Feb. 7, 1950 H. C. BURNER ET AL 2,496,696

BACK HOE EXCAVATING IMPLEMENT WITH TILTABLE BUCKET

Filed July 27, 1948 2 Sheets-Sheet 1

FIG. 1.

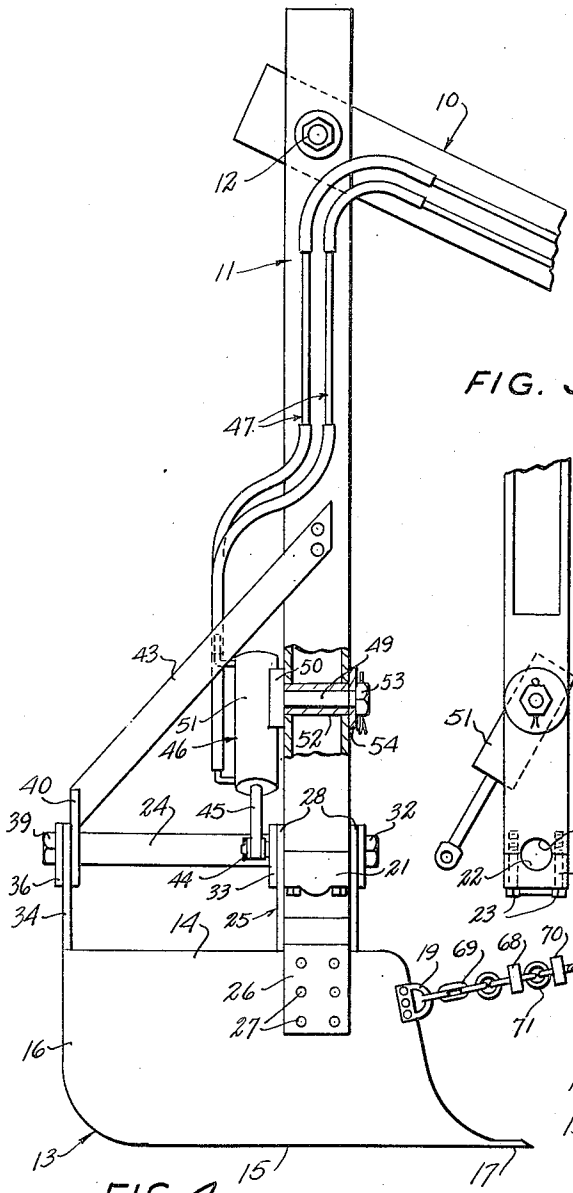


FIG. 2.

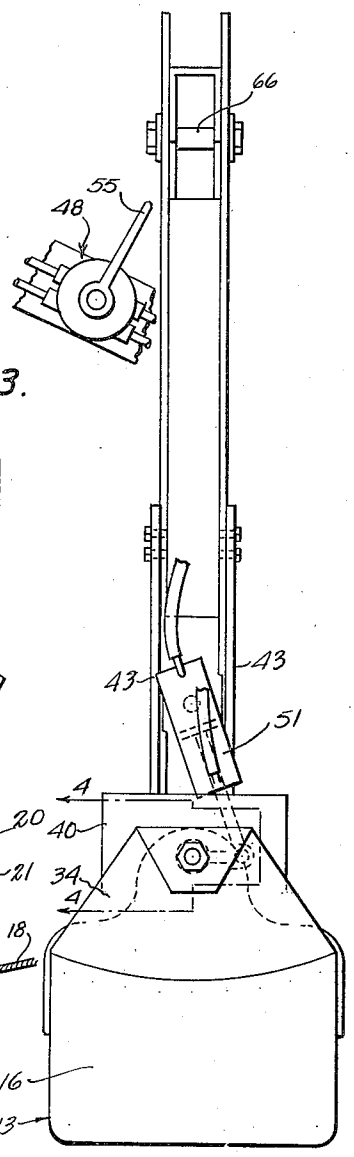
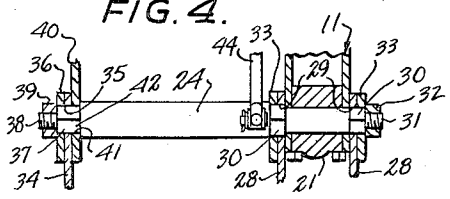


FIG. 3.

