

July 26, 1949.

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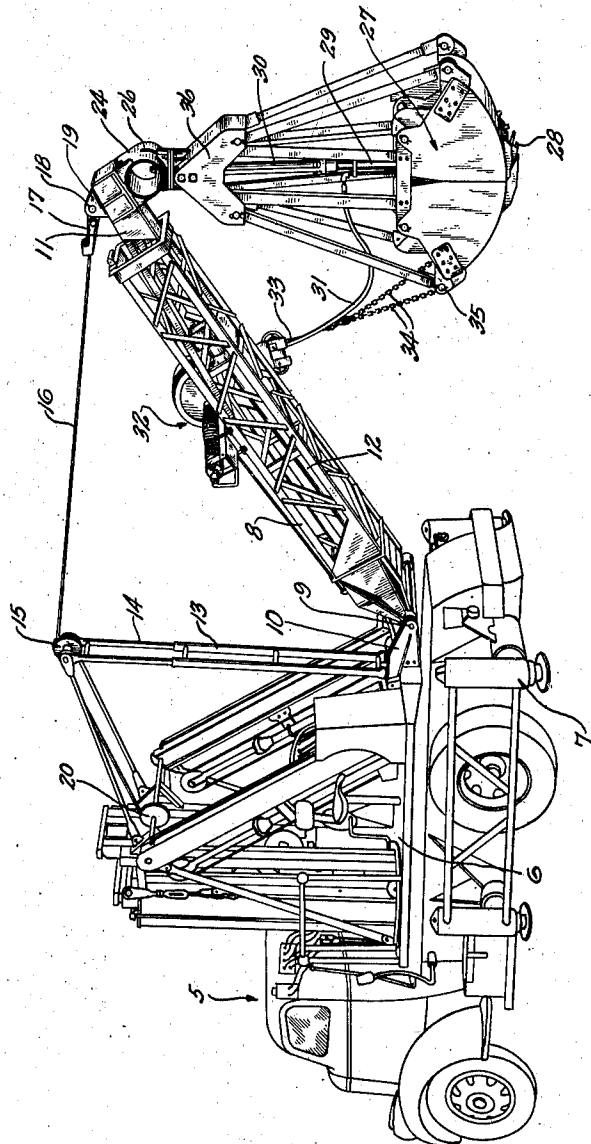
2,477,401

EXCAVATOR

Filed May 25, 1945

2 Sheets-Sheet 1

Fig. 1.



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Fig. 3.

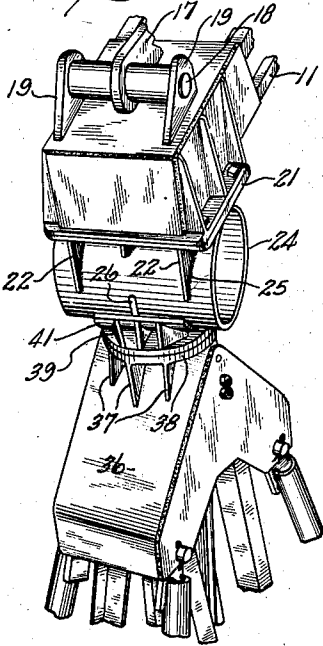


Fig. 2.

