



(11) **EP 2 083 177 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
29.07.2009 Bulletin 2009/31

(51) Int Cl.:
F15B 15/14^(2006.01)

(21) Application number: **09000389.8**

(22) Date of filing: **14.01.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR

Designated Extension States:
AL BA RS

(30) Priority: **23.01.2008 KR 20080007192**

(71) Applicant: **Volvo Construction Equipment Holding Sweden AB**
631 85 Eskilstuna (SE)

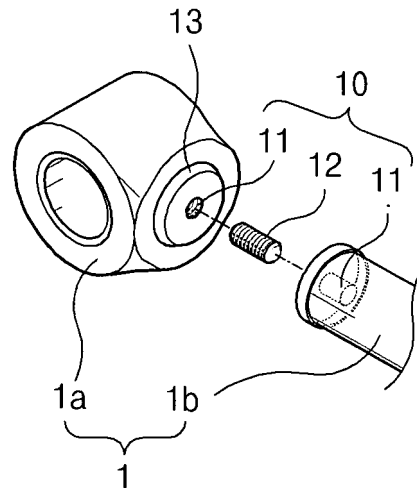
(72) Inventor: **Lee, Jin Woo**
Jangyu-myeon
Kimhae-city (KR)

(74) Representative: **Schmidt, Sven Hendrik**
Dr. Weitzel & Partner
Friedenstraße 10
89522 Heidenheim (DE)

(54) **Hydraulic cylinder having rod safety device**

(57) A hydraulic cylinder having a rod safety device is provided, which can prevent a free falling of an arm and a bucket by fastening members when a welding part is broken to protect a cab and an operator. The hydraulic cylinder having a rod safety device which includes a cylinder rod (1) sliding within a set stroke range in a tube and composed of a rod head (1a) and a rod body (1b) joint-connected to the rod head (1a); a cover (3) connected by weld joint to one end part of the tube (2); an end cover (4) connected by weld joint to the other end part of the tube (2); a piston (5) fastened to one end part of the cylinder rod (1) to reciprocate along an inner periphery of the tube; and a connection means composed of a screw engagement part (10) formed in center parts of mutual contact surfaces of the rod head (1a) and the rod body (1b) in a shaft direction to joint-connect the rod head (1a) and the rod body (1b) by screw-engaging the rod head (1a) and the rod body (1b), and a weld joint part joint-connecting the rod head (1a) and the rod body (1b) by welding outer peripheries of the contact surfaces of the rod head (1a) and the rod body (1b).

Fig. 3



EP 2 083 177 A2

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based on and claims priority from Korean Patent Application No. 10-2008-0007192, filed on January 23, 2008 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

Field of the invention

[0002] The present invention relates to a hydraulic cylinder having a rod safety device, which can improve the safety of a hydraulic cylinder by adding a joint connection means to a bonding part in which a rod head and a rod body of the hydraulic cylinder are joint-connected by welding.

[0003] More particularly, the present invention relates to a hydraulic cylinder having a rod safety device, in which a screw engagement part (e.g. a screw is used) is formed in center parts of mutual contact surfaces of a rod head and a rod body of the hydraulic cylinder in a shaft direction, and an outer surface of a joint connection part of the rod head and the rod body is welded, so that a free falling of an arm and a bucket is prevented by a screw engagement part when a welding part is broken to protect a cab and an operator.

Description of the Prior Art

[0004] As illustrated in FIG. 1, a general hydraulic cylinder includes a tube 2 accommodating a cylinder rod 1 that slides in a set stroke range; a cover 3 connected by weld joint to one end part of the tube 2 (corresponding to a side of a rod head 1a); an end cover 4 connected by weld joint to the other end part of the tube 3 (corresponding to a side of a piston 5); and a piston 5 fastened to one end part of the cylinder rod 1 to reciprocate along an inner periphery of the tube 2.

[0005] As illustrated in FIG. 2, in the conventional hydraulic cylinder, outer part of mutual contact surfaces of a rod head 1a and a rod body 1b of the cylinder rod 1 are connected by weld joint.

[0006] In this case, if stress is generated in the weld joint part due to high impact and vibration repeatedly generated during the operation of the hydraulic cylinder, fatigue fracture of the weld joint part occurs to greatly deteriorate the durability of the weld joint part 13, so that the life span of the hydraulic cylinder is shortened and the safety is degraded.

[0007] As illustrated in FIG. 5, the cylinder rod 1 receives a complex load, such as a tensile force, a compression force, and a bending load in a shaft direction. At this time, a relatively large force acts on the outer surface (i.e. an edge part) of the weld joint part 13 of the rod

body 1b rather than the center of the weld joint part 13 in the shaft direction.

[0008] Accordingly, a relatively large force is applied to the mutual weld parts of the rod head 1a and the rod body 1b. Also, in unexpected environments, such as in welding defects of the weld joint part 13 of the rod head 1a and the rod body 1b, an abrupt damage of the weld joint part may precedently occur.

[0009] As described above, even if the weld joint part 13 of the cylinder rod 1 of the hydraulic cylinder (e.g. an arm cylinder 8 of an excavator) mounted on the equipment is broken due to the welding defects and so on, the safety of the operator in the cab is not threatened by the bucked and so on in view of the working radius of a standard working device that is provided by manufacturers of heavy equipment.

[0010] However, as illustrated in FIG. 6, in order to efficiently use the expensive equipment, an owner of the equipment may mount a working device optionally remodeled to cope with diverse working environments (so called "special attachments") on a bucket 7 and so on.

[0011] In this case, if the weld joint part 13 of the arm cylinder 8 is broken due to the welding defects and so on, a mechanical free falling of an arm 9 and the bucket 7 around a point O occurs, and this may cause the damage of the cab 6 and the threatening of the operator's life.

SUMMARY OF THE INVENTION

[0012] Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art while advantages achieved by the prior art are maintained intact.

[0013] One object of the present invention is to provide a hydraulic cylinder having a rod safety device, in which a screw engagement part is formed in center parts of mutual contact surfaces of a rod head and a rod body of the hydraulic cylinder in a shaft direction, and an outer surface of a joint connection part of the rod head and the rod body is welded, so that a free falling of an arm and a bucket is prevented by fastening members when a welding part is broken to prevent the damage of a cab and to protect an operator from an accident.

[0014] Another object of the present invention is to provide a hydraulic cylinder having a rod safety device, which can improve the reliability of equipment by preventing a free falling of an arm and a bucket when a welding part of a cylinder rod is broken due to welding defects and so on, even if an owner of the equipment optionally remodels a working device to cope with divers working environments.

[0015] In order to accomplish the objects, there is provided a hydraulic cylinder having a rod safety device, according to embodiments of the present invention, which includes a cylinder rod sliding within a set stroke range in a tube and composed of a rod head and a rod body joint-connected to the rod head; a cover connected by weld joint to one end part of the tube; an end cover

connected by weld joint to the other end part of the tube; a piston fastened to one end part of the cylinder rod to reciprocate along an inner periphery of the tube; and a connection means composed of a screw engagement part formed in center parts of mutual contact surfaces of the rod head and the rod body in a shaft direction to joint-connect the rod head and the rod body by screw-engaging the rod head and the rod body, and a weld joint part joint-connecting the rod head and the rod body by welding outer peripheries of the contact surfaces of the rod head and the rod body.

[0016] The screw engagement part may include screw holes respectively formed in the center parts of the mutual contact surfaces of the rod head and the rod body in the shaft direction, and a connection bolt engaged into the screw holes to screw-engage the rod head and the rod body.

[0017] The screw engagement part may include a screw hole formed in one of the center parts of the contact surfaces of the rod head and the rod body, and a connection bolt fixed by welding to the other of the center parts of the contact surfaces of the rod head and the rod body to correspond to the screw hole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic view illustrating a general hydraulic cylinder;

FIG. 2 is a view illustrating a main portion of a joint part of a conventional hydraulic cylinder;

FIG. 3 is an exploded perspective view illustrating a main portion of a hydraulic cylinder having a rod safety device according to an embodiment of the present invention;

FIGS. 4A and 4B are sectional views illustrating a main portion of a hydraulic cylinder as illustrated in FIG. 3;

FIG. 5 is a view explaining generation of a load on a weld joint part of a cylinder rod; and

FIG. 6 is a view explaining that a cab and an operator may be threatened by a working device freely falling when the weld joint part of the hydraulic cylinder is broken due to welding defects and so on.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Hereinafter, preferred embodiments of the present invention will be described with reference to the accompanying drawings. The matters defined in the description, such as the detailed construction and elements, are nothing but specific details provided to assist those of ordinary skill in the art in a comprehensive understand-

ing of the invention, and thus the present invention is not limited thereto.

