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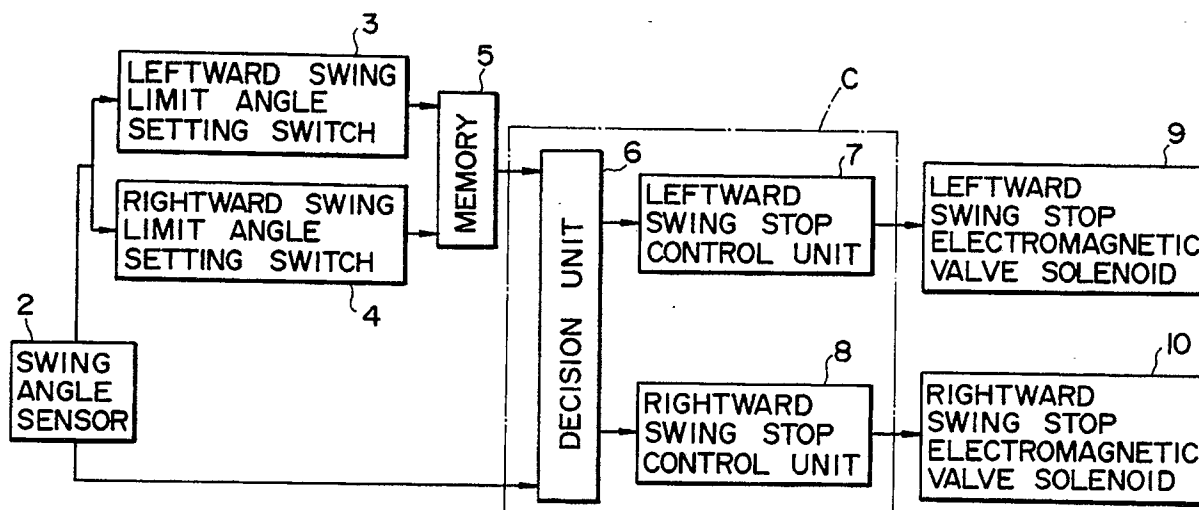
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London WC1V 6SE(GB)**(54) **Apparatus for limiting the swing of a swing type work machine such as a crane or hydraulic shovel.**

(57) A swing limiting device for limiting the swing angle of a swing body in a hydraulic shover or the like. The device comprises a limit angle setting means (3, 4) for setting left and right swing angular limits (α, β) of a swing body, a swing angle sensor

(2), and a controller (C) for outputting a swing stop command to a swing driving system when the swing angle of the swing body exceeds the set angular limit.

FIG. 1**EP 0 416 180 A1**

APPARATUS FOR LIMITING THE SWING OF A SWING TYPE WORK MACHINE SUCH AS A CRANE OR HYDRAULIC SHOVEL

The present invention relates to a swing limiting apparatus for limiting the swing of a swing type work machine such as a crane, a hydraulic shovel or the like, to improve, for example, its safe working.

In the case where there is an obstacle such as a power-transmission line, a building or the like the working area of the swing type work machine, it becomes necessary to limit the swing angle of a swing body (eg, the boom of a crane or arm of a shovel) in order to avoid a collision between the obstacle and the swing body.

In such a case, in the past, as disclosed in Japanese Patent Application Laid-open Publication No. 227693/1984, a limit switch which operates when the swing body reaches an angular limit is mounted on a swing vehicle (a lower travel body in the case of a crane), with respect to both left and right swing directions, so that an alarm is given by the operation of the limit switch.

However, according to the aforementioned conventional apparatus, adjusting the position of a limit switch so as to set an angular limit which setting has to be carried out at every work site where an obstacle is present is cumbersome, and the adjustment of position of the limit switch has to be carried out during swinging and therefore involves a danger. In addition, only an alarm is provided by operation of the limit switch, and no swing suppression mechanism is provided. Therefore, the collision preventive effect is insufficient.

We will describe a swing limiting apparatus for a swing type work machine in which the limit angle can be set simply and safely, and can stop the swing to positively prevent a collision.

According to the present invention, there is provided a swing limiting apparatus comprising a limit angle setting means for setting as an electrical value swing limit angles in both left and right directions of a swing body with respect to a swing reference point, a swing angle sensor for detecting as an electrical value swing angles in both left and right directions with respect to said swing reference point of said swing body, and a controller for outputting a swing stop command to a swing driving system when the swing angle of the swing body exceeds the set angular limit on the basis of the detected signal of the swing angle sensor and the angular limit set by the limit angle setting means.

As described above, since the swing limit angle is set as an electrical value, the troublesome and dangerous setting of the limit switch as in the prior arrangement become unnecessary. In addition, the swing stop function is automatically ac-

tivated if the swing angle of the swing body exceeds the set angular limit, and therefore, a collision preventive action is positively performed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a swing limiting device according to an embodiment of the present invention; and

FIG. 2 is a schematic plan view of a crane for explaining the function of the device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiment of the present invention will be described with reference to the drawings.