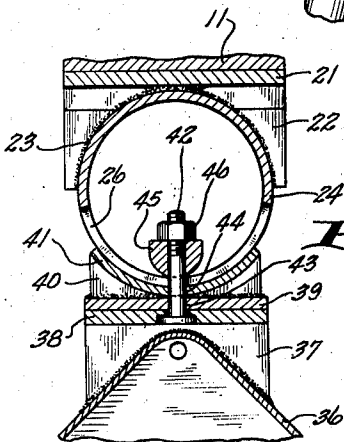
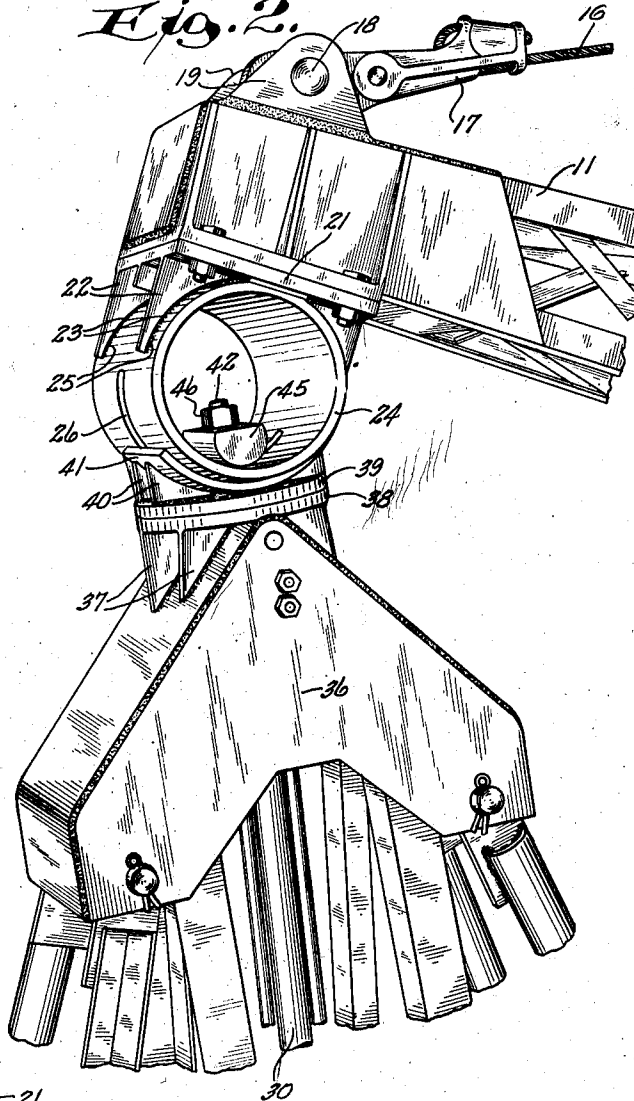


Fig. 4.

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2,477,401

EXCAVATOR

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Application May 25, 1945, Serial No. 595,733

8 Claims. (Cl. 212—42.5)

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This invention relates to improvements in excavators.

Heretofore, in excavating machines, the bucket has been suspended by a load-line from the outer end of the boom, and has been movable vertically with respect to the boom by letting out or retrieving the load-line. With this arrangement, the weight of the bucket must be relied on to cause the bucket to bite into the ground.

It is a general object of the present invention to provide an improved excavator construction wherein the use of a load-line is eliminated and wherein the upper end of the bucket is directly connected to the outer end of the boom in such a manner as to afford flexibility of movement of the bucket while adding the weight of the boom during digging operations.

A further object of the invention is to provide a construction as above described wherein the boom is composed of a plurality of telescopic sections, and wherein the bucket is pivotally connected directly to the end of the outermost section.

A more specific object of the invention is to provide an excavator wherein the bucket is so connected to the outer end of the boom as to permit swinging movement or rolling of the bucket in a vertical plane so that the force of gravity will always maintain the bucket in a substantially vertical position regardless of the position of angular adjustment of the boom.

A further, more specific object of the invention is to provide a construction as above described wherein the bucket is so connected to the outer end of the boom as to provide for rolling or swinging movement in a vertical plane and also for rotating movement on a vertical axis.

A further object of the invention is to provide in a lifting device such as a crane, novel means for directly connecting an instrument directly to the boom which means is suitable for use in connection with lifting or digging instruments other than buckets.

Other objects of the invention are to provide an excavator which can be mounted on a relatively small size truck; which allows better control over the bucket during the digging operation; which provides for a better bite into the ground during use; and which is relatively inexpensive to manufacture.

With the above and other objects in view, the invention consists of the improved excavator, and all its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating one

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complete embodiment of the preferred form of invention, in which the same reference numerals designate the same parts in all of the views:

Fig. 1 is an elevational view in perspective of the improved excavator;

Fig. 2 is a fragmentary perspective view on an enlarged scale showing the connection between the upper end of the bucket and the outer end of the boom;

Fig. 3 is a fragmentary view showing the same parts from a different perspective; and

Fig. 4 is a fragmentary sectional view taken transversely of the bucket supporting cylinder.

Referring more particularly to the drawing, the numeral 5 designates a motor truck which is equipped substantially in the manner shown in my issued patent for truck cranes, No. 2,365,167, dated December 19, 1944. The construction includes a turntable 6 mounted on the truck frame and supporting the operating mechanism. There is also included extendable outrigger mechanism 7 constructed in accordance with my Patent No. 2,365,169, dated December 19, 1944. The inner section 8 of the boom is pivoted as at 9 to the ends of brackets 10 projecting from an edge portion of the turntable 6. This method of supporting the boom is specifically different from the method shown in my prior Patent No. 2,365,167.

