(54) Title: CATWALK FOR CONSTRUCTION MACHINE

(57) Abstract: Object of the Invention: This invention relates to a catwalk which is installed along the side of upper swing structure of construction machine such as large hydraulic excavator. When the upper structure swings at construction work, the end of longer side of the catwalk is susceptible to damage by hitting with materials like piled mud near the machine. The object of this invention is to provide a catwalk which prevents the damage effectively, and has stable walkway, and also provides simple structure for lower manufacturing cost and easy use. Outline of the Invention: With reference to Fig. 1, catwalks (16, 17) are installed on both sides of construction machine (2). Catwalks (16, 17) are symmetrical. Features will be explained to the catwalk (16) by referring Fig. 2 also. The catwalk (16) which is installed along the side (6a) of upper swing structure (6) of construction machine (2) has a movable portion (18) at most outer end (H) from swing center (X). The movable portion (18) is installed around axis (Y) which locates near the side (6a) of swing structure (6), and is installed to rotate between horizontal and upper positions. When the movable portion (18) hits with materials like piled mud (S), it rotates upward (Z2) and prevents damage.
Published:

— with international search report (Art. 21(3))
DESCRIPTION

CATWALK FOR CONSTRUCTION MACHINE

TECHNICAL FIELD

[0001] The present invention relates to a catwalk that is a passage for inspection work provided on a construction machine with an upper slewing body.

BACKGROUND ART

[0002] A large-sized construction machine with an upper slewing body, for example, a hydraulic excavator, has a large vehicle height, and it is therefore difficult for an operator on the ground to perform inspection work and the like on apparatuses arranged on the upper slewing body. Accordingly, a catwalk that is a passage for inspection work is provided on a side surface of the upper slewing body (see, for example, Patent Document 1).

[0003] The catwalk is fixed to the side surface of the upper slewing body. Thus, when the upper slewing body is slewed, the operator can consciously avoid collision against an obstacle located above and laterally to the catwalk. However, disadvantageously, a longitudinal end of the catwalk located behind the operator and corresponding to the outermost side of the slewing may come into contact with and be damaged by an obstacle such as a mountain of excavated and accumulated sediment located laterally to the catwalk. Moreover, this deformation prevents a service door on a side surface of the upper slewing body from being opened. This in turn precludes inspection work on apparatuses inside the door.

[0004] A technique for solving this problem has been developed. For example, the whole catwalk is attached to the upper slewing body so as to be able to pivot upward from a horizontal orientation so that, upon coming into contact with an obstacle, the whole catwalk is pivoted upward (see, for example, Patent Document 2).

[0005] In another example, a portion of a catwalk located in a rear portion of the vehicle can be stored under a portion of the
catwalk fixedly installed in a front portion of the vehicle so that, during a slewing operation, the rear portion of the catwalk is stored to prevent contact with an object, whereas, during inspection work, the rear portion of the catwalk is brought back to a non-stored position (see, for example, Patent Document 3).


[0007] These improved catwalks still have problems to be solved as described below.

[0008] In the structure in which the whole catwalk is mounted so as to be pivotable upward from the horizontal orientation, a mounting bracket (a component 6 in FIG. 2 of Patent Document 2) is gouged over a large area in order to avoid the trajectory of pivoting movement of a tread plate (a component 3b in FIG. 2 of Patent Document 2) located inside the center of the pivoting movement. Thus, when the operator steps on the tread plate located inside the center of the pivoting movement, the catwalk pivots and becomes unstable. Furthermore, due to the gouging, providing the bracket with rigidity is difficult, and the bracket is easily damaged and deformed. Furthermore, as the difference in height between an outer end (a component 3a in FIG. 2 of Patent Document 2) that comes into contact with an obstacle and the center of pivoting movement increases, reaction force from the obstacle is more likely to act as a force that causes the catwalk to pivot. The range of the gouging and the likelihood of the bracket being damaged and deformed increase consistently with the difference in height. Moreover, in a configuration where the catwalk is fixedly held at an upper pivoting movement position, the whole catwalk needs to be returned to the original position for use. This is cumbersome.

