United States Patent

Schwing

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[45] **Apr. 18, 1972**

[54] BUCKET MOUNTING FOR TRENCH HOE

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Related U.S. Application Data

[62] Division of Ser. No. 817,062, Apr. 17, 1969, Pat. No. 3,586,182.

[52] **U.S. Cl.** .....**214/138 R,** 214/770
[51] **Int. Cl.** **E02f 3/32**
[58] **Field of Search** .....214/138, 138 B, 138 C, DIG. 10, 214/762, 145, 140, 137

[56] **References Cited**

UNITED STATES PATENTS

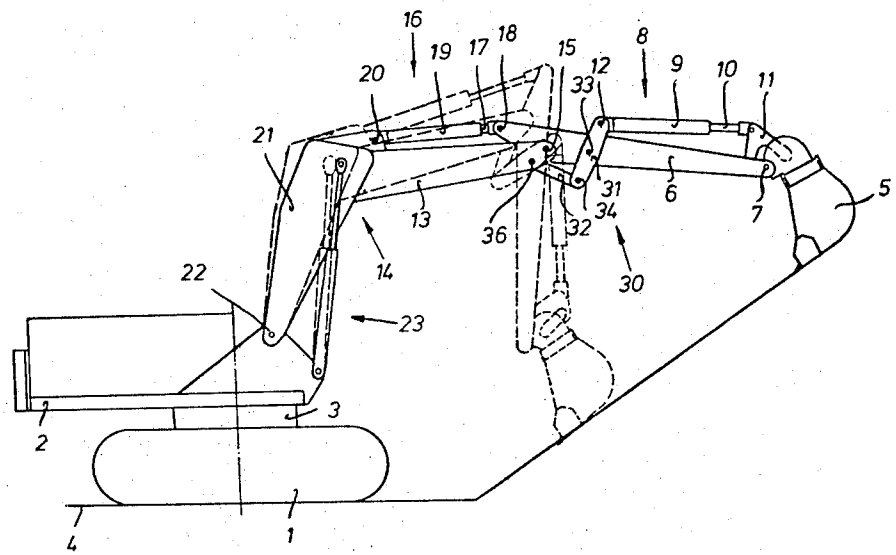
3,487,958	1/1970	Shook et al.	214/138 X
3,412,880	11/1968	Tweedale	214/138
3,197,049	7/1965	Schwing	214/138

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[57] **ABSTRACT**

A trench hoe which, when in operation, maintains the digging bucket at a given digging angle. The digging bucket is constructed as a ditcher and the dimension of the trapezoid control system consisting of the bucket, the dipper arm, the front thrust piston drive, and the link means between the front thrust piston drive and the dipper arm, in relation to the dimensions of the outrigger arm is such that the dipper arm in operation at the desired angle of slope or gradient is guided approximately parallel within a predetermined range of angles of slope or gradients.