FIG. 4.



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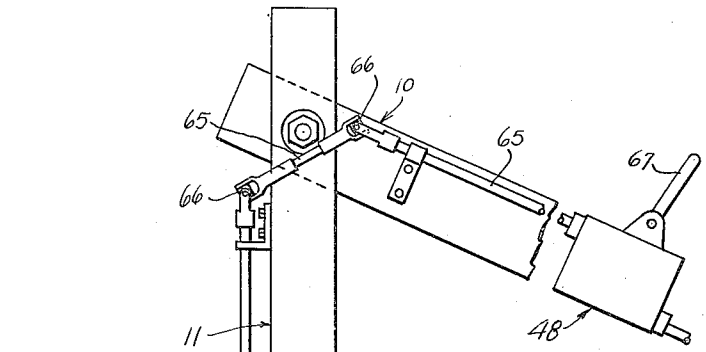


FIG. 5

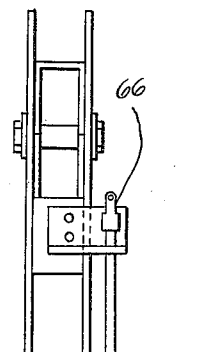


FIG. 6.

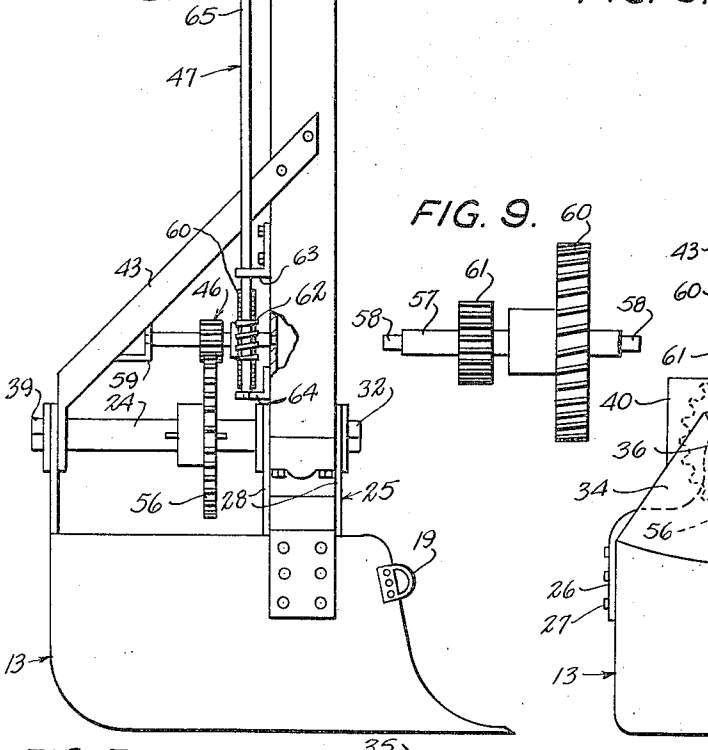


FIG. 9.

FIG. 7.

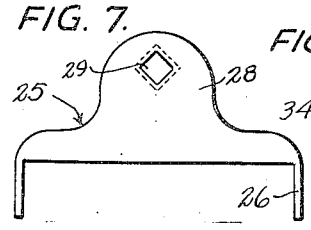
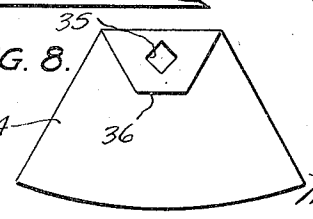


FIG. 8.