[0009] In the configuration where a portion of the catwalk is
stored in the fixed portion of the catwalk, when the operator has forgotten the storage, the portion of the catwalk may come into contact with and be damaged by an obstacle. Furthermore, the structure is complicated and involves high manufacturing costs. Moreover, when the stored portion is damaged by sediment or the like, storing or withdrawing the rear portion is difficult.

With these problems in view, it is a technical object of the present invention to provide a catwalk for a construction machine which enables effective prevention of damage resulting from contact between the catwalk during slewing and an obstacle, which allows a stable work passage to be prepared, and which has a simple structure to enable a reduction in manufacturing costs and easy handling.

DISCLOSURE OF THE INVENTION

According to the present invention, as a catwalk for a construction machine which accomplishes the above-described technical object, a catwalk for a construction machine with an upper slewing body, the catwalk being a passage extending and installed along a side surface of the upper slewing body, includes a movable portion provided at an end portion of the catwalk corresponding to a radially outermost side with respect to a slewing center of the upper slewing body, the movable portion being mounted so as to be pivotable between horizontal and vertical directions about an axis positioned on the side surface side of the upper slewing body.

Preferably, a passage surface of the movable portion is formed outside and away from the side surface of the upper slewing body, and a fixed passage surface is provided on an inside of the side surface.

Furthermore, the axis is positioned below a passage surface of the movable portion, and a bumper serving as a buffer member is mounted so as to face obliquely downward at an outer end portion, of the passage surface, away from the side surface of the
upper slewing body.

Moreover, the movable portion is mounted on the axis via an elastic bearing.

According to the present invention, the catwalk that is a passage extending and installed along the side surface of the upper slewing body of the construction machine includes the movable portion at the end portion of the catwalk corresponding to the radially outermost side with respect to the slewing center of the upper slewing body, the movable portion being mounted so as to be pivotable between the horizontal and vertical directions about the axis positioned on the side surface side of the upper slewing body. Consequently, when the end portion comes into contact with the obstacle, the movable portion is flipped up, allowing effective prevention of damage to the catwalk. Furthermore, the movable portion is provided only at the end portion, eliminating the need to gouge a support frame and allowing a stable work passage to be prepared. Additionally, a rigid and simple structure can be inexpensively provided, and the structure is easy to handle.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1(a) is a side view of a hydraulic excavator that is a typical example of a construction machine with a catwalk for a construction machine configured according to the present invention, FIG. 1(b) is a plan view of the hydraulic excavator as seen in the direction of arrow A in FIG. 1(a), and FIG. 1(c) is a rear view of a catwalk portion as seen in the direction of arrow B in FIG. 1(a).

FIG. 2 is an enlarged detailed view of a movable portion shown by C in FIG. 1.
FIG. 3 is an enlarged view of the movable portion as rotated through 90° with respect to FIG. 2 in the direction of arrow D in FIG. 2.

FIG. 4 is an enlarged cross-sectional view of a bearing portion of the movable portion taken along arrow E-E in FIG. 3.

BEST MODE FOR CARRYING OUT THE INVENTION

[0018] A catwalk for a construction machine configured according to the present invention will be described in further detail with reference to the attached drawings showing a preferred embodiment in a hydraulic excavator that is a typical construction machine with an upper slewing body.

[0019] Description will be given with reference to FIG. 1. A hydraulic excavator generally shown by reference numeral 2 includes a lower traveling body 4 and an upper slewing body 6 mounted on the lower traveling body 4 so as to be able to slew about an axis X that is a slewing center extending in the vertical direction. The upper slewing body 6 includes an operator cab 8 provided at a front end (a right end in FIG. 1(a)) of the upper slewing body 6, an engine room 10 provided behind the operator cab 8 and in which apparatuses such as an engine are housed, and a counterweight 12 provided at a rear end of the upper slewing body 6. An articulated working arm apparatus 14 with a bucket 14a is mounted on the front end side of the upper slewing body 6.

