March 5, 1963 R. D. SCHWELLENBACH 3,080,077

SIDE TILT MECHANISM FOR A SELF-LEVELLING BACKHOE

Filed June 23, 1960 2 Sheets-Sheet 1

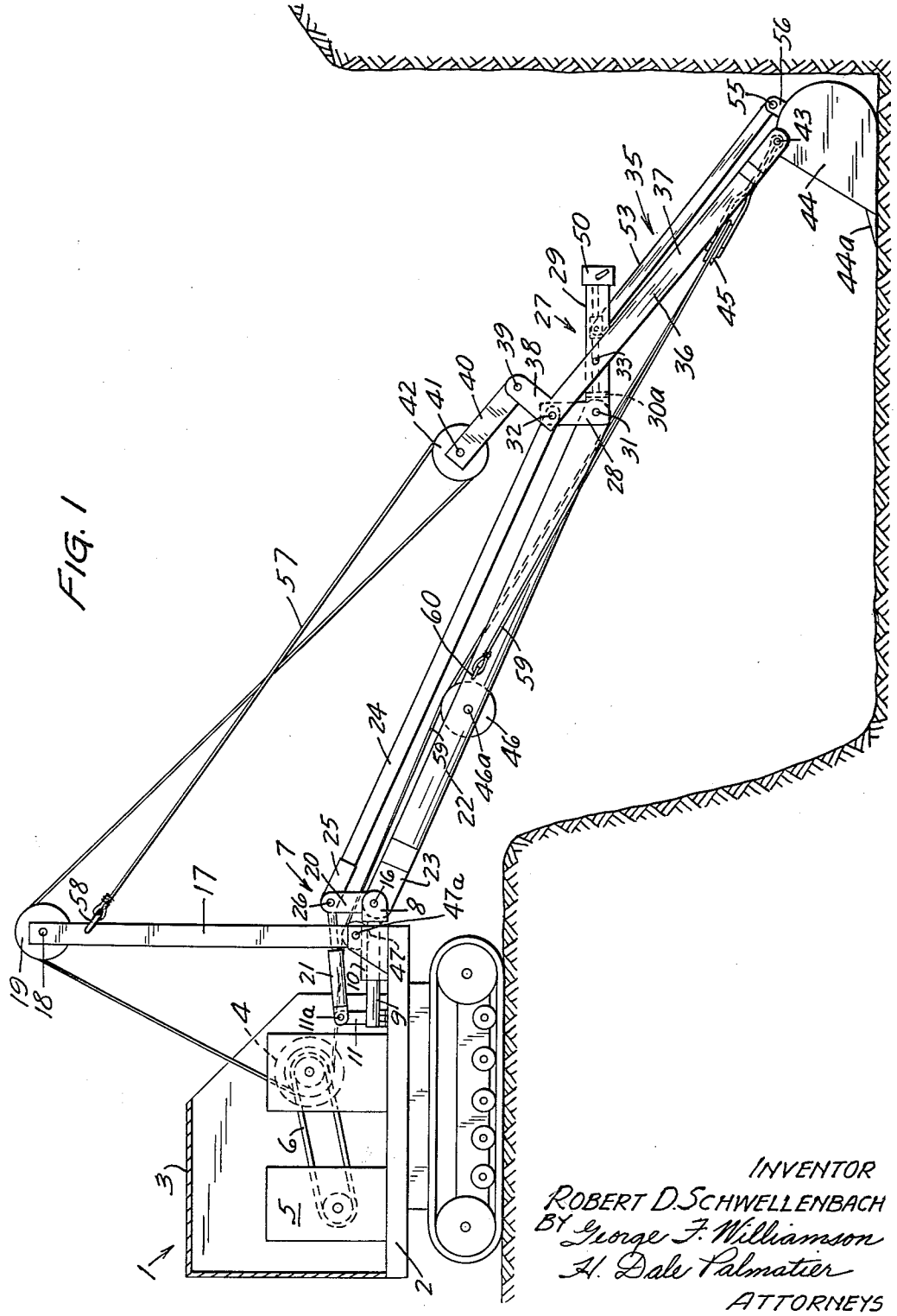


FIG. 1

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FIG. 2

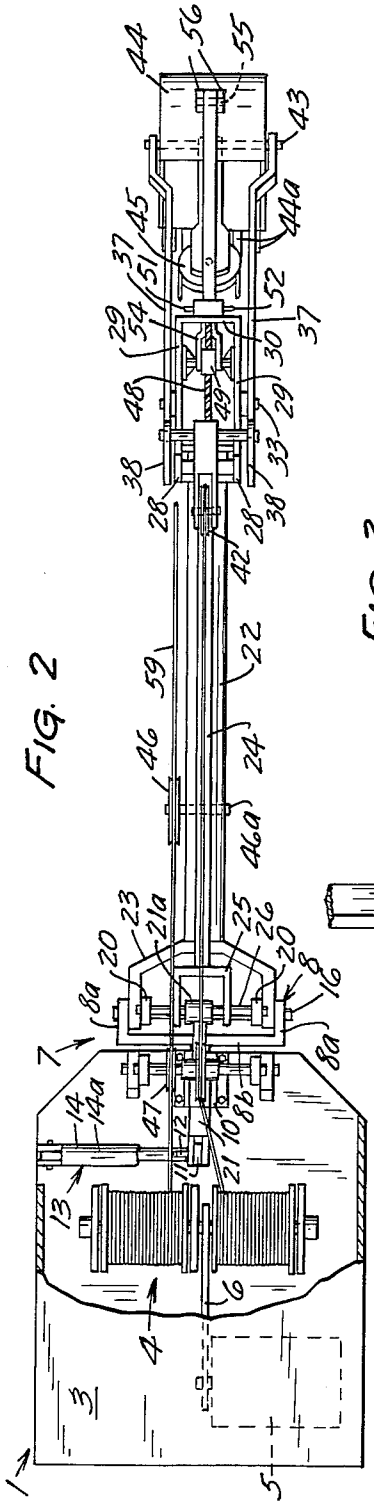
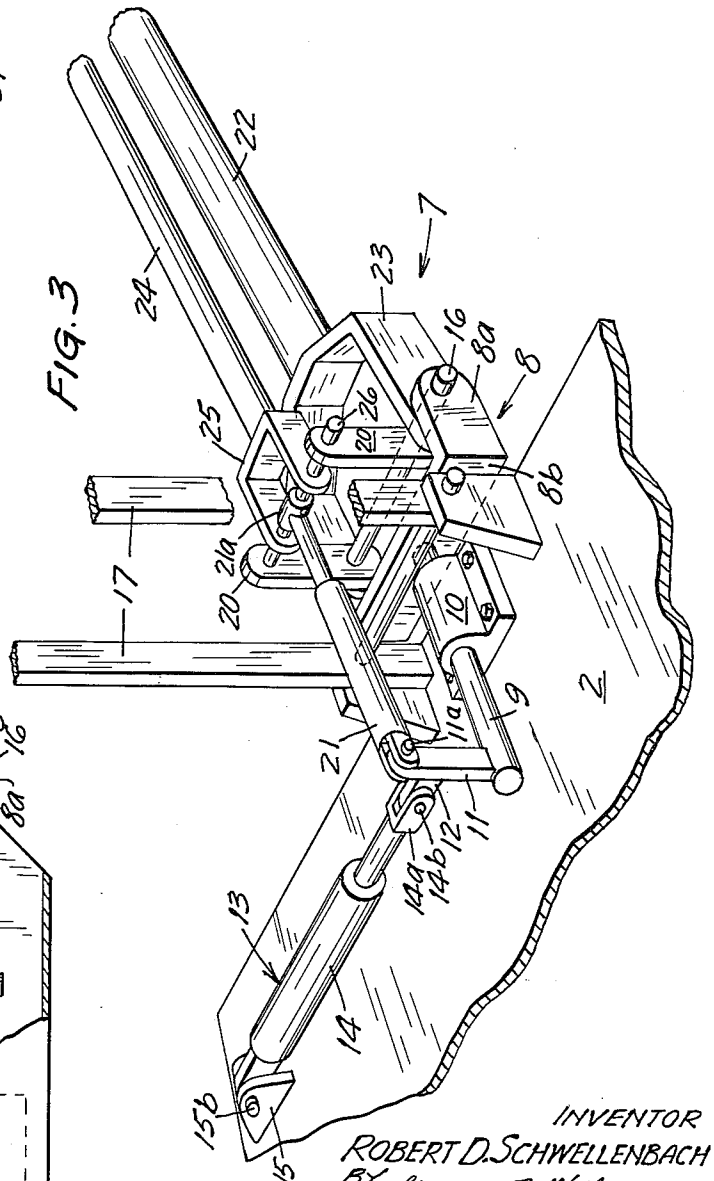


FIG. 3



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SIDE TILT MECHANISM FOR A SELF-LEVELLING BACKHOE

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5 Claims. (Cl. 214—138)

This invention relates to a self-leveling backhoe with side tilt mechanism an excavating and scarifying apparatus which is a continuation in part of my co-pending application, Serial Number 849,398, now Patent No. 3,034,671.