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BACK HOE EXCAVATING IMPLEMENT WITH TILTABLE BUCKET

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6 Claims. (Cl. 214—138)

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This invention relates to excavating implements, such as back or trench hoes, and more particularly to a back hoe having manually-controlled mechanism for adjustably tilting the bucket thereof.

It is among the objects of the invention to provide an improved back hoe excavating implement, which is operative to open an elongated evacuation or trench having a level or horizontal bottom, even though the implement may be operating on an inclined land surface, such as a hillside, so that two or more pipelines may be laid in the trench on a level with each other and without the inconvenience occasioned by the tendency of pipe sections to roll down an inclined trench bottom, and to provide simple and inexpensive, power - operated, manually - controlled mechanism easily installed on a conventional back-hoe implement without material modification of the implement for laterally tilting the excavating bucket of the implement to maintain the trench bottom substantially horizontal.

Other advantages and objects will become apparent from a consideration of the following description, and the appended claims, in conjunction with the accompanying drawings wherein:

Figure 1 is a side elevation of a fragmentary portion of an excavator boom, a boom stick and excavating bucket showing bucket-tilting mechanism illustrative of the invention operatively applied thereto;

Figure 2 is a rear-end elevation of the assembly illustrated in Figure 1;

Figure 3 is a front elevation of a fragmentary lower portion of the boom stick showing the application thereto of power-operated tilting means illustrative of the invention;

Figure 4 is a transverse cross-section of a fragmentary portion of the assembly taken substantially on the line 4—4 of Figure 2.

Figure 5 is a side elevation similar to Figure 1 showing a somewhat modified form of power-operated bucket-tilting mechanism;

Figure 6 is a rear elevation of the assembly illustrated in Figure 5;

Figure 7 is a plan view of a bail attached to the bucket for providing a pivotal connection between the bucket and the boom stick of the excavator;

Figure 8 is a rear view of a plate for attaching the rear end of the bucket to the pivotal connection; and

Figure 9 is a side elevation of a gear element constituting an operative component of the power-operated, bucket-tilting means.

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With continued reference to the drawings, and particularly to Figures 1 to 4 inclusive, the excavator boom is of conventional construction, and generally indicated at 10. The boom stick or bucket handle, generally indicated at 11, is pivotally connected to the boom near the outer end of the latter and near the upper end of the boom stick by a suitable pivotal connection, such as the pivot bolt 12, and the excavating bucket, generally indicated at 13, is suspended from the boom 10 by the boom stick 11. This bucket has a pair of substantially parallel side-walls 14, a bottom wall 15, and a rear-end closure wall 16. The front end of the bucket is open and the bottom wall is extended forwardly and provided with bits or teeth 17 for biting into earth or other material to open an elongated excavation or trench for the laying of pipe or other purpose.

Such a conventional back-hoe excavator is usually mounted on endless tracks and straddles the line of the trench. The boom 10 extends from one end of the excavator and is movable to lower the boom stick 11 and bucket 13 into the trench with the front end of the bucket facing the end of the trench adjacent the excavator. A pair of pull cables 18 is wound upon suitable power-driven drums provided in the excavator and are attached to the front end of the bucket by suitable means, such as the loops 19, to pull the bucket toward the excavator and force the front end of the bucket into the earth wall at the corresponding end of the trench. When the bucket has been filled with earth, it is raised out of the trench by the boom 10, the excavator is swung about its pivotal mounting in well-known manner, to carry the load of earth to one side of the trench and the boom stick is then forced outwardly to tip the bucket and dump its load of earth to one side of the trench being excavated. Where the trench extends across a hillside, the excavator, straddling the line of the trench, will be tilted and the boom 10 and boom stick 11 will be correspondingly tilted, so that the bottom wall 15 of the bucket will be substantially parallel to the inclination of the hillside, rather than being level or horizontal. Where the bucket is rigidly secured to the bucket-adjacent-end of the boom stick, as is conventional, the bottom of the trench will be inclined in the same direction and at the same angle as the slope of the hillside through which the trench is dug, with the result that material difficulty is encountered in laying pipe sections in the trench and coupling the sections together, particularly where it is desired to lay two separate lines of pipe in the same trench.