3 Claims, 6 Drawing Figures



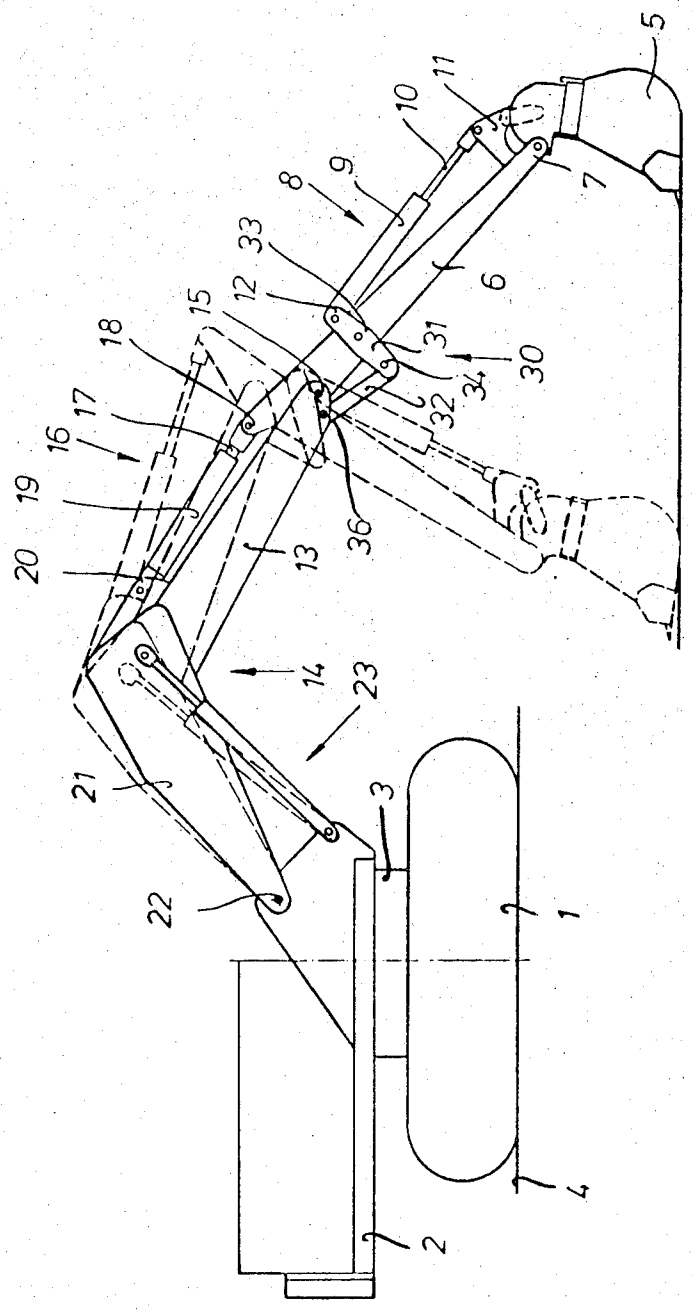


FIG. 1

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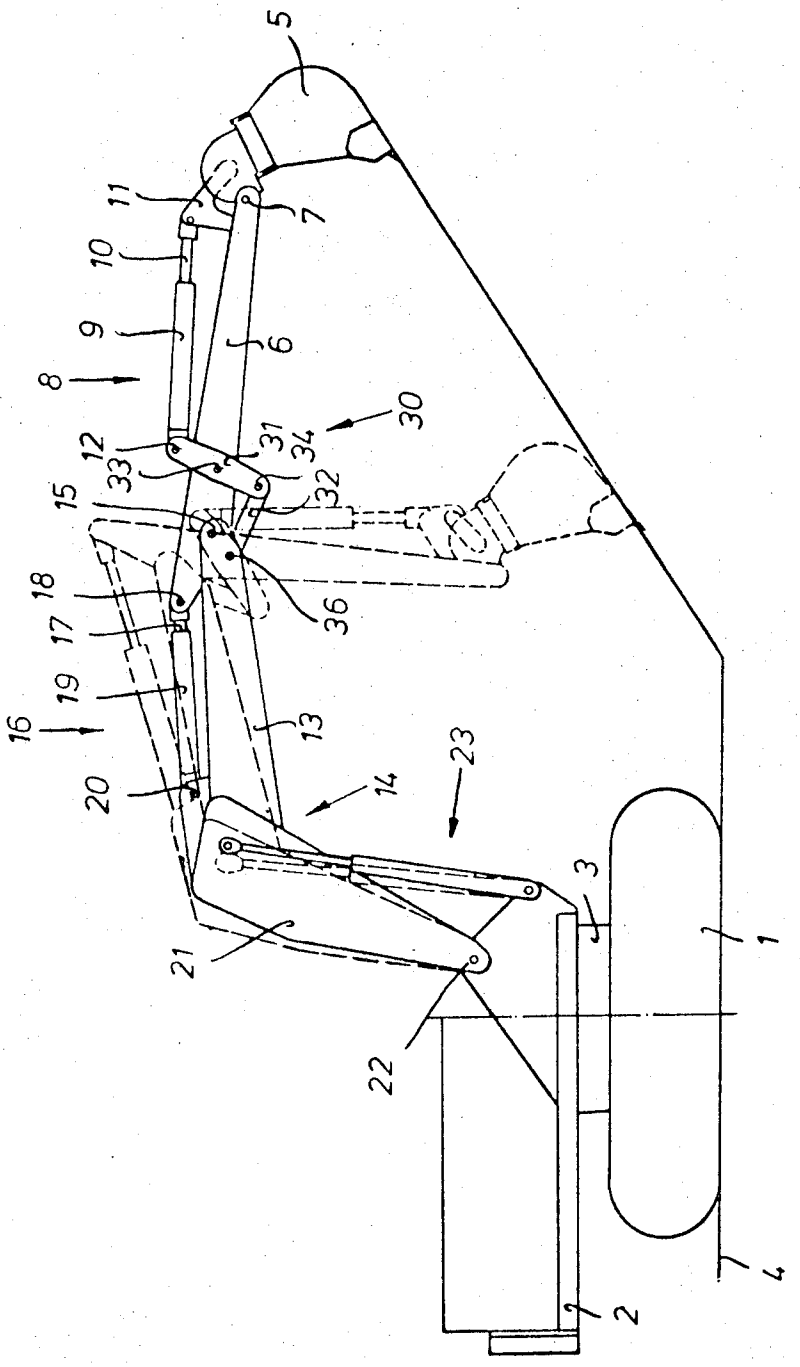