The boom includes an outer section 11 which is telescopically movable in the section 8 so that the effective length of the boom may be varied to suit requirements. The elongating of the boom may be accomplished by the use of a hydraulic cylinder 12 supported on the beam section 8 and having a ram which engages the boom section 11 to cause outward movement of the boom section 11 when the ram is extended. The controls for the hydraulic cylinder 12 may be accessible to an operator standing on the turntable 6. This mechanism for hydraulically extending the boom is substantially the same as described in my Patent No. 2,365,167, before referred to. Shortening of the effective length of the boom is accomplished by raising the boom to an elevated position, releasing the hydraulic pressure in the cylinder 12, and permitting the force of gravity to return the section 11 to the nonextended position of Fig. 1.

Connected at its lower end to the turntable is an upright support 13 having a longitudinally adjustable section 14 carrying a guiding pulley 15. A cable 16 has its outer end secured to a cable end fitting 17, and the fitting is pivotally connected as at 18 to the upper side of the boom sec-

tion 11 near the end thereof. The pivot bolt 18 may extend through ears 19, as illustrated.

The cable 16 is guided over the pulley 15 and over another pulley 20. The other end of the cable may be operated by any desired mechanism to cause swinging movement of the boom in a vertical plane on the boom pivot 9. If desired, the mechanism for operating the load-line in my prior Patent No. 2,365,167 may be employed for operating the cable 16. It is also possible to use an ordinary winch for winding up the cable 16.

Secured to the lower side of the boom section 11 near its outer end is a casting 21 having spaced depending plates 22. The plates are cut out as at 23 to receive a pivot member having a downwardly convex bearing portion on its underside, as for example the short pivot bearing cylinder 24, the plates 22 being preferably welded to the cylinder as illustrated at 25. The lower portion of the cylinder, intermediate its length, is slotted as at 26 (see Figs. 2 and 4), and the slot preferably extends for nearly 180° in substantially the manner illustrated in Fig. 4.

While the invention may be used for supporting various types of instruments such as hooks, lifting devices, and buckets, it has its greatest utility in connection with a clam shell bucket. The bucket 27 illustrated, is constructed in a manner similar to that shown in my application, Serial No. 559,373, filed October 19, 1944, and includes digging teeth 28 on the bucket sections. The opening and closing of the bucket sections is performed hydraulically by an hydraulic cylinder 29 actuating a ram 30. This construction is the same as described in the pending application, above referred to. Hydraulic fluid is delivered to the cylinder by a flexible conduit 31 which is windable on a reel 32 of the type illustrated in my pending application, Serial No. 487,709, filed May 20, 1943, and issued August 21, 1945, as Patent No. 2,382,955. This reel also controls the tag-line 33, and the tag-line is connected by chains 34 with the bucket as at 35. The chains 34 may be connected to the bucket at various points in the length of the chains to suit requirements.

The supporting head 36 of the bucket has spaced webbing 37 projecting upwardly therefrom and rigidly supporting a pivot disc 38 (see Fig. 4). A complementary disc 39 has webbing 40 projecting from its upper surface which supports a curved bearing plate 41. The curvature of the plate 41 fits the external curvature of the cylinder 24. A pivot bolt 42 has its head rotatable in a countersunk opening in the lower side of the disc 38 and the bolt extends through an opening 43 in the disc 39 and through an opening 44 in the segment 41. The upper end of the bolt projects through the slot 26 of the cylinder 24. In order to provide for good rolling movement and good support, an elongated block 45 having a hole intermediate its length is slipped onto the bolt and is adjustably held in position by a nut 46.

The construction is such that the disc 38 connected to the bucket may rotate relative to the disc 39 to permit rotating movement of the bucket on a vertical axis, such as the axis of the bolt 42. The construction also permits a very important rolling or swinging movement of the bucket in a vertical plane. This movement takes place by movement of the bolt 42 in the slot 26.

This type of excavator is particularly useful in the digging of basements or trenches. At the start of an operation, the telescopic boom sec-

tion is first adjusted to provide for a desired starting length for the boom. Then, the cable 16 is let out to lower the angular position of the boom until the bucket strikes the ground. As the boom is being lowered the bucket will roll on the cylinder 24 so that it will always maintain a vertical position. The bucket, of course, is in open position at the start of the above operation, with the teeth 28 projecting toward the ground. As the boom is being lowered, the weight of the bucket is augmented by the weight of the boom itself so that the teeth are driven firmly into the ground. Then, as the bucket is being closed, through operation of the hydraulic ram 29, the added weight of the boom constantly urges the bucket sections deeper into the ground so that a full bite is obtained. At any time during the operation the boom section 11 may be extended or retracted and, while this operation is taking place, the bucket will always adjust itself by rolling on the cylinder 24. If, at any time during the operation it becomes desirable to rotate the bucket, this may be readily performed manually by causing pivotal movement of the bucket on the vertical axis of the bolt 42.