[0020] An operator operates an operating apparatus in the operator cab 8 to control traveling of the lower traveling body 4, slewing of the upper slewing body 6 (a rightward direction shown by arrow R and a leftward direction shown by arrow L), and actuation of the working arm apparatus 14 to perform operations.

[0021] The upper slewing body 6 includes a plurality of openable and closable doors DR provided on a right side surface 6a and a left side surface 6b of the upper slewing body 6 to allow maintenance and inspection to be performed on the apparatuses in the engine room 10 and the like. Catwalks 16 and 17 are installed
on the respective side surfaces 6a and 6b of the upper slewing body 6 so as to extend in a front-rear direction along the side surfaces 6a and 6b; the catwalks 16 and 17 are passages utilized when the operator, for example, opens the door DR, to perform maintenance and inspection work on the apparatuses.

[0022] The catwalks 16 and 17 are laterally symmetric and basically have the same structure. Thus, the catwalks according to the present invention will be described with reference to the right catwalk 16.

[0023] A movable portion 18 is provided at an end portion of the catwalk 16 located behind the operator cab 8 and corresponding to the radially outermost side (arrow H) with respect to a slewing center X of the upper slewing body 6, the movable portion 18 being mounted so as to be pivotable between the horizontal and vertical directions about an axis Y positioned on the side surface 6a side (the upward position is shown by an alternate long and two short dashes line in FIG. 1(c)).

[0024] A well-known steel plate with an antiskid member such as a plurality of star-shaped projections formed thereon is attached to a passage surface including the movable portion 18 of the catwalk 16.

[0025] Description will be given with reference to FIG. 2 and FIG. 3 along with FIG. 1. A passage surface Fl of the movable portion 18 is formed outside and away from the axis Y positioned on the side surface 6a side of the upper slewing body 6. On the inside of the side surface 6a, a fixed passage surface F2 is formed as in the case of the remaining part of the catwalk 16.

[0026] The movable portion 18 includes two arms 20 spaced from each other in a longitudinal direction (a lateral direction in FIG. 2) of the catwalk 16. One end of the arm 20 is attached, around the axis Y, to a support frame 24 mounted on the side surface 6a of the upper slewing body 6 via a plurality of bolts 22. The tread surface Fl is formed on the other end side of the arm 20.

[0027] The axis Y, which is the center of movement of the
movable portion 18, is positioned below the passage surface F1. The arm 20 is shaped like a "chevron" and extends outward and upward from the axis Y and horizontally along the passage surface F1. The horizontal position (shown by a solid line in FIG. 3) of the passage surface F1 of the movable portion 18 is defined by the arm 20 in abutting contact with a stopper 25 provided on a support frame 24. This abutting contact state may be held by an elastic rubber latch (not shown in the drawings) that is manually disengageable.

[0028] A bumper 26 is attached to an outer end portion away from the side surface 6a of the passage surface F1; the bumper 26 is a buffer member directed obliquely downward and extending fully in a longitudinal direction of the movable portion 18 (the lateral direction in FIG. 2; the direction orthogonal to the sheet of FIG. 3). The bumper 26 is formed of synthetic rubber and has a cross section shaped like a thick cylinder with a U-shaped opening closed by a straight line. The straight line portion closing the U shape is attached to an obliquely downward facing surface of the outer end portion using a plurality of bolts 28 (in the embodiment, six bolts) inserted through holes formed in a circular arc portion of the U shape.

[0029] Thus, the movable portion 18 is mounted so as to be pivotable between the horizontal direction (shown by a solid line in FIG. 3) and the vertical direction (shown by an alternate long and two short dashes line) about the axis Y. Only a part of the movable portion 18 located outward of the axis Y is pivoted and flipped up.

[0030] A case is explained where the movable portion 18 of the catwalk 16 comes into contact with an obstacle. When the upper slewing body 6 is slewed leftward as shown by arrow L in FIG. 1(b) to bring the bumper 26 of the movable portion 18 into abutting contact with an obstacle S, a reaction force from the obstacle S shown by arrow Z1 in FIG. 3 acts on the bumper 26 of the movable portion 18. Thus, the downward facing bumper 26 located above the axis of pivot Y pushes up the movable portion 18, which is pivoted
upward as shown by arrow Z2 about the axis Y. The above-described rubber latch may be installed so as to extend in accordance with the magnitude of the reaction force Z1 from the obstacle. Alternatively, the rubber latch may be adapted to be disengaged or broken in this case.