By means of the present invention, the bottom wall of the bucket can be maintained substantially level or horizontal regardless of the inclination of the land surface upon which the excavator operates.

In accordance with this objective, the bucket 13 is pivotally connected to the lower or bucket-adjacent-end of the boom stick 11 by means which, while permitting free lateral tilting of the bucket relative to the boom stick, positively preclude any longitudinal tilting of the bucket relative to the boom stick, and is of sufficiently rugged construction to adequately support all operative loads between the bucket and the boom stick.

As illustrated, this pivotal connection comprises a semi-cylindrical bearing recess 20 provided in the bucket-adjacent-end of the boom stick and extending transversely of the boom stick in a fore-and-aft direction, and a bearing cap 21 having a complementary bearing recess 22 therein secured to the bottom end of the boom stick by suitable means, such as the cap screws 23. A shaft 24 is journaled in the bearing provided by the recesses 20 and 22 and extends through the boom stick from the side of the boom stick adjacent the forward end of the bucket to a position substantially in alignment with the rear end-wall 16 of the bucket.

A U-shaped bail, generally indicated at 25, of channel-shaped cross-section is secured to the side-walls of the bucket adjacent the forward, open end of the latter and extends upwardly above the bucket with the side flanges of the U-shaped section upstanding from the transverse web portion thereof. The end portions 26 of the bail are extended downwardly and apertured to receive bolts 27 by means of which the bail is rigidly secured to the side-walls of the bucket.

The flanges 28 of the bail are disposed one at each side of the bearing-including end of the boom stick 11 and are provided substantially at the mid-length location of the bail with non-circular, shaft-receiving openings 29. The shaft is provided with non-circular portions 30 thereon received in and closely fitting the non-circular openings in the flanges 28 of the bail so that the bail will be turned to tilt the bucket upon turning the shaft. The outer opening 29 and corresponding shaft portion 30 are preferably smaller than the inner opening in corresponding shaft portion in order to facilitate assembly of the device and the shaft is provided with a reduced, externally screw-threaded end portion 31 receiving a nut 32 which clamps the bail in operative position on the shaft and also secures the shaft against longitudinal movement relative to the boom-stick bearing.

The flanges 28 are provided with respective reinforcing plates 33 secured to the flanges and provided with openings registering with the openings 29 to provide a strong and rigid attachment between the bail 25 and the shaft 24.

A flat, trapezoidal plate 34 is rigidly secured along its longer edge to the upper edge of the back-wall 16 of the bucket in upstanding relationship, and is provided adjacent its upper edge and substantially at the mid-length location of the latter with a non-circular opening 35 receiving the rear-end portion of the shaft 24. A reinforcing plate 36 is secured to plate 34 and provided with an opening registering with the opening 35 and the shaft is provided with a non-circular portion 37 received in the opening in plate 34 and reinforcement 36 and closely fitting this opening to connect the shaft to the plate against

relative rotation. The shaft is provided at this rear end with a screw-threaded, reduced extension 38 which receives a nut 39 for clamping the plate 34 on the shaft. A plate 40 is provided with a circular opening 41 receiving a circular-shaft portion 42 disposed inwardly of the shaft portion 37 and a pair of parallel, diagonal braces 43 is secured at their corresponding lower ends to the plate 40 and at their upper ends to the boom stick 11, one at each side and intermediate the length of the latter to support the rear end of the shaft 24.

With this arrangement the bucket is freely tiltable laterally relative to the boom stick 11 about the axis of shaft 24, so that the bottom wall of the bucket can be maintained in a substantially horizontal plane regardless of the lateral inclination of the excavator.

In order to provide manually-controlled tilting of the bucket about the axis of shaft 24, an arm 44 projects radially from the shaft 24 adjacent the side of the boom stick opposite the front open end of the bucket and a link 45 is pivotally connected to the outer or distal end of arm 44. A power-operated mechanism, generally indicated at 46, is mounted on the boom stick 11 above the shaft 24 and operatively connected to the link 45, power-transmitting means, generally indicated at 47 extend from mechanism 46 to the excavator to receive power from the excavator power plant and transmit it to the mechanism 46, and a manually-operated device, generally indicated at 48, effective to reversibly control the application of power to the mechanism 46 is operatively interposed in the power-transmitting means 47.

In the arrangement illustrated in Figures 1 and 2, the mechanism 46 is a conventional, expansible chamber hydraulic device, such as a cylinder and piston device, pivotally mounted on the boom stick by means of a pivot pin 49 secured at one end to a plate 50 secured on the cylinder 91 and extending through a tubular bearing bushing 52 in the boom stick. A nut 53 is threaded onto the end of pin 49 opposite the cylinder and bears against a thrust washer 54 to maintain the cylinder in operative association with the boom stick. The power-transmitting means 47 comprise a pair of hydraulic conduits extending one from each end of the cylinder to a suitable hydraulic pump provided in the excavator, and the manually-operated control means 48 comprise a conventional four-way reversing valve interposed in the hydraulic conduits 47 and provided with a manually-movable handle 55.

In the somewhat modified arrangement, illustrated in Figures 5 to 9 inclusive, a spur gear 56 secured on shaft 24 is substituted for the arm 44 and the power-operated mechanism 46 comprises a shaft 57 having reduced end portions 58 one of which is journaled in a bearing aperture provided in the adjacent side-wall of the boom stick 11, and the other of which is journaled in a bracket 59 secured to the braces 43, a worm gear 60 secured on shaft 57, a spur gear 61 also secured on the shaft in spaced relationship to the worm gear 60 and meshing with the gear 56, and a worm 62 meshing with worm gear 60 and journaled at its ends in upper and lower brackets 63 and 64 respectively, secured on the rear-wall of the boom stick. The power-transmitting means comprise a plurality of shafts 65 extending in end-to-end relationship along the boom stick 11 and boom 10 and drivingly interconnected by conventional universal joints 66,

and the manually-operated control means 48 comprise a clutch-and-reversing-gear assembly of conventional construction having an operating handle 67 projecting therefrom.

A cross-bar 68 is connected at its ends to the bucket 13 by chain links 69 secured one between each end of the cross-bar and the corresponding loop 19. A second cross-bar 70 has the two cables 18 secured one to each end thereof and a swivel connection 71 is operatively connected between the cross-bars 68 and 70, so that the cables 18 will not be tilted when the bucket 13 is tilted and the cables will thus not be caused to operate unevenly on the cable drums.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

What is claimed is:

1. In an excavating implement having a boom, an excavating bucket, and a boom stick pivotally secured to said boom and suspending said bucket from said boom, and pull cables attached to the front open end of said bucket, means providing a pivotal connection between said boom stick and said bucket for tilting movement of said bucket relative to said stick about a pivotal axis extending longitudinally of said bucket, power-operated means operatively connected between said boom stick and said bucket for tilting said bucket about said pivotal axis, and a swivel connection between said pull cable and said bucket.

2. In an excavating implement having a boom, an excavating bucket, and a boom stick pivotally secured to said boom and suspending said bucket from said boom, means providing a pivotal connection between said boom stick and said bucket for tilting movement of said bucket relative to said boom stick about a pivotal axis extending longitudinally of said bucket, and power-operated means operatively connected between said boom stick and said bucket for tilting said bucket about said pivotal axis.