By having a direct connection between the upper end of the bucket and the boom there is much greater control over the bucket than in situations where the bucket is suspended from a vertically movable load-line.

Various changes and modifications may be made without departing from the spirit of the invention and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, a horizontal disc on the top of said head having a bolt projecting upwardly therefrom, a cylindrical pivot member secured transversely of the boom at the outer end thereof and having a circumferentially extending slot in the lower portion of its periphery receiving said bolt, locking means on the end of the bolt, and means having an opening through which said bolt extends and engaging the exterior of the cylindrical pivot member to slide thereon and provide for swinging movement of the bucket on the horizontal axis of the cylindrical pivot member.

2. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, a horizontal disc on the top of said head having a bolt projecting upwardly therefrom, a cylindrical pivot member secured transversely of the boom at the outer end thereof and having a circumferentially extending slot in the lower portion of its periphery receiving said bolt, locking means on the end of the bolt, and means having an opening through which said bolt extends and engaging the exterior of the cylindrical pivot member to slide thereon and provide for swinging movement of the bucket on the horizontal axis of the cylindrical pivot member, said last mentioned means having a bottom disc which is seated on the horizontal disc of the instrument head, the two discs being rotatable relative to each other during rotating movement of the instrument on the axis of said bolt.

3. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, a horizontal disc on the top of said head having a bolt projecting upwardly therefrom, a cylindrical

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pivot member secured transversely of the boom at the outer end thereof and having a circumferentially extending slot in the lower portion of its periphery receiving said bolt, locking means on the end of the bolt, and means having an opening through which said bolt extends and having a curved plate portion fitting the exterior of the cylindrical pivot member to slide thereon and provide for swinging movement of the bucket on the horizontal axis of the cylindrical pivot member.

4. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, a bolt connected to and projecting upwardly from said head, and a pivot member having an outer surface portion which is downwardly convexed and which is provided with a slot extending circumferentially of said downwardly convexed portion, said pivot member being secured transversely of the boom at the outer end thereof and having its slot slidably engaged by said bolt on the instrument head, and means for retaining said bolt in the slot.

5. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, a bolt connected to and projecting upwardly from said head, a cylindrical pivot member secured transversely of the boom at the outer end thereof and having a circumferentially extending slot in the lower portion of its periphery receiving said bolt, and locking means on the end of the bolt.

6. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, a bolt connected to and projecting upwardly from said head, a cylindrical pivot member secured transversely of the boom at the outer end thereof and having a circumferentially extending slot in the lower portion of its periphery receiving said bolt, locking means on the end of the bolt, and means engaging the exterior of the cylindrical pivot member to slide thereon and provide for swinging movement of the instrument head on the horizontal axis of the cylindrical pivot member.

7. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, and pivot means directly connecting said instrument head to the outer end of said boom for suspension

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therefrom, said means including a tubular cylindrical bearing member of relatively large diameter positioned with its axis extending transversely of the boom and in a horizontal plane, an arcuate bearing member slidably cooperating in a circumferential direction with the exterior of said cylindrical bearing member, and connecting means for maintaining said bearing members in said sliding engagement, one of said members being connected to the boom and the other of said members being connected to the head of the instrument to provide a sliding pivotal movement about a horizontal axis extending transversely of the boom, whereby gravity will cause the instrument to be suspended vertically regardless of the position of adjustment of the boom.

8. In a lifting device, a frame, a boom pivoted to said frame for angular movement in a vertical plane, a lifting instrument having a head, and means directly connecting said instrument head to the boom for suspension from the outer end thereof, said means including a tubular cylindrical pivot member of relatively large diameter positioned with its axis extending transversely of the boom and in a horizontal plane and having a circumferentially extending peripheral slot, said means also including a pivotally movable member connected in said slot for movement therein, one of said members being connected to the boom and the other of said members being connected to the head of the instrument to provide a sliding pivotal movement about a horizontal axis extending transversely of the boom whereby gravity will cause the instrument to hang vertically in any position of angular adjustment of the boom.

ROY O. BILLINGS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
767,536	Williams	Aug. 16, 1904
1,327,324	Hecker	Jan. 6, 1920
1,345,304	Zied	June 29, 1920
1,639,735	Jones	Aug. 23, 1927
1,858,903	Remde	May 17, 1932
2,030,045	Billings	Feb. 11, 1936
2,378,605	Watson	June 19, 1945