ABSTRACT OF THE DISCLOSURE

An excavator bucket, adapted to be mounted on a tractor, is formed of a first bucket section secured to lifting arms on the tractor and a second bucket section movable relative to the first bucket section. A pair of hydraulic jacks are positioned on the first bucket section and have piston arms movable between an extended position and a retracted position. The first and second bucket sections and the piston arms are interconnected by pivotally connected link members. When the piston arms are in the fully extended position, the second bucket position is in its closed position relative to the first bucket section. As the piston arm is retracted, the second bucket section first moves outwardly away from the first bucket section in a rectilinear path and then pivots along a curved linear path about its end section secured to the piston arm until it reaches its fully opened position with the piston arm fully retracted into the jack cylinder. With the piston arm fully retracted, the pivot connection to the second bucket section of the link member extending between the first and second bucket sections is aligned with the axis of the piston arm permitting the bucket to be opened at an angle of 125° with the first bucket section. Further, in its fully opened position, the link members interconnecting the first and second bucket sections and the first bucket section and the piston arm are arranged in substantially parallel relationship. Due to the arrangement of the excavator bucket, it can be employed for a number of operations.

Summary of the invention

This invention is for improvements in or relating to a single bucket excavator.

Buckets are known for use with self-propelled excavating machinery comprising hydraulically operated linkages for opening and closing a moving jaw of the bucket, so that the moving jaw can be moved arbitrarily over desired distances, more particularly to close the box or box part of the bucket, when the jaw is doing excavating work or the like as closing such box. The jaw can perform these movements because of the special nature and design of the linkages used to move the jaw.

A very important consideration in linkages of this kind, which include three stationary pivots and two movable pivots, is the positioning of the hydraulic actuators which are adapted to open and close the jaw and which take the form of hydraulic jacks, the term "positioning" referring to the position of the jacks when the bucket is in its fully lowered position and the jaw is in the closed state. Conventionally, the positioning or siting is such, depending upon the linkage, used, that with the bucket and jaw in the conditions just specified the jack axes extend substantially parallel with the horizontal plane in which the excavating machine rests on the ground. This positioning or siting limits the movements which the jaw can make and therefore limits the work which can be done, and this results in a relatively restricted range of work. Another limitation which buckets possess is that the hydraulic jacks, of which there are usually two, are disposed outside the sidewalls of the box or box part of the bucket and, consequently, when excavation work is going on and the box is being loaded with materials, the jacks offer considerable resistance: also, they are knocked by the materials being dealt with and may, therefore, be damaged or broken.

It is an object of the invention to obviate these and other disadvantages. The invention is an improvement in or relating to buckets of excavating machines or the like, of the kind in which the jaw for opening and closing the bucket mouth is connected to the bucket via lateral linkages operated by hydraulic jacks. In the bucket according to the invention, the axes of the jacks, which latter are parallel with one another, are, with the bucket in its fully lowered position and with the jaw in the closed state, substantially perpendicular to the horizontal plane in which the wheels or crawler treads of the excavating machine comprising the bucket rest on the ground; this feature in association with a linkage comprising three stationary and two mobile pivots increases the range of work which the bucket can perform. According to another feature of the invention, the hydraulic jacks are disposed on the inside of lateral planes defined by the sidewalls of the box or box part of the bucket and are received in appropriate protective zones, so that the material being dealt with does not knock the jacks and the same offer no resistance during movements of the bucket.

The present invention will now be more particularly described with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic side elevation of the preferred embodiment of the present invention mounted upon a self-propelled vehicle of which one land wheel is visible;

FIGURE 2 is a plan view of the bucket shown in FIGURE 1;

FIGURE 3 is a side elevation of a self-propelled vehicle which has been equipped with a bucket according to the invention;

FIGURE 4 shows the bucket being used as a combined skimmer and quasi-grab;

FIGURES 5 and 6 show two stages of operation, the stages shown in FIGURES 4, 5 and 6 being consecutive;

FIGURE 7 shows the bucket being used as a metering device;

FIGURE 8 shows the bucket being used as a grab bucket;

FIGURE 9 shows the bucket being used as a bulldozer; and
FIGURE 10 shows the bucket being used as a skimmer bucket.

Referring firstly to FIGURES 1 to 3, a tractor A having rubber-tyred land wheels 44 carries a bucket B on pivoted arms 10 disposed at each side of the tractor A. A movable jaw C can be opened and closed relatively to a box or box part 12 of the bucket through the agency of a hydraulically operated system 18 of links disposed near a sidewalk 14 of the box 12 and a similar system 20 is disposed near a sidewalk 16 of the box 12. An arrangement of the systems 18, 20 being symmetrical. Each system comprises two links 22, 24 of which the link 22 is pivotally connected at 26 to the respective one of the sidewalks 14, 16 and of which the link 24 is pivotally connected at 28 to the respective one of said sidewalks. The link 22 is pivotally connected at 30 to the respective sidewalk of the jaw C, and the link 24 is pivotally connected at 32 to a tailpiece 34, one tailpiece being connected to each sidewalk of said jaw C. Actually, the links 22, 24 and the tailpiece 34 form three sides of a quadrilateral whose fourth side is the unvarying distance between the pivot axes 26, 28. Associated with each system 18, 20 are actuating means in the general form of hydraulic jacks D adapted to be operated from the cab of the tractor A. Each jack D is pivotally connected at one end thereof to the bucket B and at the other end thereof to a part of the respective one of the systems 18, 20. In the embodiment shown a bottom lug 36 of cylinder 30 of each jack D is pivotally connected to the bottom corner of the box 12 and the free end of a rod 40 of each jack D is pivotally connected to the point 32 at which the link 24 is connected to the tailpiece 34.

