Jan. 8, 1957 J. G. SANDERSON 2,776,766

TRENCH DIGGER

Filed March 10, 1954

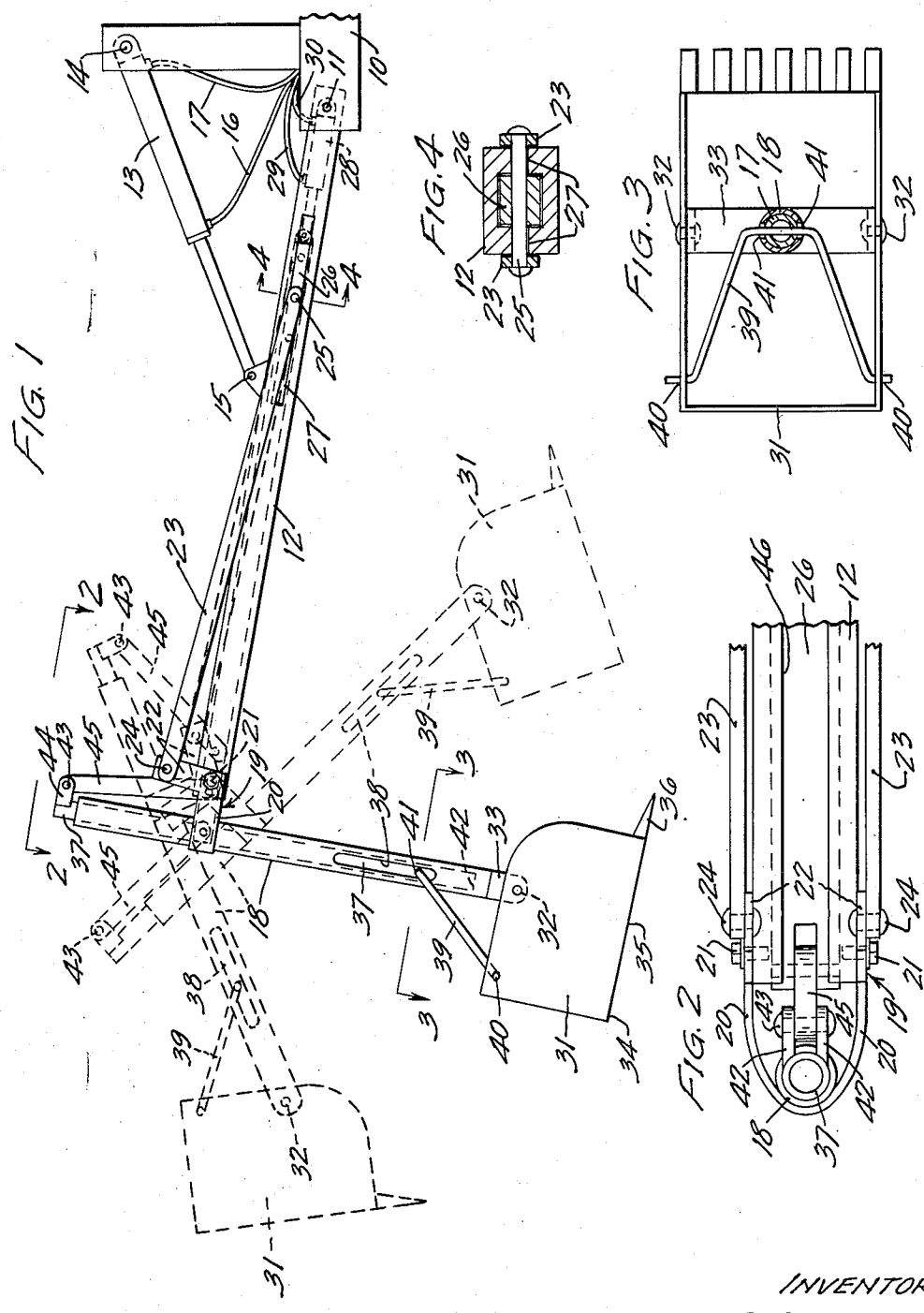


FIG. 1

FIG. 4

FIG. 3

FIG. 2

INVENTOR
JERRY G. SANDERSON
BY
Williamson, Williamson, Schroeder & Adams
ATTORNEYS

United States Patent Office 2,776,766 Patented Jan. 8, 1957

2,776,766

TRENCH DIGGER

Jerry G. Sanderson, Elliston, Mont., assignor of one-half to Floyd C. Frey, Elliston, Mont.

Application March 10, 1954, Serial No. 415,366

4 Claims. (Cl. 214—138)

This invention relates to a trench digger and more particularly to an arm actuating mechanism therefor which will automatically angulate the digging bucket to achieve efficient results.