FIG. 2

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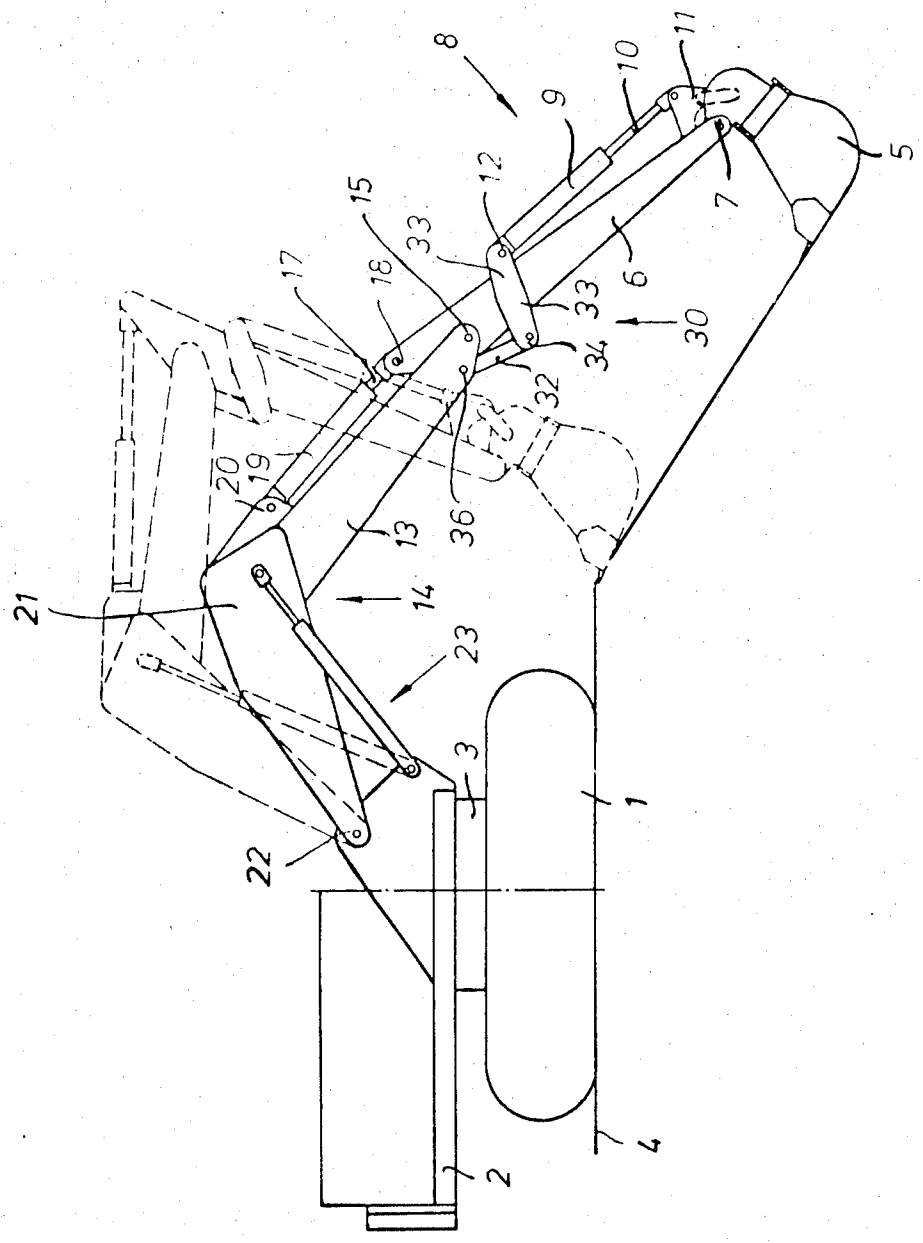