[0031] A hinge plate 30 with a hinge 30a attached to the side surface 6a side of the upper slewing body 6 is provided at a part of the passage surface F2 through which the arm 20 of the movable portion 18 passes when the movable portion 18 pivots between the "horizontal direction" and the "upward position". The hinge plate 30 is moved up and down around the hinge 30a in conjunction with the pivoting movement of the arm 20.

[0032] The arm 20 of the movable portion 18 is mounted on the axis Y via an elastic bearing. Description will be given with reference to FIG. 4 along with FIG. 3. A boss 20a corresponding to a part of the support frame 24 of the arm 20 of the movable portion 18 which part is mounted on the axis Y is positioned between two prongs of the support frame 24. The boss 20a includes a cylindrical elastic bearing 32a inserted between a pair of spacers 32b. The arm 20 is attached to the support frame 24 using a bolt 34a passed through the support frame 24 and the elastic bearing 32a and forming the axis Y, and two nuts 34b located at the other end of the bolt 34a.

[0033] The effects of the catwalk for the construction machine as described above will be described below.

[0034] As clearly shown in FIG. 1, the catwalk 16 that is a passage extending and installed along the side surface 6a of the upper slewing body 6 of the construction machine 2 includes the movable portion 18 at the end portion of the catwalk 16 corresponding to the radially outermost side H with respect to the slewing center X of the upper slewing body 6, the movable portion 18 being mounted so as to be pivotable between the horizontal and vertical directions about the axis Y positioned on the side surface 6a side.

[0035] Thus, the movable portion 18 mounted so as to be
pivotable between the horizontal and vertical directions is
provided at the end portion of the catwalk 16 corresponding to the
radially outermost side H with respect to the slewing center X,
the end portion being likely to come into contact with the obstacle
S during slewing. Thus, when the end portion comes into contact
with the obstacle S, the movable portion 18 is flipped up, allowing
effective prevention of damage to the catwalk 16. Furthermore, the
movable portion 18 is provided only at the end portion, allowing
a stable work passage to be prepared. The structure is simple,
ensuring a reduction in manufacturing costs, and is also easy to
handle.

[0036] Furthermore, as clearly shown in FIG. 2, the passage
surface F1 of the movable portion 18 is formed outside and away
from the side surface 6a of the upper slewing body 6, and the fixed
passage surface F2 is provided on the inside of the side surface
6a.

[0037] Therefore, a stable passage surface can be prepared by
the passage surface F1 of the movable portion 18, only the outside
of which is flipped up, and the inner fixed passage surface F2.

[0038] Moreover, as clearly shown in FIG. 3, the axis Y about
which the movable portion 18 pivots is positioned below the passage
surface F1 of the movable portion 18, and the bumper 26 serving
as a buffer member is mounted so as to face obliquely downward at
the outer end portion, of the passage surface F1, away from the
side surface 6a.

[0039] Therefore, even when the movable portion 18 comes into
contact with the obstacle S, the movable portion 18 is easily flipped
up because the passage surface F1 of the movable portion 18 is offset
above the axis Y and because the bumper 26 at the outer end portion
of the passage surface F1 is mounted to face obliquely downward.

[0040] Furthermore, as clearly shown in FIG. 4, the movable
portion 18 is mounted on the axis Y via the elastic bearing 32a.

[0041] Therefore, the elastic bearing 32a enables a reduction
in impulse force applied to the movable portion 18 and also assist
in upward pivoting movement of the movable portion 18.

[0042] The present invention has been described in detail based on the embodiment. However, the present invention is not limited to the above-described embodiment. For example, many variations and modifications may be made to the embodiment without departing from the scope of the present invention.

[0043] In the embodiment, the construction machine is a hydraulic excavator. However, the present invention is applicable to any other construction machine with an upper slewing body, for example, a crane truck.