[0020] As shown in FIGS. 3, 4A and 4B, a hydraulic cylinder having a rod safety device according to an embodiment of the present invention includes a cylinder rod 1 sliding within a set stroke range in a tube 2 and composed of a rod head 1a and a rod body 1b joint-connected to the rod head 1a; a cover 3 connected by weld joint to one end part of the tube 2; an end cover 4 connected by weld joint to the other end part of the tube 2; a piston 5 fastened to one end part of the cylinder rod 1 to reciprocate along an inner periphery of the tube 2; and a connection means composed of a screw engagement part 10 formed in center parts of mutual contact surfaces of the rod head 1a and the rod body 1b in a shaft direction to joint-connect the rod head 1a and the rod body 1b by screw-engaging the rod head 1a and the rod body 1b, and a weld joint part 13 joint-connecting the rod head 1a and the rod body 1b by welding outer peripheries of the contact surfaces of the rod head 1a and the rod body 1b.

[0021] In a preferred embodiment of the present invention, the screw engagement part 10 includes screw holes 11 respectively formed in the center parts of the mutual contact surfaces of the rod head 1a and the rod body 1b in the shaft direction, and a connection bolt 12 engaged into the screw holes 11 to screw-engage the rod head 1a and the rod body 1b.

[0022] The hydraulic cylinder having a rod safety device according to an embodiment of the present invention, except for the screw engagement part 10 including the screw holes 11 respectively formed in the center parts of the mutual contact surfaces of the rod head 1a and the rod body 1b in the shaft direction, and the connection bolt 12 engaged into the screw holes 11 to screw-engage the rod head 1a and the rod body 1b, is substantially the same as the conventional hydraulic cylinder as illustrated in FIGS. 1 and 2, and thus the detailed description thereof will be omitted. In the description of the present invention, the same drawing reference numerals are used for the same elements across various figures.

[0023] Hereinafter, the operation of the hydraulic cylinder having a rod safety device according to an embodiment of the present invention will be described in detail with reference to the accompanying drawings.

[0024] As illustrated in FIGS. 3, 4A and 4B, the rod head 1a and the rod body 1b are joint-connected by screw-engaging the connection bolt 12 into the screw holes 11 respectively formed in the center parts of the mutual contact surfaces of the rod head 1a and rod body 1b of the cylinder rod 1. The outer surfaces of the contact surfaces of the rod head 1a and the rod body 1b, which are in close contact with each other and are joint-connected by the connection bolt 12, are fixed together by welding.

[0025] That is, the rod head 1a and the rod body 1b are firstly joint-connected by the connection bolt 12 that is screw-engaged with the center parts of the mutual contact surfaces of the rod head and the rod body in a shaft

direction, and are secondly joint-connected by the weld joint part 13 that fixes by welding the outer surfaces of the contact surfaces of the rod head 1a and the rod body 1b to each other.

[0026] During working of the equipment, if external forces, such as a tensile force, a compression force, a bending load, and the like, are repeatedly applied to and accumulated on the weld joint part 13 of the cylinder rod 1, the weld joint part 13 may be broken or damaged due to welding defects and so on.

[0027] As described above, even in the case where the weld joint part 13 is broken in unexpected environments, the rod head 1a and the rod body 1b can be kept in a joint connection state by the connection bolt 12 that is screw-engaged with the inner center portion of the weld joint part 13 in a shaft direction.

[0028] Accordingly, even in the case where the weld joint part 13 of the rod head 1a and the rod body 1b of the cylinder rod 1 is broken, the arm and the bucket are prevented from freely falling by the connection bolt 12, and thus a cab or an operator can be protected from safety accidents.

[0029] As illustrated in FIG. 4B, the screw engagement part 10, which is formed in the center parts of the mutual contact surfaces of the rod head 1a and the rod body 1b in a shaft direction to joint-connect the rod head 1a and the rod body 1b through screw-engagement, may a screw hole 11 formed in one of the center parts of the contact surfaces of the rod head 1a and the rod body 1b (e.g. formed in the rod head 1a), and a connection bolt 12 fixed by welding to the other of the center parts of the contact surfaces of the rod head 1a and the rod body 1b to correspond to the screw hole 11.