FIG. 3

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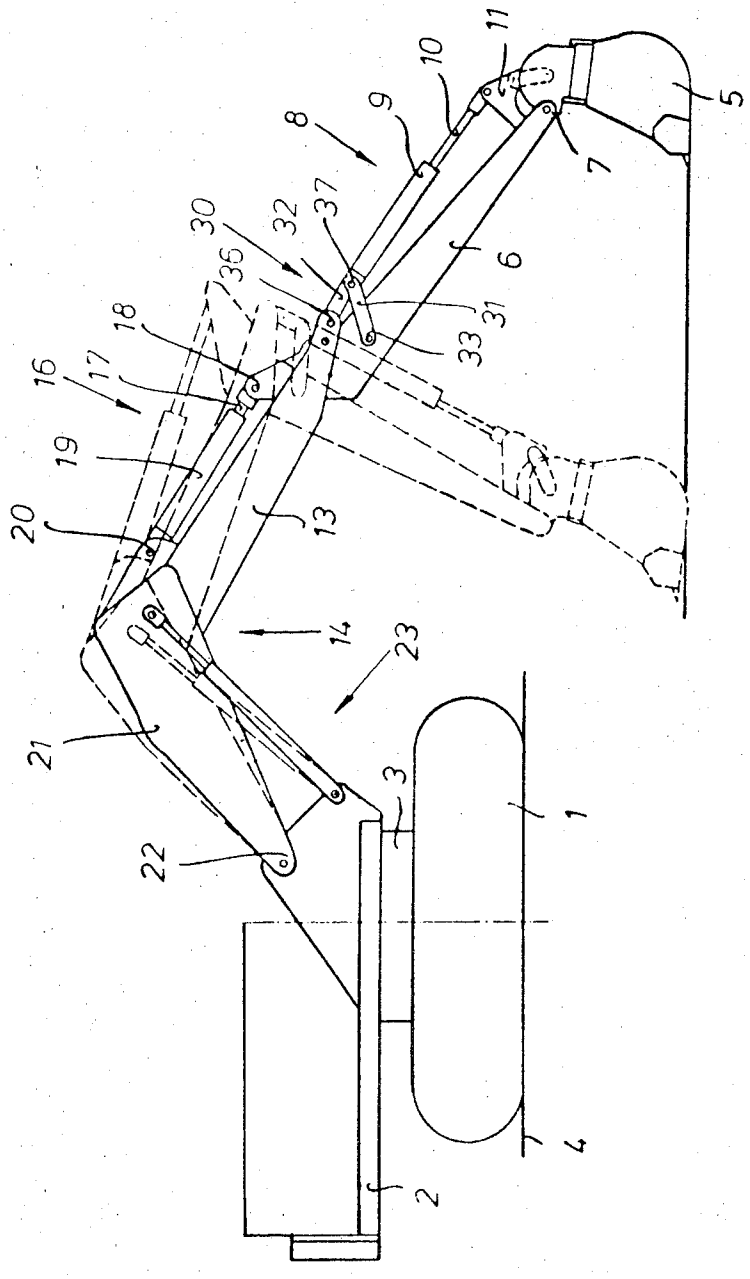