An object of this invention is to provide a novel excavating and scarifying apparatus, of inexpensive construction and operation, which is arranged and constructed so that the implement may be readily controlled during operation thereof to permit the apparatus to function in a more efficient manner than any heretofore known devices.

Another object of this invention is to provide a novel excavating and scarifying apparatus including a side-tilt mechanism for causing lateral tilting of the excavating implement to thereby permit excavation of a sloping grade or to permit lateral levelling of the implement during operation of the apparatus upon uneven or sloping terrain.

Another object of this invention is to provide a novel excavating and scarifying apparatus including an implement control linkage arranged and constructed to permit the implement to be completely levelled during the entire earth working movement thereof.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like character references refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a side elevational view of my novel excavating and scarifying apparatus;

FIG. 2 is a top plan view of the apparatus shown in FIG. 1 with certain parts thereof broken away and other concealed parts indicated by dotted line configuration; and

FIG. 3 is an enlarged perspective view of the side tilt and bearing mechanism.

Referring now to the drawings, it will be seen that one embodiment of my invention includes a self-propelled mobile carriage or vehicle designated in its entirety by the reference numeral 1 and which includes a substantially flat platform 2 and a cab 3. Carriage 1 is of the crawler type and is provided with a cable drum mechanism 4 which is connected to a source of power or engine 5 by a drive belt 6. Rotation of the engine 5 imparts rotative movement to the cable drum mechanism 4 to thereby effect winding and unwinding of cables wound thereon.

My novel excavating and scarifying apparatus also includes a mounting mechanism 7 mounted on the platform 2 for oscillating movement relative thereto and mounting mechanism 7 includes a substantially U-shaped member 8 as best seen in FIGURES 2 and 3. This U-shaped member 8 includes a pair of spaced apart ears 8*a* interconnected by a bight or interconnecting portion 8*b*. An elongate pin 9 is affixed to the rearmost surface of the bight portion 8*b* and extends rearwardly therefrom as best seen in FIG. 3. Pin 9 is journalled in a socket-type bracket 10 which is suitably fixed to the platform 2 by bolts and the like so that the U-shaped member is mounted for rotation or oscillating movement relative to the platform of the carriage 1. The rearmost end of pin 9 has a lever member 11 integrally formed therewith and extending in upstanding relation thereto and this lever member 11 is provided with a laterally extending lug 12 adjacent the uppermost end thereof. Means are provided for causing oscillating movement of the mounting mechanism 7 and

include a hydraulic ram 13 comprised of a cylinder 14 and a piston rod 14*a*. The end of the piston rod 14*a* is pivotally connected to the lug 12 by means of a pivot pin 14*b* and the cylinder 14 is pivotally connected to a bracket 15 by means of a pivot 15*a*. Bracket 15, of course, is affixed to the uppermost surface of platform 2 and it will be seen that extension and retraction of the piston rod 14*a* causes oscillating movement of the mounting mechanisms 7.

A pair of elongate support members 17 are fixedly connected to platform 2 in substantially upright relationship and are interconnected adjacent their upper ends by transverse pin or shaft 18. A sheave is rotatably mounted on shaft 18 in a manner substantially identical to the arrangement in my co-pending application, Serial Number 849,398. Referring again to FIG. 3 it will be seen that a transversely extending shaft 16 extends through the ears 8*a* of the mounting mechanism 7 and a pair of laterally spaced upright arms 20 are pivotally mounted on this shaft 16 for fore and aft rocking movement relative thereto. Power means are provided for rocking arms 20 and include a hydraulic ram 21 pivotally secured to the uppermost end portions of lever member 11 by pivot pin 11*a* and having its piston rods 21*a* pivotally connected with the upright arms 20 in controlling relation therewith and causing pivotal movement of the arm about shaft 16.