[0030] In this case, the construction, except for the screw engagement part 10 composed of the screw hole 11 formed in the center of the contact surface of the rod head 1a and the connection bolt 12 fixed by welding to the center of the contact surface of the rod body 1a, is substantially the same as that as illustrated in FIGS. 3 and 4A, the detailed description thereof will be omitted. In the description of the present invention, the same drawing reference numerals are used for the same elements across various figures.

[0031] As described above, the hydraulic cylinder having a rod safety device according to the embodiments of the present invention has the following advantages.

[0032] Since the screw engagement part is formed in the center parts of the mutual contact surfaces of the rod head and the rod body of the hydraulic cylinder in the shaft direction (i.e. in a direction of extension and compression of the cylinder rod), and the outer surface of the joint connection part of the rod head and the rod body is welded, a free falling of the arm and the bucket is prevented by the fastening members when the welding part is broken, so that the cab is prevented from being damaged, and the operator is protected from an accident.

[0033] Also, even if an owner of the equipment optionally remodels a working device to cope with divers work-

ing environments, the reliability of the equipment is improved by preventing a free falling of the arm and the bucket when the welding part of the cylinder rod is broken due to welding defects and so on.

[0034] Although preferred embodiment of the present invention has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A hydraulic cylinder having a rod safety device, comprising:

a cylinder rod sliding within a set stroke range in a tube and composed of a rod head and a rod body joint-connected to the rod head;

a cover connected by weld joint to one end part of the tube;

an end cover connected by weld joint to the other end part of the tube;

a piston fastened to one end part of the cylinder rod to reciprocate along an inner periphery of the tube; and

a connection means composed of a screw engagement part formed in center parts of mutual contact surfaces of the rod head and the rod body in a shaft direction to joint-connect the rod head and the rod body by screw-engaging the rod head and the rod body, and a weld joint part joint-connecting the rod head and the rod body by welding outer peripheries of the contact surfaces of the rod head and the rod body.

2. The hydraulic cylinder of claim 1, wherein the screw engagement part comprises screw holes respectively formed in the center parts of the mutual contact surfaces of the rod head and the rod body in the shaft direction, and a connection bolt engaged into the screw holes to screw-engage the rod head and the rod body.

3. The hydraulic cylinder of claim 1, wherein the screw engagement comprises a screw hole formed in one of the center parts of the contact surfaces of the rod head and the rod body, and a connection bolt fixed by welding to the other of the center parts of the contact surfaces of the rod head and the rod body to correspond to the screw hole.

Fig. 1

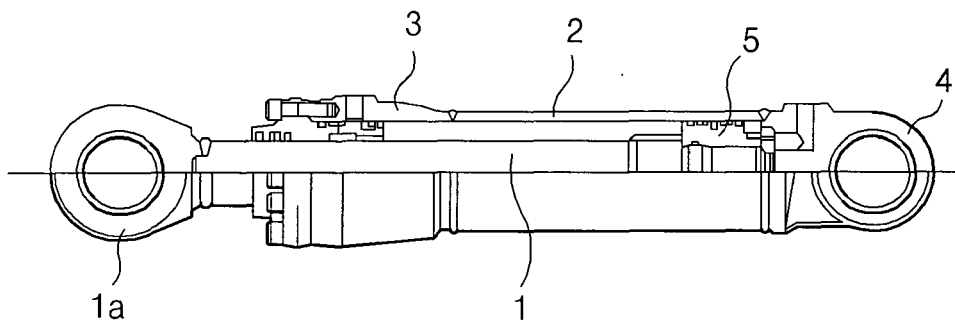


Fig. 2

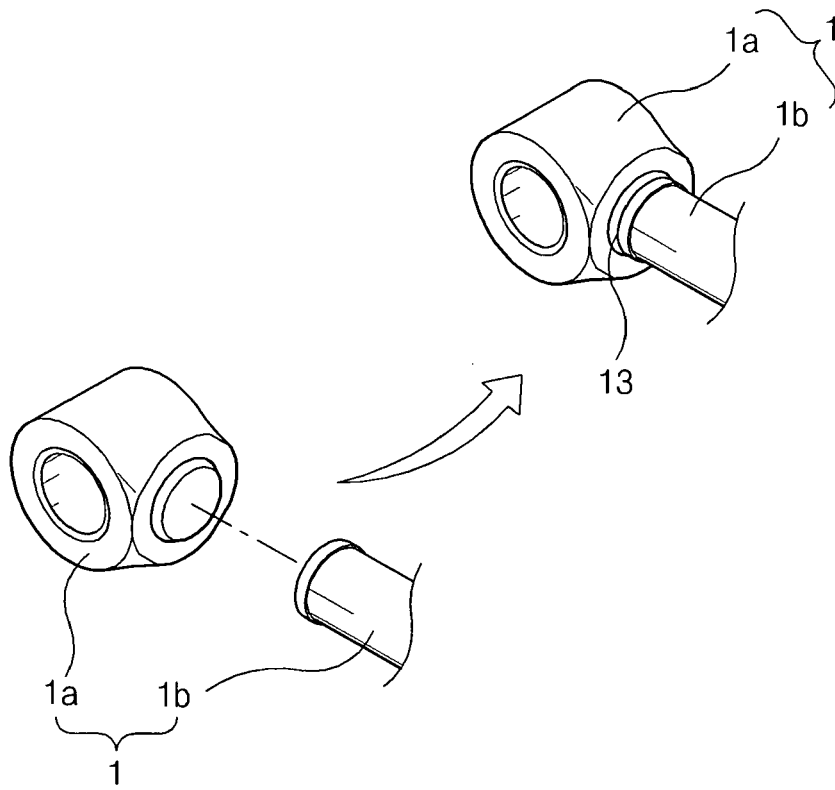


Fig. 3

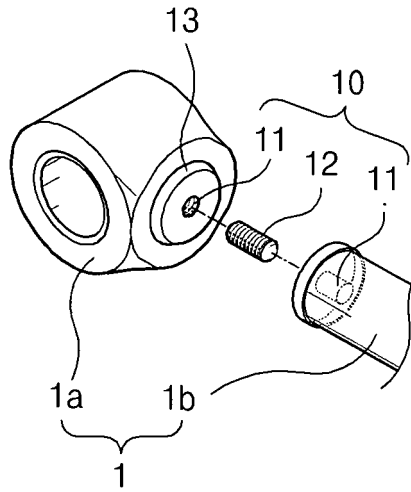


Fig. 4A

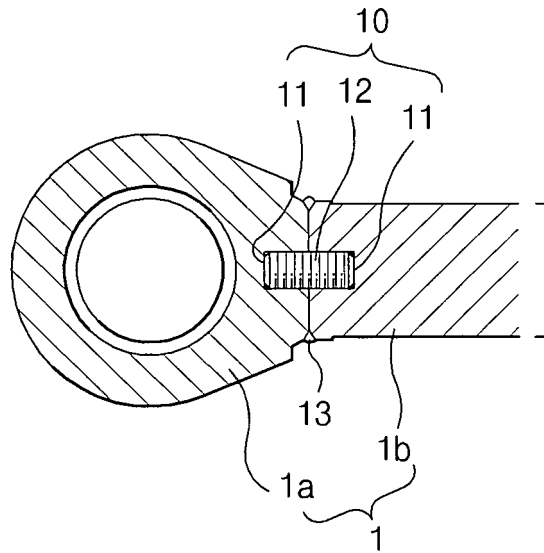


Fig. 4B

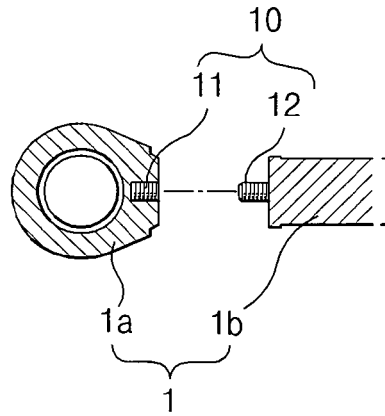


Fig. 5

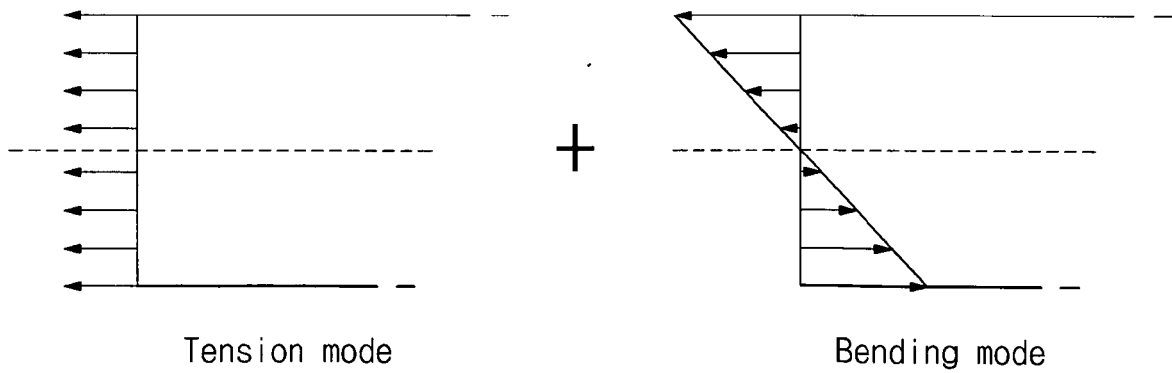
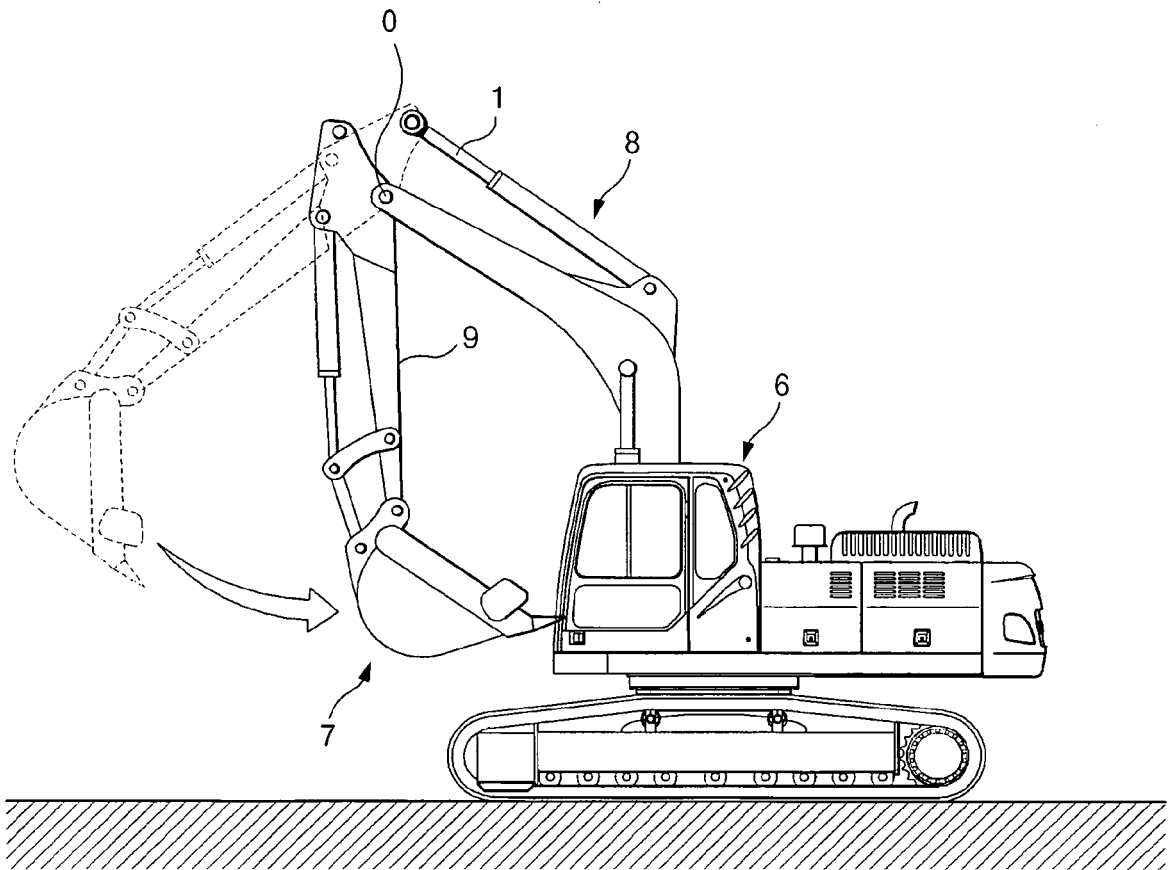


Fig. 6



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- KR 1020080007192 [0001]