3. In an excavating implement having a boom, an excavating bucket, and a boom stick pivotally secured to said boom and suspending said bucket from said boom, means providing a pivotal connection between said boom stick and said bucket for tilting movement of said bucket relative to said boom stick about a pivotal axis extending longitudinally of said bucket, and power-operated means operatively connected between said boom stick and said bucket for tilting said bucket about said pivotal axis, said means providing said pivotal connection comprising a shaft bearing in the bracket-adjacent end of said boom stick, a shaft journaled in said bearing and extending through said stick, a U-shaped bail of channel-shaped cross-section secured to the sides of said bucket near the front end of the latter and extending upwardly from said bucket with its flanges disposed one at each side of said boom stick substantially at the mid-length location of said bail, each of said flanges having a non-circular, shaft-receiving opening therein and said shaft having non-circular portions received in said openings, a plate secured to the rear, closed end of said bucket and upstanding therefrom, said plate having a shaft-receiving opening in alignment with the shaft-receiving openings in said bail and said shaft having a reduced end portion received in said plate opening, and a pair of nuts threaded one on each end of said shaft to retain said bail and said plate in operative position on said shaft.

4. In an excavating implement having a boom, an excavating bucket, and a boom stick pivotally secured to said boom and suspending said bucket from said boom, means providing a pivotal connection between said boom stick and said bucket for tilting movement of said bucket relative to said boom stick about a pivotal axis extending longitudinally of said bucket, and power-operated means operatively connected between said boom stick and said bucket for tilting said bucket about said pivotal axis, said means providing said pivotal connection between the bucket and the boom stick comprising a shaft bearing in the bucket-adjacent end of the boom stick, a shaft journaled in said bearing, a bail secured at its ends to said bucket near the front end of the latter and secured intermediate its length to said shaft against relative rotation, means securing said shaft to the rear end of said bucket, and diagonal brace means inter-connected between the end of said shaft and rear end of said bucket and said boom stick intermediate the length of the latter.

5. In an excavating implement having a boom, an excavating bucket, and a boom stick pivotally secured to said boom and suspending said bucket from said boom, means providing a pivotal connection between said boom stick and said bucket for tilting movement of said bucket relative to said boom stick about a pivotal axis extending longitudinally of said bucket, and power-operated means operatively connected between said boom stick and said bucket for tilting said bucket about said pivotal axis, said means providing said pivotal connection comprising a shaft bearing in the bucket-adjacent end of said boom stick, a shaft journaled in said bearing, a bail secured at its ends to said bucket near the front end of the latter and secured intermediate its length to said shaft against relative rotation, and means securing said shaft to the rear end of said bucket, and said power-operated means comprising an arm projecting radially on said shaft, a hydraulic cylinder pivotally mounted on said boom stick, and a link pivotally connected at one end to the distal end of said arm and extending into said cylinder to move said arm by the application of hydraulic fluid under pressure to a piston carried by said link within said cylinder, and hydraulic conduit means connected with said cylinder for supplying hydraulic fluid under pressure thereto.

6. In an excavating implement having a boom, an excavating bucket, an a boom stick pivotally secured to said boom and suspending said bucket from said boom, means providing a pivotal connection between said boom stick and said bucket for tilting movement of said bucket relative to said boom stick about a pivotal axis extending longitudinally of said bucket, and power-operated means operatively connected between said boom stick and said bucket for tilting said bucket about a pivotal axis, said means providing said pivotal connection comprising a shaft bearing in the bucket-adjacent end of said boom stick, a shaft journaled in said bearing, a bail secured at its ends to said bucket near the front end of the latter and secured intermediate its length to said shaft against relative rotation, and means securing said shaft to the rear end of said bucket, and

said power-operated means comprising a spur gear secured on said shaft, a jack shaft rotatably mounted adjacent said shaft and having a spur gear thereon meshing with said first-mentioned spur gear, a worm gear on said jack shaft, a worm journaled on said boom stick and meshing with said worm gear, drive shafts extending in end-to-end relationship from said worm to the excavator, and universal joints drivingly connecting together the adjacent ends of said drive shafts.

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