An elongate boom member 22 has one of its ends bifurcated to define a pair of arms 23 disposed in straddling relation with respect to the ears 8*a* of U-shaped member 8 and which are journalled upon shaft 16 to thereby permit pivoting of the boom in a substantially vertical plane. Another elongate member or levelling arm 24 is positioned above and substantially parallel with boom 22 and also has one of its ends bifurcated to define a pair of arms 25 which are pivotally connected to upright arms 20 by pivot pin 26. It will be noted that the free end of piston rod 21*a* is actually pivotally connected to this pivot pin 26 for controlling pivotal movement of the arm 20 and that levelling arm 24 is therefore swingable with boom 22 in a vertical plane.

My novel excavating scarifying apparatus also includes an L-shaped frame 27 which is pivotally connected to the respective outer ends of boom 22 and levering arm 24 and includes a pair of laterally spaced vertical legs 28 each having an elongate horizontal leg 29 formed integrally therewith. Horizontal legs 29 are connected at their rear ends by a transverse bar 30 and are connected adjacent their respective front ends by front-transverse bar 30*a*. Boom 22 is pivotally secured to L-shaped frame 27 by transverse pivot pin 31 extending between the lower portions of vertical leg 28 and levelling arm 24 is secured to frame 27 by transverse pivot pin 32 extending between the upper portions of vertical legs 28. It will be noted that upright arms 20, U-shaped frame 27, levelling arm 24 and boom 22 define a parallelogram whereby the horizontal legs 29 of L-shaped frame 27 are maintained in a substantially horizontal relationship throughout the vertical swinging movement of the boom and levelling arm.

The particular construction and operation of the L-shaped frame 27 is essentially identical to that of my co-pending application, Serial Number 849,398 and it will, therefore, be seen that the horizontal legs 29 of L-shaped frame 27 are each provided with laterally extending lugs 33 positioned intermediate the ends thereof. A dipper stick, generally designated 35, includes a pair of links 36 in the form of bell cranks and each is pivoted adjacent its upper end to one of the lugs 33. Each of the links of bell cranks 36 includes an elongate arm portion 37 and a relatively shorter arm portion 38. A cross pin 39 extends between and is journalled for rotation in the upper ends of the shorter arm portions 38.

A pair of sheave-supporting arms 40 are affixed to cross pins 39 and are interconnected adjacent their upper ends by pin 41 upon which a sheave 42 is journalled. Thus, the supporting arms 40 are secured to dipper stick 35 to improve the pivotal movement relative thereto.

The lower ends of links 36 are each journalled upon a cross pin 43 which is affixed to a scoop-type bucket 44. Scoop 44 is of the conventional type and is provided with a plurality of teeth 44*a* and functions as an excavating or loading type implement.

A sheave 45 is secured to scoop 44 and extends rearwardly and upwardly therefrom and a cable supporting sheave 46 is rotatably mounted on boom 22 by pin 46*a* as best seen in FIGS. 1 and 2. Another cable-supporting sheave 47 is mounted for rotation about shaft 47*a* and cooperates with sheaves 45 and 46 for supporting a cable to be described hereinbelow.

It is pointed out that the legs 29 of frame 27 are in the form of channels in cross sectional shape and define a pair of opposed tracks. An elongate screw 48 extends between and is journalled for rotation in rear transverse bar 30 and front transverse bar 30*a*. A traveling nut 49 has a threaded bore and threadedly engages elongate screw element 48 for movement thereon. Although not clearly shown in the drawings, nut 49 is provided with a pair of rollers which are positioned in the tracks defined by the horizontal legs 29 for longitudinal shifting relative thereto in the manner of my co-pending application.

A hydraulic motor 50 is secured to rear transverse bar 30 and is drivingly connected to screw element 48 for rotating the same. Hydraulic motor 50 is provided with an inlet conduit 51 and an outlet conduit 52 each of which extends into the cab of the carriage whereby suitable controls, not shown, are provided.

An implement control link or rod 53 has its upper end bifurcated as at 54 which is pivotally secured to the traveling nut 49. The lower end of implement control rod 53 is pivotally secured to a pin 55 extending between a pair of lugs 56 which are affixed to scoop 44. Referring now to FIG. 1, it will be seen that the pivotal connection between control rod 53 and scoop 44 is positioned forwardly of the pivotal connection between the dipper stick 35 and scoop 44. A cable 57 has one end thereof secured to one of the uprights 17 as at 58 and is trained over and supported by sheaves 40 and has the other end wound upon cable drum mechanism 4 as seen in FIG. 1. Cable 57 serves to raise and lower boom 22 and levelling arm 24 in a vertical plane and further functions to orient dipper stick 35. Another cable 59 has one end thereof affixed to boom 22 as at 60 and is trained over sheaves 45, 46 and 47 also shown in FIG. 1. Cable 59 also has one end thereof wound upon drum mechanism 4 and serves to drag or pull the scoop rearwardly thus causing pivoting of dipper stick 35. It is pointed out that a hydraulic system may be employed for operating the apparatus rather than the cable arrangement shown.