FIG. 4

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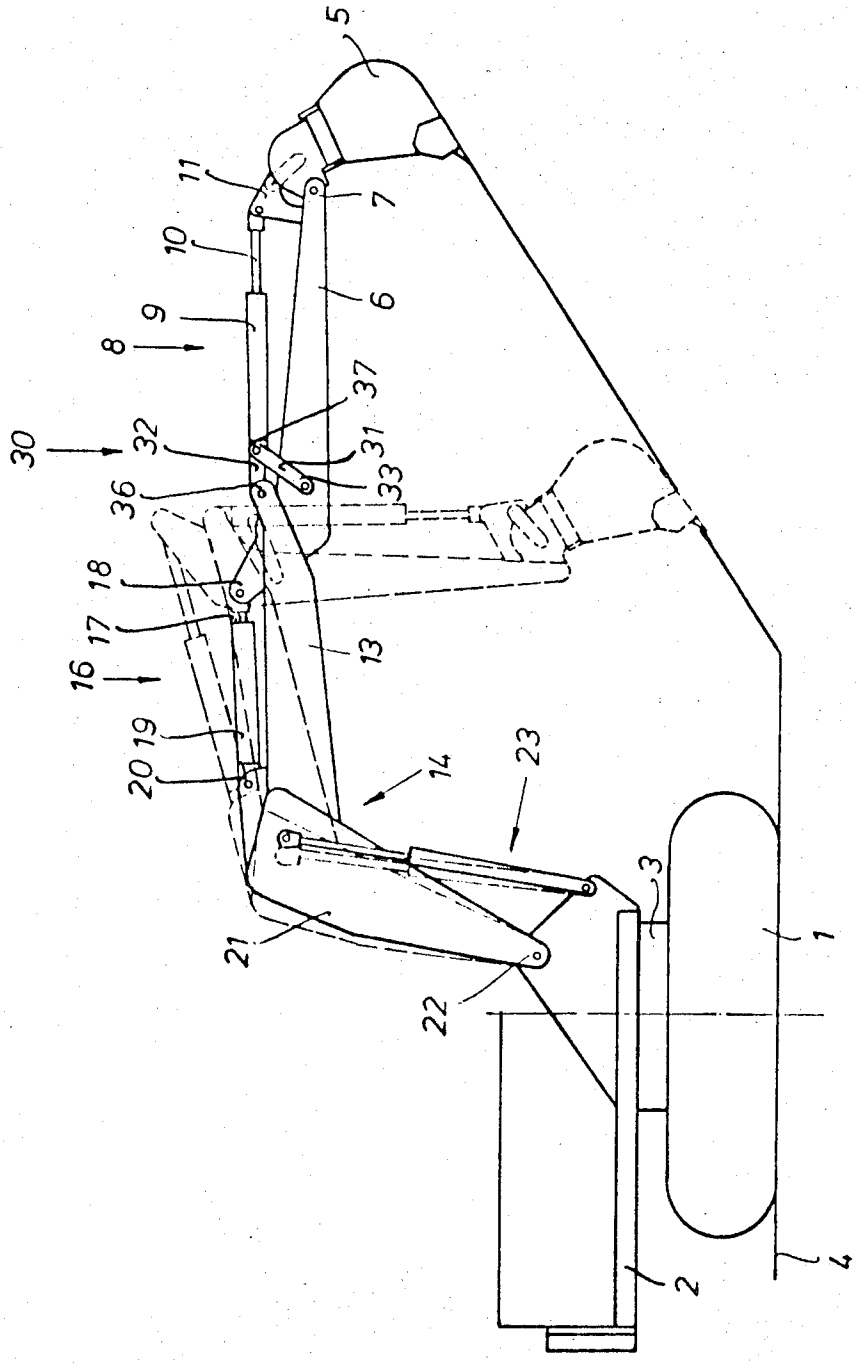


