

SPECIFICATION

Dual purpose bucket attachment for an excavator

5 The present invention relates to a dual purpose bucket attachment for an excavator machine capable of serving the combined purposes of excavation and grabbing. More particularly, the invention relates to a working attachment adapted to be mounted in the
10 distal end of the arm of an excavator machine for civil engineering, and in detail to a dual purpose bucket attachment consisting of two complementary members to function for excavation and grabbing of objects, and further having a plurality of inter-
15 connected links in combination, thereby permitting both operations of excavation and grabbing of objects to be made from one single hydraulic cylinder actuator.

Excavation of soils and grabbing of objects such
20 as timber, etc. constitute different phases of civil engineering work done by mechanical power so that, conventionally, separate kinds of attachments have been provided for these respective purposes and the attachments have to be replaced in the arm
25 of an engineering machine as required by the intended operations. The conventional attachments have, however, rendered it impossible to shift continuously from excavation to grabbing and vice versa, and when mounted or demounted for replacement, have required very awkward operations, thus
30 not only lowering efficiency of the engineering work overall, but causing frequent accidents injurious to humans.

A bucket apparatus which is directed to overcoming the above stated drawbacks was shown in, for example, Japanese Patent Pre-publication No. 5201/1973 which claimed priority from U.S. Patent Applications Serial Nos. 133501 and 203977, where the apparatus had a back and a fore bucket pivoted to
40 allow operations of excavation and grabbing. In the known apparatus, however, an extra cylinder actuator was required to actuate the back and the fore bucket away from and toward each other, in addition to a cylinder actuator for rocking the back
45 bucket. The back and the fore bucket were unable to be actuated away from and toward each other, in association with rocking of the back bucket, by one single cylinder actuator. Two separate cylinder actuators thus had to be operated to achieve both
50 actuations of the buckets, so that the excavating operation could not be made in a close association with the grabbing operation, thus rendering it feasible to shift continuously between the both kinds of operations. Moreover, provision of a cylinder
55 actuator between the back and the fore bucket imposed a substantial limitation on the distance over which both bucket members could be operatively moved relative to each other, and prevented the range of angular movement of the members from
60 being as wide as 180° as in the embodiment described below of the invention. The cylinder actuator for actuating the back and the fore bucket away from and toward each other was located in a position such that it directly contacted with soil,
65 stones, etc. after excavation, so that it was likely to

be soiled or damaged, and more significantly disadvantageously, stones once caught therein could hinder the relative movement between the bucket members.

70 According to the present invention, there is provided a dual purpose bucket attachment for excavation and grabbing adapted to be rockingly mounted to an arm which in turn is rockingly connected to a boom of an excavator machine, the bucket attachment comprising: a bucket portion comprising a bucket proper and a complementary sub-bucket pivotally engaged at their upper ends for a rocking movement by a pair of common pivot apertures for connection of said bucket portion to the distal end of
75 the arm of an excavator machine; a pair of upper stays, disposed on said bucket proper and each having an upper link aperture; a pair of upper link members each having one end pivotally secured in said upper link aperture and the other end pivotally
80 secured to the distal end of a plunger rod; a pair of sub-link members each having one end adapted to be pivotally secured to a respective one of opposed side plates of the arm and the other end pivotally secured to a respective one of said upper link
85 members for association therewith; and a pair of lower link members each having one end pivotally secured to said sub-bucket at a location substantially spaced from said common pivot aperture and being pivotally associated with said upper link members
90 and said sub-link members, thereby forming a link arrangement which is adapted to be actuated by a single cylinder actuator to allow said bucket proper and said sub-bucket to perform excavating and grabbing operations.

100 The invention will be further described by way of example with reference to the accompanying drawings, in which:-

Figures 1 and 2 are a side and a front view, respectively, of the bucket portion of a bucket attachment embodying the present invention;

105 *Figure 3* is a sectional view taken along line A-A' of *Figure 1*;

Figures 4a and 4b are both side views showing a link arrangement of an embodiment of the invention, connecting the bucket attachment to the arm and the cylinder actuator, the bucket portion being shown as open in *Figure 4a* and shown as closed with an object clasped therein *Figure 4b*;

110 *Figure 5* is a side view showing a link arrangement of another embodiment of the invention connecting the bucket attachment thereto;

115 *Figure 6* is a side view showing a modified embodiment of the invention where a bracket is used to connect the bucket portion and sub-link member to the machine arm; and

Figure 7 is a magnified plan view of the bucket attachment shown in *Figure 6*.