Although the operation of the apparatus is essentially the same as in my co-pending application, it is again pointed out that actuating nut 49, which in effect defines a pivotal axis of the implement control rod 53, may be readily adjusted to vary the particular position of the pivotal axis of the implement control rod. The actuating nut may be moved from a position disposed rearwardly of the pivotal axis 33 of dipper stick 35 wherein the dipper stick and control rod 33 are disposed in substantially parallel relation to a position forwardly of the pivotal axis of the dipper stick 35. When the axis of pivot of the control rod is rearwardly of the axis of pivot of the dipper stick, the frame member 27 scoop 44, dipper stick 35 and control rod 53 define a second parallelogram linkage which cooperates with the first mentioned parallelogram linkage to cause the movement of the implement to be substantially straight from a point of initial contact with the earth to a point when the implement is elevated and this particular predetermined horizontal relationship with the implement will be maintained throughout the movement of the entire mechanism. This permits the implement to work evenly over a substantially wide range which is a substantially different effect than that of the arcuate movement of an implement used on conventional backhoe apparatus. A level indicator is preferably fixed to the upper end of one of the arms 20 to permit the operator to know the precise disposition of the scoop when he is unable to visually see the scoop. Pivotal movement of the arms 20 by extension or retraction of piston rod 21*a* is necessary only to permit the support arms 20 to be levelled when the carriage is disposed upon uneven terrain and is inclined along its longitudinal axis from front to rear. It will, therefore, be noted that the piston rod 21*a* will be extended to move the upper end of the upstanding arms 20 forwardly or outwardly from the carriage 1 when the carriage is disposed on an upwardly sloping surface and the piston rod 21*a* will be retracted when the converse situation prevails.

It is again pointed out that when it is desirable to use my apparatus as the conventional backhoe, actuating nut 49 is moved rearwardly until the pivotal axis of the control rod 53 is substantially co-axial with the pivotal axis of the dipper stick 35 whereby the implement will describe a substantially vertical arc in its movement.

To permit a vertical descent of the shovel or vertical digging with the implement, the hydraulic motor 50 is energized to drive actuating screw 48 which in turn imparts rectilinear movement to travelling nut 49 so that the pivotal axis of the control rod 53 is moved substantially rearwardly of the axis of pivot of the dipper stick. The implement may be lowered in a substantially vertical plane as clearly illustrated and described in my co-pending application Serial Number 849,398.

In addition to the aforementioned controls, it will be noted that a uniquely constructed mounting mechanism 7 permits lateral levelling of the implement 44 when, for example, excavating or scarifying is being done on a sloping surface. Extension and retraction of piston rod 14*a* of hydraulic ram 13 permits oscillating movement of the entire implement support linkage about an axis which extends substantially normal to the axis of pivot of the boom 22 and levelling arm 24. It will be noted that tilting of the mounting mechanism 7 causes the boom and levelling arm to pivot about their longitudinal axis so that lateral levelling of the implement may be very easily and quickly accomplished. It is also pointed out that the uniquely constructed mounting mechanism 7 also permits an implement to be tilted to permit an inclined cut to be made even though the surface is substantially level.

It is to be understood that other implements besides a scoop may be used in my apparatus such as backfill blades, slope drags and frost and hard pan ripper tooth attachments. It is also pointed out that implements performing trenches may be utilized with my apparatus to permit my apparatus to function as a trenching machine.

It will, therefore, be noted from the preceding paragraphs, that I have provided a novel earth working apparatus which is arranged and constructed not only to permit the implement to be maintained in a predetermined position with regard to its longitudinal axis but also readily permits the implement to be maintained in a predetermined position with regard to its transverse axis. It will, therefore, be noted that my novel earth working apparatus is so arranged and constructed that the implement may excavate or scarify on an even grade over a substantially wide range.

It will also be noted that my apparatus is arranged and constructed to be quickly adjusted during the operation thereof to change the angle of attack of the implement from a position for even grading to a position to effect prying action on embedded objects. It will also be noted

that the uniquely constructed mounting mechanism of my apparatus readily permits lateral levelling of the implement regardless of the unevenness of the terrain and also permits cutting of a sloped surface if it is so desired.