The structure, size and design of the bucket B and, more particularly, of the systems 18, 20 of links thereof, of all of which are described above, are such that, when the bucket is in the fully lowered position shown in FIGURE 1 with the jaw C closing the mouth of the box 12, the longitudinal axes of the hydraulic jacks D extend substantially at right-angles to the surface 42 (which may or may not be truly horizontal) of the ground on which wheels 44 of the tractor A rest.

As can be seen more particularly in FIGURE 2, the jacks D are disposed between the planes containing the exterior surfaces of the sidewalks of the box 12, and, therefore, do not project beyond said sidewalks. If required, the jacks can be housed in seats or the like in the box 12.

Each system 18, 20 has three stationary pivot axes 26, 28, 30, 36 and two pivot axes 30, 32 which are displaceable. To open the jaw C (the opening movement is in the direction indicated by an arrow X in FIGURE 1), the jacks D are operated to retract the rods 40 into their respective cylinders, the movable pivots 32 approaching the stationary pivot axes (see FIGURE 9). To close the jaw C (the closing movement is in the direction opposite to that of the arrow X), the jacks D are operated so that the rods 40 move axially and outwardly of the cylinders and move the movable pivot points 32 away from the stationary pivot axes 36.

The structure and size and design of the improved bucket and, more particularly, the arrangement of the jacks relatively to one another are such that the bucket B can perform a wide range of jobs whose main features are schematically shown in FIGURES 4 to 10.

FIGURE 4 shows the bucket B in the first stage of working as a combined skimmer bucket and quasi-grab bucket. At this stage the jaw C is in the fully open position in which the rods 40 are in their fully retracted position. The bucket B has been moved in the direction indicated by an arrow Y in FIGURE 4 and has skimmed a pile of debris.

FIGURE 5 shows the next stage, namely, that at which the jaw C, moving in the direction indicated by an arrow Z, has bitten into the pile 11, the front edge of the jaw C having moved in an arc until the desired point was reached.

In the final stage, shown in FIGURE 6, the bucket B is in its closed condition with the "bite" of earth in the bucket. The geometric and kinematic characteristics of the systems 18, 20 are such that, during the movement from the position shown in FIGURE 5 to the position shown in FIGURE 6 the front edge 13 of the jaw C has moved rectilinearly along the ground. The total path of travel of the jaw C between the extreme positions thereof therefore has two components, and arcuate and a rectilinear motion. Whilst the jaw C is accomplishing these movements, the box 12 stays in the position shown in FIGURES 4 to 6.

FIGURE 7 shows the bucket B adapted to act as a dispensing or metering device, this being made possible by the fact that the spacing s between the front edge 13 of the jaw C and the leading edge of the box 12 can be adjusted very accurately and can be maintained by the systems 18, 20 of links.

FIGURE 8 shows the bucket B being used as a grab bucket. The paths travelled by the front edge 13 of the jaw C and the leading edge of the box 12 are shown by the chain line.

FIGURE 9 shows, as has been stated above, the bucket B in its fully open condition thereof, this being the condition which must be maintained when the bucket is to be used as a bulldozer.

FIGURE 10 shows the bucket arranged to act as a skimmer. The bucket B is kept in its closed condition but, instead of sitting on the ground as in FIGURES 1 and 3, the levers 10 are so operated that the sloping wall of the jaw C as seen in FIGURES 1 to 3 is moved into a position which is horizontal or parallel to the ground.

FIGURE 3 includes an illustration of the bucket B' which has been raised by the lever 10' and also tilted to dump the load.

The mounting of the jacks D in the manner described above with particular reference to FIGURE 2 has the result that the jacks offer no resistance to the working movements of the bucket and also that the jacks are protected against damage and breakage.

What I claim is:

1. An excavator bucket adapted to be mounted on a tractor and comprising a first bucket section adapted to be secured to lifting arms on the tractor, a second bucket section movable relative to said first bucket section between a fully opened position and a fully closed position, said second bucket section comprising a floor member and two triangularly shaped spaced side members secured along one edge thereof to said floor member and the other two edges thereof extending from the floor member in converging relationship and meeting at an apex point remote from said floor member, a tail piece secured to said second bucket section and extending from said apex point away from said floor member, a pair of hydraulic jacks pivotally mounted on said first bucket section and each having a piston arm movable between an extended position and a retracted position, said piston arm connected to the apex point of said second bucket section by means of a pivot assembly and movable between the extended position and the retracted position, said second bucket section being at said extended position when said second bucket section is in its fully closed position relative to said first bucket section and said piston arm being in its extended position when said second bucket section is in its fully extended position, said piston arm being in its extended position when said second bucket section is in its fully extended position, said first moveable link member pivotally secured at one end to said first bucket section and at its other end to said second bucket section at the apex point of its side member, a second moveable link member pivotally secured at one end to the outer end of said piston arm and at its other end to a second bucket section, said first and second link members disposed in substantially parallel relationship when said second bucket section is disposed in its fully open position and the connection of said first link member to said second bucket section.
section disposed in line with the longitudinal axis of said piston arm whereby the angular extent of the opening between said first and second bucket sections is in excess of 90°, and as said piston arm is moved from its fully retracted position to its fully extended position said second bucket section travels from its fully opened position in a curvilinear path about the pivotal point of attachment of its tail piece to said piston arm until the edge of its floor member adapted to contact said first bucket section is located in a common plane with the lower end of said first bucket section, then said second bucket section travels in a rectilinear path into contact with said first bucket section when said piston arm is fully extended.

2. An excavator bucket, as set forth in claim 1, wherein said hydraulic jacks are positioned at spaced locations on the exterior of said bucket section closely adjacent to said side members of said second bucket section.

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