Figures 1 and 2 show the bucket portion 10 of a bucket attachment of the invention which consists of a bucket proper 1 and a complementary sub-bucket 2. The bucket proper 1 has a pair of stays 4, 4 rigidly secured on the upper portion, and the remote ends of the pair of stays 4, 4 and the upper ends of the lateral side walls of the sub-bucket 2 are pivotally engaged with each other through hollow bushes 6, 6

fitted in common pivot apertures 5, 5. The common pivot apertures 5, 5 receive therethrough a pin 5' to serve for pivotal mounting of the attachment to the arm of an excavator machine. Because of embossments 2'' of the sub-bucket 2 and the bucket proper 1 are, as shown in Figure 3, pivotally engaged with each other via the abovementioned bushes 6, the bucket proper 1 and the sub-bucket 2 are kept connected to each other even without the pin 5' fitted therethrough, which facilitates transportation and mounting of the bucket attachment to the machine arm, without the necessity of re-assembling of the bucket attachment.

The abovementioned bushes 6 are provided with flanges 6' whose thickness may selectively vary. Selection of the thickness of the bush flanges permits the bucket portion 10 and the machine arm 11 to be connected in a close-fit relationship to each other even when the machine arm 11 to which the bucket portion is pivotally secured by the pin 5' extending from one to another bush 6 has various widths.

The bucket proper 1 and the complementary sub-bucket 2 are provided along respective opposed side edges with series of suitably shaped, mutually spaced projections 1', 2'. A plurality of pawls 3, 3' may be provided, if desired, at the bottom edges of the bucket proper 1 and the sub-bucket 2 to engage meshingly with each other.

The pair of stays 4, 4 carried on the upper portion of the bucket proper 1 have link apertures 7, 7 formed in the fore ends, respectively. Each of the side plates of the sub-bucket 2 has link aperture 8 formed to be positioned adjacently below the above mentioned pivot aperture 5.

As shown in Figure 4a, a pair of upper link members 16, 16 each have one end pivotally secured by a pin 7' in the link apertures 7, 7 formed in the laterally opposed stays of the bucket proper, and another end connected to the free end of the plunger rod 13' of a cylinder actuator 13. A pair of sub-link members 14, 14 each are supported pivotally at one end on the abovementioned arm and also pivotally secured at the other end to each of the upper link members 16, 16 so that the sub-link members 14, 14 can be moved in association with the upper link members actuated by the plunger rod 13'. On the other hand, a pair of lower link members 15, 15 each have one end pivotally secured by a pin 8' in each of the abovementioned link apertures 8, 8 of the sub-bucket sides plates and the other end also pivotally secured to the intermediate portion of each of the abovementioned sub-link members 14, 14.

The arm 11 is supported for rocking movement on the boom 12 of an excavator machine and can be rocked about a pivot 11' by means of separate cylinder actuator 18 or the like.

Referring to Figure 5 in which a similar bucket attachment, but with a modified link arrangement, is shown, each of lower link members 15, 15 pivotally secured in the link aperture 8 of the sub-bucket 2 at one end has the other end connected by a pin 16' pivotally to the distal end of the plunger rod 13 to which the distal end of each of upper link members 16, 16 is also pivotally connected. Each of sub-link

members 14, 14 is pivotally connected to the intermediate portion of each of the upper link members 16, 16.

In a modification shown in Figure 6, pivotal engaging portions of bucket proper 1 and sub-bucket 2 and the lower end pivot 14' of sub-link members are preliminarily disposed in one single bracket 9, with any other link members arranged in a determined relationship to each other. The arrangement thus provided permits the lower end pivots of the sub-link members to be located in an offset position relative to the machine arm, and renders it unnecessary to make positioning of the lower end pivots of the sub-link members because of the position of sub-link lower end pivots being determined in the link arrangement. Obviously, the bracket 9 may be rigidly secured onto the inner opposed sides of the machine arm 11 by the intermediary of the abovementioned pin 5' and a mount portion 9' as shown in Figures 6 and 7.

Bucket members, link members and other members hereinabove referred to are all made of steel and/or any other known suitable tough materials.

In operation of the embodiments above described, when the plunger rod 13' is drawn toward the cylinder 13, the bucket proper 1 and sub-bucket 2 are, as shown in Figure 4a, pivotally moved about the pivot engaging portions in the opposed directions or away from each other. When the plunger rod 13' is pushed out, the bucket proper 1 is actuated to excavate and scoop soil, etc. and the sub-bucket 2 in association is rocked toward the bucket proper 1 to serve for effectively holding almost all the material excavated. The operation of grabbing an object such as timber 17 as shown in Figure 4b can be independently performed, if necessary, by means of the cylinder actuator 13. When a greater amount of soil is desired to be excavated by one scoop, the arm 11 may be rocked by means of cylinder actuator 18 to drive the bucket proper 1 into the earth, with the bucket proper being positioned away from the sub-bucket 2, and then the cylinder actuator rod 13' may be pushed out to rock the bucket proper and the sub-bucket about the pivotal engaging portions toward each other.

It can be understood from the foregoing that the bucket attachment of the invention is capable of performing both operations of excavation by the bucket proper and grabbing by the bucket proper and the sub-bucket in a free, continuous manner, thanks to the associated link arrangement actuated by one single cylinder actuator 13.

CLAIMS

1. A dual purpose bucket attachment for excavation and grabbing adapted to be rockingly mounted to an arm which in turn is rockingly connected to a boom of an excavator machine, the bucket attachment comprising: a bucket portion comprising a bucket proper and a complementary sub-bucket pivotally engaged at their upper ends for a rocking movement by a pair of common pivot apertures for connection of said bucket portion to the distal end of the arm of an excavator machine; a pair of upper

fitted in common pivot apertures 5, 5. The common pivot apertures 5, 5 receive therethrough a pin 5' to serve for pivotal mounting of the attachment to the arm of an excavator machine. Because of embossments 2'' of the sub-bucket 2 and the bucket proper 1 are, as shown in Figure 3, pivotally engaged with each other via the abovementioned bushes 6, the bucket proper 1 and the sub-bucket 2 are kept connected to each other even without the pin 5' fitted therethrough, which facilitates transportation and mounting of the bucket attachment to the machine arm, without the necessity of re-assembling of the bucket attachment.

The abovementioned bushes 6 are provided with flanges 6' whose thickness may selectively vary. Selection of the thickness of the bush flanges permits the bucket portion 10 and the machine arm 11 to be connected in a close-fit relationship to each other even when the machine arm 11 to which the bucket portion is pivotally secured by the pin 5' extending from one to another bush 6 has various widths.

The bucket proper 1 and the complementary sub-bucket 2 are provided along respective opposed side edges with series of suitably shaped, mutually spaced projections 1', 2'. A plurality of pawls 3, 3' may be provided, if desired, at the bottom edges of the bucket proper 1 and the sub-bucket 2 to engage meshingly with each other.

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- stays disposed on said bucket proper and each having an upper link aperture; a pair of upper link members each having one end pivotally secured in said upper link aperture and the other end pivotally secured to the distal end of a plunger rod; a pair of sub-link members each having one end adapted to be pivotally secured to a respective one of opposed side plates of the arm and the other end pivotally secured to a respective one of said upper link members for association therewith; and a pair of lower link members each having one end pivotally secured to said sub-bucket at a location substantially spaced from said common pivot aperture and being pivotally associated with said upper link members and said sub-link members, thereby forming a link arrangement which is adapted to be actuated by a single cylinder actuator to allow said bucket proper and said sub-bucket to perform excavating and grabbing operations.
2. A bucket attachment as defined in Claim 1, wherein said pair of lower link members each have one end pivotally secured to respective opposed side plates of said sub-bucket and another end pivotally secured to a respective one of said pair of sub-link members.
3. A bucket attachment as defined in Claim 1, wherein said pair of lower link members each have one end pivotally secured to a respective one of opposed side plates of said sub-bucket and another end pivotally secured to a respective one of said pair of upper link members.
4. A bucket attachment as defined in Claim 1, wherein the pivotal engaging portions of said bucket proper and said sub-bucket and said sub-link members are preliminarily pivotally secured to one single integral bracket by the intermediary of which said bucket attachment is adapted to be mounted to the arm.
5. A bucket attachment as defined in any one of Claims 1, 2, 3 or 4, wherein the pivotal engaging portions of said bucket proper and sub-bucket are preliminarily connected to each other, with a hollow bush fitted therein and having a flange of variable thickness.
6. A bucket attachment constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 4b of the accompanying drawings.
7. A bucket attachment according to Claim 6 when modified substantially as herein described with reference to Figure 5 or Figures 6 and 7 of the accompanying drawings.
8. A dual purpose bucket attachment according to Claim 7 when modified substantially as herein described with reference to Figure 5 or Figures 6 and 7 of the accompanying drawings.