Thus it will be seen from the foregoing description that I have provided a novel earth working apparatus which is so arranged and constructed that the implement may be caused to function in a more efficient manner than any devices heretofore known.

It will, of course, be understood that various changes may be made in the form, details arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. Excavating apparatus comprising a mobile carriage, mounting mechanism pivotally mounted on said carriage for pivotal movement relative thereto, an upper and a lower elongate member disposed in substantially parallel relation and each having an end thereof pivotally connected to said mounting mechanism for pivotal movement relative thereto about substantially horizontal axes and in a vertical plane, a frame pivotally connected to said members at their respective other ends, a dipper stick hingedly connected at one end thereof to said frame for fore and aft rocking about a horizontal axis, an implement pivotally connected to the other end of said dipper stick, means for raising and lowering said members and for orienting said dipper stick, means connected with said implement for rocking said dipper stock, a link having one end thereof pivotally connected to said implement, pivot mechanism pivotally connected to the other end of said link and being shiftably mounted over said frame for reciprocating movement relative thereto between a point spaced rearwardly of the dipper stick axis of pivot and a point substantially co-axial with said dipper stick axis of pivot, and actuating means operatively connected to said mounting mechanism and being operable to cause pivoting movement of said mounting mechanism about an axis extending substantially normal to the axis of pivot of said elongate members.

2. The structure defined in claim 1 wherein the actuating means comprises a hydraulic ram mounted on said carriage.

3. Excavating apparatus comprising a mobile carriage, a mounting mechanism pivotally mounted on said carriage for pivoting movement relative thereto, a boom pivotally connected at one end thereof to said mounting mechanism for pivoting movement relative thereto about a substantially horizontal axis, a levelling arm positioned above and substantially parallel to said boom and being pivotally connected at one end thereof with said mounting mechanism, said boom and levelling arm extending forwardly of said carriage and being swingable in a vertical plane, a frame pivotally connected to said members at their respective other ends, a dipper stick hingedly connected at one end thereof to said frame for fore and aft rocking about a horizontal axis, an implement pivotally

connected to the other end of said dipper stick, means for raising and lowering said members and for orienting said dipper stick, means connected with said implement for rocking said dipper stick, an implement control link having one end thereof pivotally connected to said implement, a pivot element pivotally connected to the other end of said link and mounted for longitudinal reciprocating shifting on said frame, power means operatively connected with said pivot element for shifting said element rearwardly on said frame from a point spaced forwardly of said dipper stick axis of pivot to a point spaced substantially rearwardly of the dipper stick axis of pivot, and additional power means for causing said mounting mechanism to pivot about an axis extending substantially normal to the axis of pivot of said boom and levelling arm.

4. Excavating apparatus comprising a mobile carriage, a mounting mechanism pivotally mounted on said carriage for pivotal movement relative thereto, an elongate arm pivotally connected in upstanding relation to said mounting mechanism for fore and aft rocking about a substantially horizontal axis, power means connected to said upright arm for causing fore and aft rocking thereof, a boom having one end thereof pivotally connected to said carriage, an elongate levelling arm having an end thereof pivotally connected to said upright arm and being positioned above and substantially parallel to said boom, said levelling arm and boom being swingable in a vertical plane and extending forwardly of said carriage, a frame pivotally connected to said boom and levelling arm at their respective other ends, a dipper stick connected at one end thereof to said frame for fore and aft rocking movement about a horizontal axis, an implement pivotally connected to the other end of said dipper stick, means for raising and lowering said boom members and for orienting said dipper stick, means connected with said implement for rocking said dipper stick, an implement control link having one end thereof connected to said implement, power actuated pivot means mounting the other end of said link for reciprocating movement on said frame between a point spaced forwardly of the dipper stick axis of pivot to a point spaced substantially rearwardly of the dipper stick axis of pivot, power means for oscillating said mounting mechanism on said carriage about an axis extending substantially normal to the axes of pivot of said boom and levelling arm.

5. The structure as defined in claim 4 wherein said power means for causing pivotal movement of said upright arm comprises a hydraulic ram pivotally mounted on said mounting mechanism.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,080,077 March 5, 1963

Robert D. Schwellenbach

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 29, for "stock" read -- stick; line 32, for "over" read -- on --.

Signed and sealed this 24th day of September 1963.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents