ABSTRACT
An end loader in which the bucket operating linkage has lift arms that form a secondary boom pivoted on the frame, lifting jacks to control the position of the secondary boom, bell cranks fulcrumed at the free ends of the lift arms which have first arms forming a primary boom and short second arms, the bucket having lower pivots by which it is carried on the primary boom and there being primary jacks pivoted to the frame and to the second bell crank arms to swing the primary boom on the secondary boom. Bucket aspect on the primary boom is controlled by control levers fulcrumed on the bell crank fulcrums, dumping jacks pivoted to first arms of the control levers and to upper bucket pivots, and tag links pivoted to short second arms of the control levers and to the primary jack pivots on the frame.

20 Claims, 4 Drawing Figures
LOADER LINKAGE WITH JOINTED LIFT ARMS

BACKGROUND OF THE INVENTION

A wide variety of linkage systems has been developed for operating the buckets of end loaders which are to be used for excavation and the loading of excavated material into dump vehicles. Of the patents on end loaders which are known to applicant, those which are most pertinent to the present invention are believed to be Beyerstedt U.S. Pat. No. 2,929,521, Bernotas U.S. Pat. No. 2,978,124 and Wagner U.S. Pat. No. 3,115,259. Also of interest is Peterson U.S. Pat. No. 3,658,202, owned by applicant's assignee.

The problem that has confronted this art is to provide a high capacity loader which is very effective both for excavating at ground level and for cutting vertically into a wall of earth, which has the great structural integrity necessary for the rough work for which it is intended, which has a reasonable degree of stability when it has a full bucket in transport position, and which has a high reach, both for vertical wall excavation and for emptying the bucket into a dump vehicle. The apparatus of each of the above identified patents, as well as those of other patents known to applicant, lack one or more of the desirable operating characteristics above set out.

SUMMARY OF THE INVENTION

The principal object of the present invention is to provide an end loader which has all of the desirable characteristics previously described.

A secondary boom is carried on main pivots near the front upper corners of the sides of the machine frame, and lifting jacks pivoted on the frame below the main pivot control the vertical position of the secondary boom. Bell cranks fulcrumed at the free end of the secondary boom have first arms forming a primary boom which is about half the length of the secondary boom, and the primary boom is connected to lower pivots on the bucket. The bell cranks have short second arms, and primary hydraulic jacks which are mounted on the sides of the frame on aligned primary jack pivots adjacent the main pivots are pivotally connected to the second bell crank arms to swing the primary boom between a first position generally aligned with the secondary boom and a second position generally perpendicular to the secondary boom.

The aspect of the bucket on the primary boom is controlled by bucket control levers, dumping jacks which connect the control levers to upper pivots on the bucket, and tag links which connect the control levers to the frame. Specifically, the bucket control levers are on the same fulcrums as the bell cranks, and the tag links are connected to the frame on extensions of the primary jack pivots.

The secondary boom, the primary cylinders, the second bell crank arms, and the frame between the main pivots and the primary jack pivots comprise a first four bar linkage which causes bucket thrust to be transmitted to the frame through the main pivots and the primary jack pivots.

The primary boom, the dumping jack, the first arms of the bucket control levers, and the bucket between its lower and upper pivots constitute a second four bar linkage, and that linkage is essentially a parallelogram linkage when the dumping jack is retracted.

Integral stops on the secondary boom are abutted by the second bell crank arms when the primary boom is in its first position, so bucket thrust is carried principally through the primary and secondary booms whenever the primary boom is in that position.

The relative lengths of the primary and secondary booms permits the former to occupy a load carrying position in which the bucket is well balanced above the wheels. When the secondary boom is in its upper position with the primary boom extended, the bucket occupies a very high position which is also well balanced over the wheels.

The pivotal connections of the primary cylinders and of the tag links are so arranged as to provide very easy control of bucket aspect with respect to the primary boom as the secondary boom is moved between its raised and lowered positions.

THE DRAWINGS

FIG. 1 is a side elevational view of the front portion of an end loader embodying the linkage of the present invention with the bucket disposed in a ground level digging position;

FIG. 2 is a view similar to FIG. 1 with the primary boom and bucket in the carry position;

FIG. 3 is a fragmentary side elevational view on a reduced scale, showing the primary and secondary booms in their fully elevated position and the bucket level; and

FIG. 4 is a top plan view on the same scale as FIG. 3 and in the position of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

As best seen in FIGS. 1 and 4, a mobile unit, indicated generally at 6, includes a frame 8 and wheels 10. A bucket 12 is mounted on the sides 9 of the vehicle frame by an operating linkage, indicated generally at 14.

The linkage 14 includes a pair of lift arms 16 which are carried on main pivots 18 on the upper front extremities 19 of the side frame members 9. The lift arms 16 are moved between the downwardly inclined position of FIG. 2 and the upwardly inclined position of FIG. 3 by lifting jacks, indicated generally at 20, which have their cylinders 22 pivotally mounted on the side frame members 9 at 24, and which have their piston rods 26 pivotally connected to the lift arms 16 at 28. The lifting arms 16 provide a secondary boom.

Bell cranks, indicated generally at 30, are pivoted on fulcrums 32 at the free end of the secondary boom, and the bell cranks have relatively long first arms 34 which are connected by a cross beam 36 to form a primary boom. The bell cranks also have short second arms 38.

Primary jacks, indicated generally at 40, include cylinders 42 mounted on the sides of the frame on aligned primary jack pivots 44 which are close to the main pivots 18, and the jacks 40 also include piston rods 46 which are pivoted at 48 to the second bell crank arms 38. Comparing FIG. 1 with FIG. 2, it is seen that when the secondary boom is in its lowered position, extension of the piston rod 46 of the jack 40 moves the primary boom from a first position in which it is generally aligned with the secondary boom to a second position in which it is generally perpendicular to the secondary boom. Integral stops 50 on the lift arms 16 are abutted by the second arms 38 of the bell crank 30 when the
primary boom 34 is in its first position, which may be either with the secondary boom lowered as seen in FIG. 1 or raised as seen in FIG. 3.

Bucket control means, indicated generally at 52, includes a pair of bifurcated bucket control levers, indicated generically at 54, which are pivoted on the fulcrums 32 of the bell cranks 30 and which have relatively long first arms 56 and shorter second arms 58. The bucket control means also includes dumping jacks, indicated generally at 60, which include cylinders 62 which are pivoted at 64 on the long bucket control lever arms 56, and which have piston rods 66. The bucket control means 52 is completed by tag links 68 which are pivotally connected at 70 to the short lever arms 58 and which are also pivotally connected to the primary jack pivots 44 on the frame 8.

The bucket 12 has lower bifurcated bosses 72 which carry lower pivots 74 by means of which the bucket is mounted upon the primary boom 34, and there are also upper bifurcated bosses 76 carrying upper pivots 78 by means of which the bucket is connected to the piston rods 66.

As best seen in FIG. 3, the lift arms 16, the primary jacks 40, the second arm 38 of the bell crank, and the frame 8 between the pivots 18 and 44 form a four bar linkage, and the arrangement is such that when the loader is moved forward with the bucket in the digging position of FIG. 1 the thrust from the bucket is transmitted principally through the primary boom 34, the stop 50 and the secondary boom, and any thrust on the primary jacks 40 is also carried to the frame.

In addition, as best seen in FIG. 2 the primary boom 34, the long bucket control lever arms 56, the cylinders 60, and the bucket between the lower pivots 74 and the upper pivots 78 forms another four bar linkage which, because of the dimensions of the bars, is very nearly a parallelogram linkage. This provides extremely strong and stable support for a loaded bucket in the transport position of FIG. 2.

When the bucket is used for digging in a vertical face by movement from the position of FIG. 2 to that of FIG. 3 the thrust is carried to the frame through the primary jacks 40 and the tag links 68. Further, when the bucket is dumped by extending the dumping jack piston rods 66 the thrust is carried through the tag links to the frame.

The short bell crank arms 38 and the short lever arms 58 are best seen in FIG. 2 to be nearly the same length, and to be nearly parallel in that position of the linkage. Thus the tag links 68 are nearly the same length as the extended primary jacks 40. As the linkage moves from the position of FIG. 2 to that of FIG. 3, bucket aspect relative to the primary boom is maintained by the dumping jacks 52, the control levers 54 and the tag links 68.

The foregoing detailed description is given for clearness of understanding only and no unnecessary limitations should be understood therefrom as modifications will be obvious to those skilled in the art.

1. Claim

1. In a mobile loader having a mobile frame and a bucket, an operating linkage for the bucket comprising, in combination:

a pair of forwardly extending lift arms forming a secondary boom mounted on aligned main pivots which are adjacent the upper front extremities of the sides of the frame:
ally connected to the dumping jacks, and said levers having short arms, and tag links pivoted to said short arms and to the frame, the length of the primary boom is about ½ the length of the secondary boom, and in which the primary boom, the dumping jacks, the long arms of the control levers, and the bucket between the lower and upper pivots form a four bar linkage.

9. The combination of claim 8 in which the tag links are pivotally connected to the frame on pivots that are extensions of the primary jack pivots.

10. The combination of claim 8 which includes stops on the secondary boom that are abutted by the second bell crank arms in the first position of the primary boom, whereby bucket thrust in said first position is transmitted to the frame almost entirely through the primary and secondary booms.

11. In an end loader having a mobile frame and a bucket, an operating linkage for the bucket comprising, in combination:

(a) a pair of forwardly extending lift arms forming a secondary boom mounted on aligned main pivots which are adjacent the upper front extremities of the sides of the frame;

(b) a pair of lifting jacks mounted on the sides of the frame on aligned pivots which are below the main pivots, said lifting jacks being pivotally connected to the lift arms so that extension of the jacks swings the secondary boom on the main pivots from a downwardly inclined position to an upwardly inclined position;

(c) a pair of bell cranks pivoted on aligned fulcrums at the free end of the secondary boom, said bell cranks having forwardly extending first arms that form a primary boom which is connected to lower pivots on the bucket, and said bell cranks having short second arms;

(d) a pair of primary hydraulic jacks mounted on the sides of the frame on aligned primary jack pivots, said primary jacks being pivotally connected to the second bell crank arms so that operation of said primary jacks swings the primary boom between a first position generally aligned with the secondary boom and a second position above and generally perpendicular to said secondary boom, bucket control levers pivot on fulcrums that are generally aligned with the bell crank fulcrums, said levers having a long arm and a short arm; hydraulic dumping jacks pivotally connected to the long arms of the bucket control lever and to upper pivots on the bucket, the primary boom, the dumping jacks, the long arms of the bucket control levers, and the bucket between the lower and upper pivots forming a four bar linkage;

and tag links pivotally connected to the short arms of the bucket control lever and to the frame.

12. The combination of claim 11 in which the dumping jacks when retracted are about the same length as the primary boom, and the length of the long arms of the bucket control levers is about equal to the distance between the lower and upper pivots on the bucket.

13. The combination of claim 11 in which the bucket control lever fulcrums are coaxial with the bell crank fulcrums, the short bell crank arms and the short lever arms are substantially the same length, the length of the tag links is about equal to the extended length of the primary jacks, and the tag links are pivot to the frame on extensions of the primary jack pivots.

14. The combination of claim 11 which includes stops on the secondary boom that are abutted by the second bell crank arms in the first position of the primary boom, whereby bucket thrust in said first position is transmitted to the frame almost entirely through the primary and secondary booms.

15. The combination of claim 11 in which the length of the primary boom is about one-half the length of the secondary boom.

16. In an end loader having a mobile frame and a bucket, an operating linkage for the bucket comprising, in combination:

(a) a first four bar linkage that includes a secondary boom and a primary jack pivotally mounted on the frame on adjacent mounting pivots, and a short arm of a bell crank which has its fulcrum on a pivot on the end portion of the secondary boom, said first four bar linkage including the frame between said adjacent pivots;

(b) a second four bar linkage that includes a long arm of said bell crank which constitutes a primary boom on which the bucket is pivotally mounted by means of lower pivots, a bucket control arm pivotally mounted on the secondary boom adjacent the bell crank fulcrum, and a dumping jack pivotally mounted on said control arm and pivotally connected to the bucket by means of upper pivots, said second four bar linkage including the bucket between said lower and upper pivots;

and a lifting jack pivotally connected to the frame and to the secondary boom.

17. The combination of claim 16 in which the bucket control jack is a long arm of a lever, and said lever also has a short arm, and in which a tag link is pivotally connected to said short arm and to the frame adjacent the mounting pivot for the primary jack.

18. The combination of claim 16 in which the pivotal mountings for the lever and for the control arm are coaxial.

19. The combination of claim 18 in which the pivotal connection of the tag link to the frame is coaxial with the mounting pivot for the primary jack.

20. The combination of claim 19 in which the short bell crank arm and the short lever arm are substantially the same length, and the length of the tag link is substantially equal to the extended length of the primary jack.

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