Numerous trench diggers and excavating equipment have been proposed in which the digging bucket is capable of angulation so as to effect, during the digging stroke, a greater or lesser influence of the teeth portion upon the material which is being excavated and, in some instances, to effect an angulation which will permit undercutting the excavated wall. These prior art devices, however, generally provide additional control means for effecting the angulation of the bucket member. Such additional control means requires added skill on the part of the operator and, in some instances, complicates the digging operation to the point where the efficiency of the digging operation is impaired. In other instances, means are provided for automatically raising the heel portion of the bucket during the digging stroke but not compensating for the elevation thereof during the return stroke nor in the event of a change in position of the main boom.

It is an important object of the present invention to overcome the above noted difficulties and to provide a simple and efficient trench digging device which will automatically provide for proper angulation of the digging bucket in a prescribed manner regardless of the position of the bucket in its digging stroke or of the elevation of the main boom.

It is a further object of the invention to provide for a single control in the digging stroke of a trench digger which will cause the bucket teeth to always define a path or locus below and in spaced clearance with the path or locus described by every portion of the remainder of the bucket bottom.

It is a further object of the invention to provide a bucket angulating control which will automatically function during the digging to prevent the heel portion of the bucket from rubbing and thereby excessively wearing during the use of the trench digger.

It is a still further object of the invention to provide a device of the class described in which the actuating mechanism is associated with the main boom and dipper arm in such a manner as to minimize the wear, lubrication and maintenance 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 reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a side elevation of my trench digger at the boom portion of the device, the shovel being shown in intermediate position in full line and in extended and retracted positions in dotted lines. The main body of the digger including power source, cab and traction elements are omitted as non-essential to the invention;

Fig. 2 is a top enlarged view of the outer end of the main boom and the upper end of the bucket arm taken

in the directions of the arrows 2—2 as viewed in Fig. 1;

Fig. 3 is a sectional enlarged view of the bucket and bucket arm taken on the line 3—3 of Fig. 1; and

Fig. 4 is a sectional enlarged view through the pivotal connection between the arm actuating link and boom plunger taken on the line 4—4 of Fig. 1.

Referring now more particularly to the drawing, my trench digging device may be adapted to any ordinary type of powered vehicle such as a crawler type chasis with a turret platform which is common in the art, said vehicle having a framework 10 to which may be attached the boom mechanism. A segment of the forward part of frame 10, is shown in Fig. 1, and is illustrative of any suitable framework forming a part of the vehicle and power source. Pivotally secured by such means as pin 11 to the frame 10 is the boom 12, the boom 12 being capable of raising and lowering about the pivot pin 11 and swingable from side to side together with the forward portion 10 of the framework. Power means for raising and lowering the boom 12 is supplied and may be typified by hydraulic ram 13 which is pivotally mounted at 14 to frame 10 and at 15 to an intermediate point on the boom 12. Hydraulic lines 16 and 17 are connected to a source of fluid power (not shown) for respective actuation to raise and lower boom 12.

Adjacent the outer end of boom 12 is pivotally mounted a bucket arm 18, the pivotal interconnection being preferably accomplished through an L-shaped double bell crank lever 19 which is rigidly secured at one pair of legs 20 to the bucket arm 18 and is pivotally secured at 21 with the other legs 22 extending laterally to the first mentioned leg and preferably parallel to the bucket arm 18. An arm actuating link means 23 is pivotally secured at 24 to the legs 22 of the bell crank 19 and at the other end of the arm actuating link is provided a pivotal connection 25 with the boom plunger 26. The arm actuating link means may also comprise a pair of links 23 each of which is adapted to work in unison through the pivot pin 24 with the respective legs 22 of bell crank 19. Each of the arm actuating links 23 are pivotally mounted by pin 25 which extend through slot 27 formed at each side of the main boom 12 as shown in Figs. 1 and 4. The boom plunger in turn is extensible and retractable in a longitudinal direction along the boom 12 irrespective of its raised or lowered position. The boom plunger is preferably slidable within the boom 12, a passageway being provided throughout the length thereof to accommodate the boom plunger. The function of the boom plunger will be described herebelow.

Both the arm actuating link means 23 and the boom plunger 26 are simultaneously advanced and retracted by any suitable power means mounted conveniently so as to swing bucket arm 18 forwardly and rearwardly, such as hydraulic ram 28 which is pivotally interconnected between framework 10 as at the pivot pin 11 and the pivot pin 25 which connects the arm actuating link means and the boom plunger. The hydraulic ram may be powered through fluid lines 29 and 30 as shown in Fig. 1.