FIG. 5

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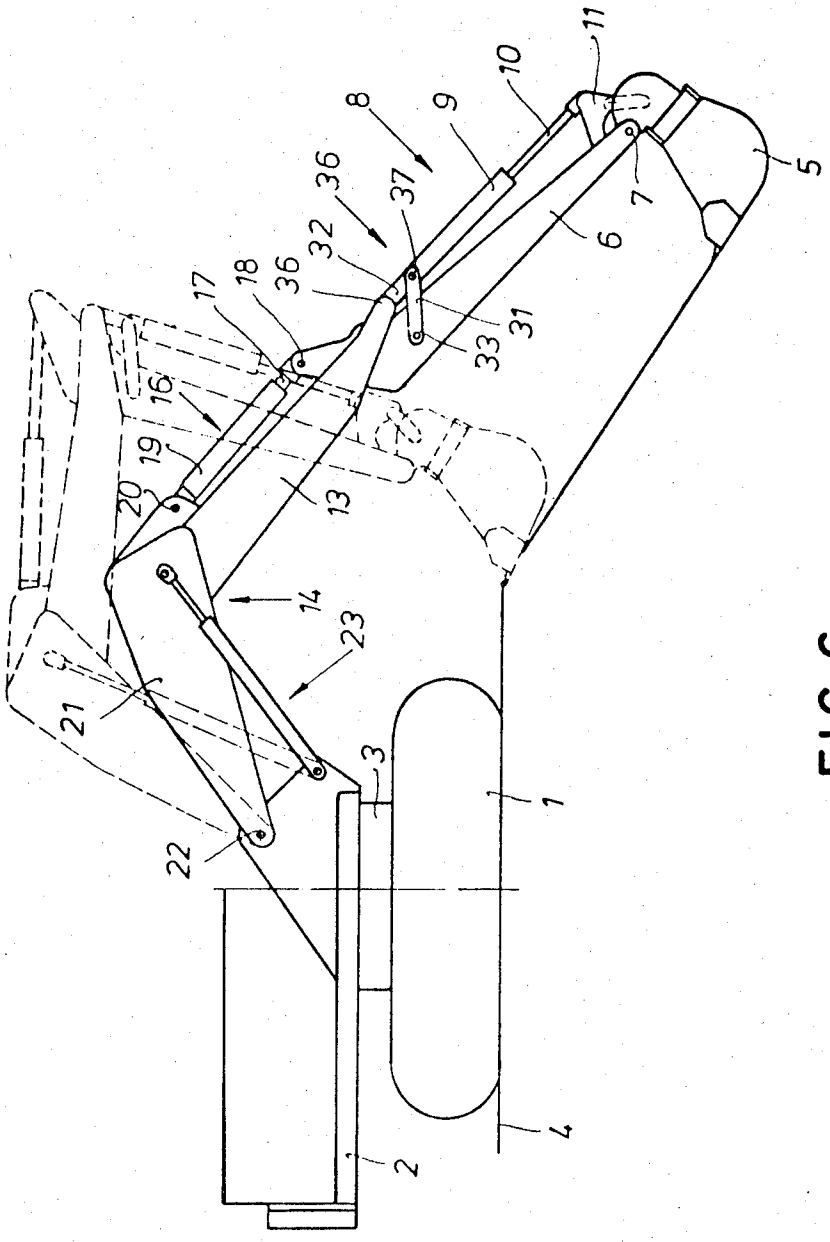


FIG. 6

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BUCKET MOUNTING FOR TRENCH HOE

CROSS REFERENCE TO RELATED APPLICATION

This application constitutes a division of my copending application, Ser. No. 817,062, filed Apr. 17, 1969, and entitled Bucket Mounting For Trench Hoe, now U.S. Pat. No. 3586182.

BACKGROUND OF THE INVENTION

The invention relates to a trench hoe provided with a digging bucket which is pivoted to a shaft for actuation by a forward thrust hydraulic piston. The bucket shaft may be pivoted to an outrigger arm, which is actuated by a rear thrust piston. A third thrust piston is provided for actuating the assembly. Such mechanism must be as simple as possible to keep the cost as low as possible, but it must be controllable by the operator with a minimum of control movements.

With known trench hoes, the front piston drive, which serves for the actuation of the digging bucket, is pivoted to the shaft. With these devices, the excavator operator must actuate three thrust piston drives simultaneously, if the digging bucket is guided along a straight line and the correct digging angle is to be carried out. Therefore, the trench produced in this manner is very inaccurate.

Trench hoes are, however, already known which entirely take away from the operator this type of complicated control movements. These trench hoes adhere exactly to a given digging angle, because the digging bucket is guided forcefully on a straight line. The technical expenditure required for the purpose, however, is appreciable, because of the multiplicity of necessary control devices.

The trench hoe above described was previously solely to be driven with a loading or charging shovel, and insures, however, an almost parallel guidance of the shovel solely upon horizontal thrust at the height of the plane of position of the machine.

SUMMARY OF THE INVENTION

The problem serving as basis for the invention is to construct the trench hoe in such manner, that with a movement imparted to it, the digging bucket maintains a given digging angle. This problem is solved according to the invention, in that the digging bucket is constructed as a ditcher and that the dimension of the trapezoid control system is so chosen that the dipper arm in operation at a desired angle of slope or gradient is guided approximately parallel within a predetermined range of angles of slope or gradients.

Thereby it is attained that upon control of the excavator operator, the front thrust piston drive need not be adjusted at all or only to a slight degree for the maintenance of the angle of intersection. It may be restricted substantially to the actuation entirely of the rear thrust piston drive and of making corrections by the third thrust piston drive.

It is first of all surprising that if the excavator operator omits these corrections, a trial line results because apparently the parallel guidance characteristics of the ditcher are so excellent that through raising of the excavator as the case may be, the correction omitted by the excavator operator will be carried out automatically.

