part 70.

The spacer 71 has a vertical plate 81 in the gap between the vertical sides of the spacer and beam 74 and a horizontal spacer 82 between the lower surface of the beam 74 and the lower side of the spacer 71. The spacer 71 and boom section 73 carry in their vertical sides threaded studs 83, 84 and in their upper horizontal sides a vertical threaded stud 85. On the inner surfaces of the studs 83-85 are bonded wear plates 86, 87 and 88 that bear inwardly against the vertical side and the upper horizontal side of the beam 74. The studs 83-85 may be adjusted so as to maintain the preferred pressure against the beam 74. Also, the studs 83-85 operate to secure the spacer member in its correct position relative to the boom section 63.

At the rear end of the boom section 63 there is provided a pair of transversely spaced and upwardly projecting metal plates 90, 91. The lower edges of the plates 90, 91 are welded to the outer surface and the top of the side plates 65, 66 respectively. The plates 90, 91 have elongated slots 92 that are substantially parallel to the first beam part 74 and that also receive opposite ends of a transverse guide pin 93 and operate as a track for the pin 93 in longitudinal movement. The pin 93 extends between and is fixed to a pair of upright plates 94, 95 that lie adjacent to the structural plates 90, 91 and are adapted to slide longitudinally in respect to the plates. The plates 94, 95 form the sides of an elongated second part of the dipper stick extension and are interconnected at their lower edges by a transverse plate 97. The plates 94, 95 have inwardly projecting boss portions 98, 99 that reinforce the plates 94, 95 at the point of entry of the aforementioned pin 93. They also receive opposite ends of a transverse pivot pin 100 that connects the plates 94, 95 to a hydraulic cylinder 103, shown in representative form, that has its forward ram end connected to a linkage system for turning and tilting the bucket in much the same manner as previously described relative to the other form of the invention. The forward ends of the side plates 94, 95 are pivotally connected to the forward end of the beam 74 by a pivot pin 101. Retained within the center of the first extension portion or beam 74 is an extensible and retractable hydraulic cylinder, shown in dotted representation at 102, that has its cylinder end connected to the boom 62 and its rod end connected to the beam 74 in much the same manner as previously set forth in detail. As the hydraulic cylinder 102 extends, it will force extension of the beam 74 relative to the boom leg portion 63. Also, the upper portion of the extension composed of the parts 94, 95 and 97 along with the hydraulic cylinder 102 and its respective connections will move lengthwise or longitudinally in respect to the boom 62.

The inclined leg portion 64 of the boom 62 is connected to the main boom 14 and the dipper stick control cylinder 18 at pivot points 105, 106 respectively and the dipper stick is operated and used in the manner of the previous form.

What is claimed is:

1. In combination, an elongated hollow boom having four sides; a boom extension structure composed of a first part disposed within the hollow boom for sliding longitudinal movement relative thereto and having an end extending outwardly thereof, an elongated second part disposed externally of one side of the aforesaid sides and extending lengthwise of the boom, and means connecting the first and second parts at the aforesaid end; a hydraulic piston and cylinder structure within the boom having one end connected to the boom and the other end connected to the extension whereby extension

and retraction of the piston relative to the cylinder will effect movement of the extension relative to the boom; an earth-working device supported on the end of the extension outwardly of the boom; and an extendible and retractable hydraulic motor offset to the aforesaid one side and being connected to the working device and to the second part whereby said motor may adjustably position the earth-working device.

2. The structure as set forth in claim 1 further characterized by longitudinally extending guide means on the boom and means on the second part spaced from the aforesaid one end engaging the guide means for supporting the part in its longitudinal movement.

3. The structure as set forth in claim 1 in which the means connecting the first and second parts is a pivot means and further characterized by the second part being connected to the boom adjacent its opposite end by track and guide means that is adapted to permit longitudinal movement of the second part relative to the boom.

4. The structure as set forth in claim 2 in which the guide means are a pair of longitudinally extending tracks on the one side and the second part has a pair of elements guided on the tracks and substantially retained against movement other than in the longitudinal direction.

5. The structure as set forth in claim 4 in which the said one side is the top side of the boom and is horizontally disposed and has opposite edges and the tracks are a pair of rigid elongated elements projecting upwardly from the edges and having inwardly projecting flanges substantially parallel to the side, and the elements on the second part extend under the flanges for guidance longitudinally.

6. The structure as set forth in claim 4 in which said one side is the top side of the boom and is horizontally disposed and has opposite edges, and the tracks are rigid elongated flange-like elements projecting upwardly from the respective edges with each of the latter elements having elongated slots substantially parallel to the boom, the second part is disposed at least partially between the flange-like elements, and the elements on the second part project outwardly therefrom and to opposite sides thereof and extend through the slots.

7. The structure as set forth in claim 1 in which the

boom and first part are rectangular in cross section and there are provided wear plates in the gap between the outer surface of the first part and the inner surface of the boom.

8. The structure as set forth in claim 7 in which there is adjustment means on the boom for moving the wear plates to thereby adjust the fit of the plates in respect to the first part.

9. The structure as set forth in claim 7 in which the boom and first part have vertical and horizontal sides and the wear plates include plates that are fixed in respect to one of the vertical and horizontal sides and plates adjacent the other of the vertical and horizontal sides, and the latter plates are adjustable by threaded elements that extend through the respective vertical and horizontal sides of the boom and are adjustable externally thereof to move said latter plates toward and away from the first part.

10. In combination an elongated hollow boom having a top side; a boom extension composed of a first part disposed within the hollow boom for sliding longitudinal movement relative thereto and having an end extending outwardly thereof, and an elongated second part connected to the end and extending therefrom above and substantially parallel to the top side; track means on the boom disposed above the top side of the boom and extending substantially parallel to the boom; guide means on the second part engaging the track means for guiding the second part; bucket means supported on the one end of the first part; an extensible and retractable hydraulic motor within and connected to the boom and first part for extending and retracting the first part relative to the boom; and an extensible and retractable hydraulic motor connected to the bucket means and second part for adjusting the bucket means.

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