The bucket arm 18, which was previously described as pivotally mounted to the outer end of main boom 12, has at its lower end a bucket or dipper 31 which is pivotally secured thereto by such means as pivot connections 32 between yoke 33 rigidly formed to the bucket arm 18, the pivotal interconnection being located adjacent the upper edge of bucket 31. Bucket 31 has conventional structure, the bottom portion thereof having at its rear a heel portion 34, an intermediate area 35 and forwardly extending bucket teeth 36.

Longitudinally of the bucket arm 18 and irrespective of its angulation is an arm plunger 37. The arm plunger 37 is preferably slidably retained within a hollow pas-

sageway formed throughout the length of the bucket arm as shown in Fig. 1. Opposed slots 38 are formed at each side of the bucket arm to expose a portion of the arm plunger 37 and to accommodate a pivotal interconnecting link such as bail 39. The bail 39 may be pivoted at each side of the bucket 31 at 40 and may pass through or otherwise be pivoted to the arm plunger 37 at 41. The lower end of arm plunger 37 terminates at 42 and does not interfere with the material loaded in the bucket 31. The upper end of the arm plunger 37 has a pivotal connection as through pin 43 on bracket 44 secured to the upper end of arm plunger 37, with the plunger connecting rod 45. The plunger connecting rod 45 in turn is pivoted to the end of boom plunger 26, the plunger connecting rod being operable through a slotted opening at the upper side of the main boom extending inwardly from the end thereof as shown in Fig. 2, the said slot being designated by the numeral 46.

In the operation of my trench digger boom mechanism, the main boom 12 is swung laterally and lowered to the desired position for making an initial cut into an excavation. It is within the contemplation of this invention to use any conventional type of actuating power such as the hydraulic ram 13 or other means (not shown) such as cable hoist. The arm actuating link and boom plunger are then retracted through such means as the hydraulic ram 28 to swing the bell crank lever 19 in a clockwise arc and hence to advance the bucket 31 to the upper and outermost dotted line position in Fig. 1. It will be noted that the plunger connecting rod will be angulated with respect to the bucket arm and will be so positioned that the arm plunger will be raised a short distance above the top of the bucket arm. The heel 34 of bucket 31 will then be slightly raised with respect to the pivotal mounting 32 between bucket 31 and the bucket arm 18. The hydraulic ram 28 is then caused to extend which in turn operates the bell crank lever in a counterclockwise direction bringing the bucket 31 downwardly in a digging stroke. The full line position of Fig. 1 shows the intermediate condition of the bucket arm and the angulation of the bucket as the bucket teeth 36 are approaching their lowermost point of digging. At this intermediate position, the boom plunger and arm actuating link have been moved forwardly and simultaneously, causing the plunger connecting rod to close its angulated relation with the bucket arm. At the same time, the relative swinging movement of the bucket arm has caused the arm plunger to move to its lowermost relative position with respect to the bucket arm and hence lowering the heel portion 34 to its lowermost position with respect to the bucket arm 18 during the entire stroke of the bucket. As the hydraulic ram 28 continues to extend the bucket arm and bucket will be swung to the lower and innermost dotted line position shown in Fig. 1, the excavating stroke is nearing its completion and the arm actuating link and boom plunger continue to move forwardly, the outer ends thereof again tending to converge as the arms 22 of bell crank 19 proceed in a counterclockwise direction. The arm plunger again rises with respect to the bucket arm, causing the heel 34 of bucket 31 to rise with respect to the bucket arm 18. With the bucket in raised position, the boom 12 may be swung to one side and the contents of the bucket unloaded in conventional manner. When the arm is again swung back to its digging position, it will not be necessary to vertically swing the arm through a large arc. In most instances, the arm can be left at its previous height, the heel 34 of the bucket maintaining clearance with the ground or its backward stroke. It is then only necessary to lower the boom for a slight distance to condition the boom mechanism for the next excavating cut.

Fig. 1 shows both the locus of the bucket teeth 36 in passing from its forward position to the rearmost position and also shows the locus of the heel portion of bucket 31 while making the same stroke with the boom 12 in the same position. It will be noted that the bucket is caused to dig sharply downwardly in the beginning of its stroke, then inwardly in a path having a very low rate of curvature, then in the final stages of the stroke will again abruptly move upwardly to finish the digging operation. The low rate of curvature at the medial digging portion of the stroke makes for more uniform finishing of excavations, since there is not so much tendency for the bucket to gouge in short arcuate paths. Furthermore, during this desirable bucket angulation the heel portion 34 has, at all times, been maintained in a locus which is in spaced relation above the locus of the digging teeth 36. Thus, excessive wear and unnecessary power are avoided in the operation of my device.

It may thus be seen that I have devised a trench digger and boom mechanism therefor which is highly efficient in manipulation, automatically accomplishing a prescribed path and angulation without the use of additional control levers, the mechanism which creates the advantageous action and activity of the digging bucket being designed for minimum wear and easy maintenance.