In accordance with the invention, the end of the front thrust piston drive facing away from the digging bucket is connected with a control system, which has a front control articulated to the dipper arm and a rear control which is rotatably fixed to the outrigger arm.

This control system so dimensioned that the parallel control characteristics of the trencher are maintained. On the other hand, however, by correspondingly dimensioning the lengths of the controls, the the guide drive and the dipper arm to the outrigger arm are from one another, that they can be accommodated without construction problems.

According to the invention, the front guide rod of the control system is articulated between its two ends to the dipper arm, whereby one of its ends is rotatably fixed to the front thrust piston drive and the other end to the second guide rod swingably positioned on the outrigger arm. The front guide rod forms accordingly a double armed lever and the entire control system consists solely of two guide rods.

This holds true also for a further embodiment of the invention, in which the front thrust piston drive is articulated in the apex of the two control drive, whose ends are fixed rotatably to the dipper arm or to the outrigger arm, respectively.

In both forms of embodiment of the invention, there results an additional advantage that the length of the dipper arm may appreciably exceed the length of the front thrust piston drive, because with the described control system, the difference in length may be equalized.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a trench hoe showing the digging bucket in two positions, whereby the digging plane extends horizontally and lies below the plane of the trench hoe chassis;

FIG. 2 is a side elevation of the trench hoe corresponding to FIG. 1, whereby the angle of slope or gradient increases slantingly from the plane of the trench hoe chassis;

FIG. 3 is a side elevation of the trench hoe corresponding to FIGS. 1 and 2, the modus operandi with an angle of slope or gradient decreasing from the plane of the trench hoe chassis; and

FIGS. 4 to 6 are side elevations of a trench hoe corresponding to FIGS. 1 to 3, but showing an alternate form of articulated connections between the chassis and the digging bucket.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the figures, similar reference characters designate parts corresponding to one another.

The trench hoe has a chassis 1, which is connected with the upper structure 2 through a rotary connection 3 and stands on a plane of position 4.

The digging device mounted on the excavator is first to be explained in its basic traits;

It consists of a digging implement constructed as bucket 5, which is swingable on the end of a bent dipper arm 6 about an axis of rotation 7 with the aid of a front hydraulic thrust piston drive 8, which consists of a cylinder 9 and a piston rod 10. The piston rod 10 is pivoted to the apex of a triangular shift lever 11, one arm of which is pivoted to the inner end of the bucket 5 and the other arm of which is pivoted to the dipper arm 6 near the pivotal connection 7. The front part 13 of a ground outrigger arm 14 carries a shaft 15 for the pivoting of the dipper arm 6. For swinging the dipper arm 6 about the axis 15 is a rear thrust piston drive 16, whose piston rod 17 is pivoted at 18 to the rearward end of the dipper arm 6, while a cylinder 19 is pivoted at 20 to the outrigger arm 14.

The rearward part 21 of the outrigger arm 14 is pivoted at 22 to the upper structure of the trench hoe. The outrigger arm 14 is actuated by a third thrust piston drive 23.

The digging bucket 5, the dipper arm 6, the front thrust piston drive 8 and the partial length of the outrigger arm 14 between the dipper arm axis 15 and the pivot 12 of the front thrust piston drive 8 form a trapezoid control system (Trapezlenkersystem). This trapezoid control system is laid out in relation to the dimensions of the outrigger arm 14 so that the dipper arm 6 is guided approximately parallel at desired angles of slope or gradients, three of which are shown which all lie within a predetermined range of angles of slope or gradient. Insofar, the showings in the figures are indicated accurately enough and the dotted line showings indicate that insignificant deviations from the predetermined angles of starting movement are adjusted at the end of the digging movement. These are, however, for practical conditions negligibly small and could furthermore be equalized by means of a corresponding control movement.

Deviating from the embodiments shown by way of example, the rear thrust piston drive 16 may also be so disposed that it

does not engage on the projecting end of a dipper arm but at a desired point between the axis **15** and the axis **7**. The articulation of the front thrust piston drive **8** has solely as prerequisite that it is conducted outside of the axis of rotation **15**, so that the axis **12** may be disposed at a desired point between the axis **15** and the axis **22** of the ground outrigger arm.