[0044] In the embodiment, the movable portion is provided at the rear end portion of the catwalk behind the operator cab on the upper slewing body. However, if, for example, a front end portion corresponds to the outermost side of the slewing radius, the movable portion may be provided at the front end portion, which corresponds to the outermost side.

EXPLANATION OF REFERENCE NUMERALS

[0045] 2 Hydraulic excavator (construction machine)
  6 Upper slewing body
  6a, 6b Side surface
  16, 17 Catwalk
  18 Movable portion
  26 Bumper
  32a Elastic bearing
  Fl, F2 Passage surface
  H Outermost side
  S Obstacle
  X Axis (slewing center)
  Y Axis
CLAIMS

1. A catwalk for a construction machine with an upper slewing body, the catwalk being a passage extending and installed along a side surface of the upper slewing body, the catwalk comprising:

   a movable portion provided at an end portion of the catwalk corresponding to a radially outermost side with respect to a slewing center of the upper slewing body, the movable portion being mounted so as to be pivotable between horizontal and vertical directions about an axis positioned on the side surface side of the upper slewing body.

2. The catwalk according to claim 1, wherein a passage surface of the movable portion is formed outside and away from the side surface of the upper slewing body, and

   a fixed passage surface is provided on an inside of the side surface.

3. The catwalk according to claim 1 or claim 2, wherein the axis is positioned below a passage surface of the movable portion, and

   a bumper serving as a buffer member is mounted so as to face obliquely downward at an outer end portion, of the passage surface, away from the side surface of the upper slewing body.

4. The catwalk according to any of claims 1 to 3, wherein the movable portion is mounted on the axis via an elastic bearing.
INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/065526

A. CLASSIFICATION OF SUBJECT MATTER

INV. E02F9/Q8 A01D41/12 B62D25/10 B60R3/00 B66C13/54
E02D17/13

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E02F B60R B62D B66C E02D A01D B60P E01C E21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>J P 2013 064232 A (KOBELCO CONSTR MACHINERY LTD) 11 April 2013 (2013-04-11)</td>
<td>1,3,4</td>
</tr>
<tr>
<td></td>
<td>figures 2,3,4,7,8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>figures 2,4</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>J P 2013 064239 A (KOBELCO CONSTR MACHINERY LTD) 11 April 2013 (2013-04-11)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>figures</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>US 5 996 737 A (HEDLEY ROBERT IAN [AU] ET AL) 7 December 1999 (1999-12-07)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>figures</td>
<td></td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :
  * "A" document defining the general state of the art which is not considered to be of particular relevance
  * "E" earlier application or patent but published on or after the international filing date
  * "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  * "O" document referring to an oral disclosure, use, exhibition or other means
  * "P" document published prior to the international filing date but later than the priority date claimed
  * "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  * "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  * "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  * "Z" document member of the same patent family

Date of the actual completion of the international search
15 September 2014

Date of mailing of the international search report
23/09/2014

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer
Papadimi triou, S
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>J P H06 171429 A (HITACHI CONSTRUCTION MACHINERY) 21 June 1994 (1994-06-21) abstract; figures 1-3</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>J P H10 237900 A (HITACHI CONSTRUCTION MACHINERY) 8 September 1998 (1998-09-08) abstract</td>
<td>1</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>JP 2013064232 A</td>
<td>11-04-2013</td>
<td>NON E</td>
</tr>
<tr>
<td>KR 20110046856 A</td>
<td>06-05-2011</td>
<td>NON E</td>
</tr>
<tr>
<td>JP 2013064239 A</td>
<td>11-04-2013</td>
<td>NON E</td>
</tr>
<tr>
<td>US 5996737 A</td>
<td>07-12-1999</td>
<td>CA 2261406 Al</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 5996737 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZA 9901028 A</td>
</tr>
<tr>
<td>JP H06171429 A</td>
<td>21-06-1994</td>
<td>NON E</td>
</tr>
<tr>
<td>JP H10237900 A</td>
<td>08-09-1998</td>
<td>NON E</td>
</tr>
</tbody>
</table>