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

What I claim is:

1. A trench digger boom mechanism comprising, a forwardly extending boom capable of being raised, lowered and moved from side to side, a bucket arm pivotally secured adjacent the outer end of said boom and having a lower extension swingable outwardly and inwardly with respect to said boom, a digging bucket pivotally secured to the lower end of said extension, said bucket being provided with a bottom member having a heel portion at the rear with respect to the direction of travel during digging movement thereof and a tooth portion at the fore, an arm actuating link for pivotally swinging said bucket arm forwardly and rearwardly, a boom plunger mounted for reciprocation longitudinally of said boom, an arm plunger mounted for reciprocation longitudinally of said bucket arm, a plunger connecting rod pivotally interconnecting said boom plunger and said arm plunger, a pivotal interconnecting link between said arm plunger and said bucket at a point to one side of the pivotal connection of said bucket arm with the bucket, and power means for simultaneously reciprocating said arm actuating link and said boom plunger whereby to swing said bucket forwardly and rearwardly with the locus of said teeth during said swing underlying in spaced clearance the locus of the heel of the bucket bottom.

2. A trench digger boom mechanism comprising a forwardly extending boom capable of being raised, lowered and moved from side to side and having a passageway extending longitudinally of its length, a bucket arm pivotally secured adjacent the outer end of said boom for swinging inwardly and outwardly with respect to the boom and having a longitudinally passageway disposed therethrough, a digging bucket pivotally secured to the lower end of said extension, said bucket being provided with a bottom member having a heel portion at the rear with respect to the direction of travel during digging movement and a tooth portion at the fore, an arm actuating link for pivotally swinging said bucket arm forwardly and rearwardly, a boom plunger mounted for reciprocation within the passageway of said boom, an arm plunger mounted for reciprocation within the passageway of said bucket arm, said arm plunger and boom plunger being pivotally interconnected at their respective upper and outer ends, a pivotal interconnecting link between said arm plunger at a lower portion thereof and a rearward portion of said bucket, and power means for simultaneously reciprocating said arm actuating link and said boom plunger whereby to swing said bucket forwardly and rearwardly with the locus of said teeth during said swing underlying in spaced clearance the locus of the heel of the bucket bottom.

3. In a trench digger, a forwardly extending boom capable of being raised, lowered and moved from side to side, a bucket arm pivotally secured adjacent the outer end of said boom and having a lower extension swingable outwardly and inwardly with respect to said boom, a digging bucket pivotally secured to the lower end of said extension, said bucket being provided with a bottom member having a heel portion at the rear with respect to the direction of travel during digging movement thereof and a tooth portion at the fore, a boom plunger mounted for reciprocation longitudinally of said boom, an arm link pivotally secured inwardly from the outer end of said boom to the boom plunger and movable inwardly and outwardly with respective outward and inward movement of said bucket arm, an arm plunger mounted for reciprocation longitudinally of said bucket arm, a plunger connecting rod pivotally interconnecting said boom plunger and said arm plunger, a pivotal interconnecting link between said arm plunger and said bucket at a point to one side of the pivotal connection of said bucket arm with the bucket, and power means for simultaneously reciprocating said boom plunger and said arm link whereby to swing said bucket forwardly and rearwardly with the locus of said teeth during said swing underlying in spaced clearance the locus of the heel of the bucket bottom.

4. In a trench digger, a forwardly extending boom capable of being raised, lowered and moved from side to side, a bucket arm pivotally secured in inwardly offset

relation to an outer portion of said boom and having a lower extension swingable outwardly and inwardly with respect to said boom, a digging bucket pivotally secured to the lower end of said extension, said bucket being provided with a bottom member having a heel portion at the rear with respect to the direction of travel during digging movement thereof and a tooth portion at the fore, a boom plunger mounted for reciprocation longitudinally of said boom, an arm link pivotally interconnected with said boom at an inward position, and interconnected pivotally with said bucket arm at a position above the inward offset pivotal connection of said arm with the boom, an arm plunger mounted for reciprocation longitudinally of said bucket arm, a plunger connecting rod pivotally connecting said boom plunger and said arm plunger, a pivotal interconnecting link between said arm plunger and said bucket at a point to one side of the pivotal connection of said bucket arm with the bucket, and power means for simultaneously reciprocating said arm link and said boom plunger whereby to swing said bucket forwardly and rearwardly with the locus of said teeth during said swing underlying in spaced clearance the locus of the heel of the bucket bottom.

References Cited in the file of this patent

UNITED STATES PATENTS

2,498,000 McLean ---------- Feb. 21, 1950