If the trench hoe in accordance with the invention is laid out so that in the large range of angles of slope or gradients necessary for trenches a sufficient parallel guidance of the digging bucket is attained, then also other digging implements which do not have to be guided parallel in so great an angle range, may be utilized effectively, for example, loading shovel and highdigger or shovel.

As shown in FIGS. **1** to **3**, the free end of the cylinder **9** of the front thrust piston drive **8** is pivoted to a guide drive **30** at **12**. This control system consists of a front control lever **31** and a rear guide link **32**. The front guide is shown in the embodiment according to FIGS. **1** to **3** as a double-armed lever, which is pivoted between its two ends at **33** to a dipper arm **6**. One of the two ends carries the pivot **12** for the front thrust piston drive **8**, while the other end has the pivot **34** for the front end of the rear guide link **32**. The other end of the guide link **32** is pivoted at **36** to the front part **13** of the outrigger arm **14**.

In contrast to the embodiment by way of example illustrated in FIGS. **1** to **3**, in the embodiment by way of example according to FIGS. **4** to **6**, the front guide **31** is constructed as a one arm lever link, and the control drive has an apex **37**, to which both the free end of the cylinder **9** of the front thrust piston drive **8** as well as the front end of the rear guide link **32** are pivoted. The other end of the rear guide link **32** likewise forming a one arm lever is pivoted at **36** again to the outrigger arm **14**.

In all figures it is shown in two phases, that the digging bucket **5** upon exploration is guided approximately parallel under a designated and desired angle of slope or gradient within a predetermined range of angles of slope or gradients. The parallel guidance is attained by means of a corresponding dimensioning of the control system of the digging bucket **5**, dipper arm **6**, front thrust piston drive **8** and the partial length of the outrigger arm or jib **14** between dipper arm axis **15** and pivoting of the front thrust pistron drive, in which the described control system **30** is interpolated, in relation to the dimensions of the outrigger arm **14**.

In practice it has been found that the trench hoe operator does not need to readjust except in a very small degree for the maintenance of the particular digging angle. He may thereupon limit himself essentially to full actuation of the rear thrust piston drive **16** and with correcting at the time the third thrust piston drive **23**. If he omits these corrections, the straight line of digging occurs by itself, because apparently the guidance characteristics of the bucket **5** guided in parallel are so excellent that the bucket rises in case the operator omits the corrections in proper time and thereby insures automatically the maintenance of the digging angle.

What I claim is:

1. A trench hoe comprising a digging bucket, a triangular shift lever having one arm pivoted to the inner end of said bucket, a front hydraulic thrust piston drive having a piston rod pivoted to the apex of said shift lever, a dipper arm at one side of said shift lever and pivoted at its outer end to said bucket inner end and in spaced relation to the pivotal connection of said shift lever and said bucket, a pivotal connection between the other arm of said shift lever and said dipper arm in close spaced relation to said pivotal connection between said dipper arm and bucket, an outrigger arm, link means providing an articulated connection between the inner end of said front thrust piston drive and said dipper arm and said outrigger arm, a pivotal connection between said dipper arm and said outrigger arm and disposed at the other side of the dipper arm facing away from said triangular shift lever, the end portion of said dipper arm extending beyond said last pivotal connection, a rear hydraulic thrust piston drive connected to the end of said last end portion and disposed above said outrigger arm, the arrangement being such that a trapezoid control linkage for said digging bucket is provided consisting of said bucket, said dipper arm, said front thrust piston drive, and said link means between said front piston drive and said dipper arm, and said control linkage being so dimensioned in relation to the dimensions of said outrigger arm that said digging bucket is guided in operation approximately parallel under a desired angle of slope or gradient within a predetermined range of angles of slope or gradient.

2. A trench hoe as claimed in claim **1**, in which said link means providing an articulated connection comprises a front control lever pivoted at one end to the inner end of said front thrust piston drive and at an intermediate portion to said dipper arm, and a guide link pivotally connected at one end to the other end of said front control lever and at the opposite end to said outrigger arm.

3. A trench hoe as claimed in claim **1**, in which said link means providing an articulated connection comprises a pair of link arms, each being pivoted at one end to the inner end of said front thrust piston drive, means pivotally connecting the opposite end of one link arm to the adjacent portion of said dipper arm, and means pivotally connecting the opposite end of the other link arm to the end of said outrigger arm adjacent the pivotal connection between said dipper arm and said outrigger arm.

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