In FIG. 2, reference numeral 1 designates a lower travel body of a crawler crane such as a swing truck. O Designates the swing center of a swing body (not shown), P a swing reference point α , a swing limit angle to the left with respect to the swing reference point P, and β a swing limit angle to the right thereof.

A block diagram of the present apparatus for limiting the left and right swing angles of the swing body to the aforesaid limit angles α and β is shown in FIG. 1.

Reference numeral 2 designates a swing angle sensor in which during operation, the left and right swing angles with respect to the swing reference point P of the swing body are detected as an electrical value by the sensor 1. The detected value is taken into a controller C. A potentiometer can be used as the swing angle sensor 2, in which the resistance to the swing reference point P (swing angle is O) is used as the electrical reference value, and the resistance varies as the swing body swings to left or right. In the case where a sensor for generating an analog signal such as a potentiometer is used, an A/D converter is provided between the sensor 2 and the controller 3.

Reference numeral 3 designates a leftward swing limit angle setting switch, and 4 a rightward swing limit angle setting switch. Prior to the commencement of the operation, when the switches 3 and 4 are operated in the state wherein the swing body is swung to the left and right limit angles α and β , whereby the detected value of the sensor is stored as a set value of the swing limit angle into a memory 5 such as a RAM and then taken into the controller C.

The controller C comprises a decision unit 6

which compares the detected value (actual swing angle) of the sensor 2 during the swinging, and the set value (α or β) of the angular limit to decide whether the detected value is smaller than the set value, that is, the swing angle is within the angular limit, and swing stop control units 7 and 8 for controlling energization and deenergization of solenoids 9 and 10 of a left and right swing stop electromagnetic valve (not shown) according to the result of the decision by the decision unit 6.

The swing stop control units 7 and 8 energize the solenoids 9 and 10 of the swing stop electromagnetic valve when the decision unit 6 decides that the detected value is smaller than the set value, and cuts off the energization of the solenoids 9 and 10 when the detected value exceeds the set value. The swing stop electromagnetic valve causes a remote control valve operated by a lever in a swing hydraulic circuit and a main control valve (the remote control valve and the main control valve not being shown) to be energized when the solenoids 9 and 10 are energized, and solenoids 9 and 10 are switched to the cutoff position when deenergized.

Accordingly, when the swing angle of the swing body is within the angular limits α and β , the swing hydraulic circuit is operated in a normal manner and the swing operation is carried out. When the swing angle exceeds the angular limits α and β , the swing hydraulic circuit is cut off and the swing operation of the swing body is automatically stopped.

When the swing angle exceeds the angular limit, the swing stop function is automatically effected, and therefore, collision between the swing body, boom or the like and the obstacle is positively prevented.

Since the swing stop control units 7 and 8 and the swing stop electromagnetic valve function separately with respect to both left and right swinging directions, even if one swing operation is suppressed, the other swing operation can be performed within the angular limit.

While in the above-described embodiment, we have described an on/off valve as the swing stop electromagnetic valve, an electromagnetic proportional reducing valve may be used in which a primary pressure changes in proportional to an energizing current. In this way, as the swing angle comes close to the angular limit, the secondary pressure of the electromagnetic proportional reducing valve reduces, and the speed of swing gradually reduces accordingly. Therefore, the swing operation can be gradually stopped. Moreover, an alarm may be issued in a manner similar to the prior art at the same time as the swing stop function is operated.

As described above, according to the present

invention, since the swing limit angle is set as an electrical value by the swing limit angle setting means, the setting of the limit can be much simpler and safer than the prior art in which the angular limit is set by the adjustment of position of the limit switch. Furthermore, when the swing angle exceeds the angular limit, the swing is automatically stopped, positively preventing collision of the swing body with the obstacle as compared with the conventional device in which an alarm is merely provided, thus enhancing the safety of operation.

Claims

1. A swing limiting apparatus comprising a limit angle setting means for setting as an electrical value swing limit angles in both left and right directions of a swing body with respect to a swing reference point, a swing angle sensor for detecting as an electrical value swing angles in both left and right directions with respect to said swing reference point of said swing body, and a controller for outputting a swing stop command to a swing driving system when the swing angle of the swing body exceeds the set angular limit on the basis of the detected signal of the swing angle sensor and the set angular limit by the limit angle setting means.
2. The apparatus according to claim 1, characterised in that said swing angle sensor comprises a potentiometer, and an A/D converter is provided between the sensor and the controller.
3. The apparatus according to claim 1, characterised in that said controller comprises a decision unit for deciding whether the swing angle is within the angular limit from the result of comparison between the detected value of the sensor and the set value of the angular limit, and swing stop control units for controlling the energization of solenoids on the basis of the result of decision by the decision unit.

FIG. 1

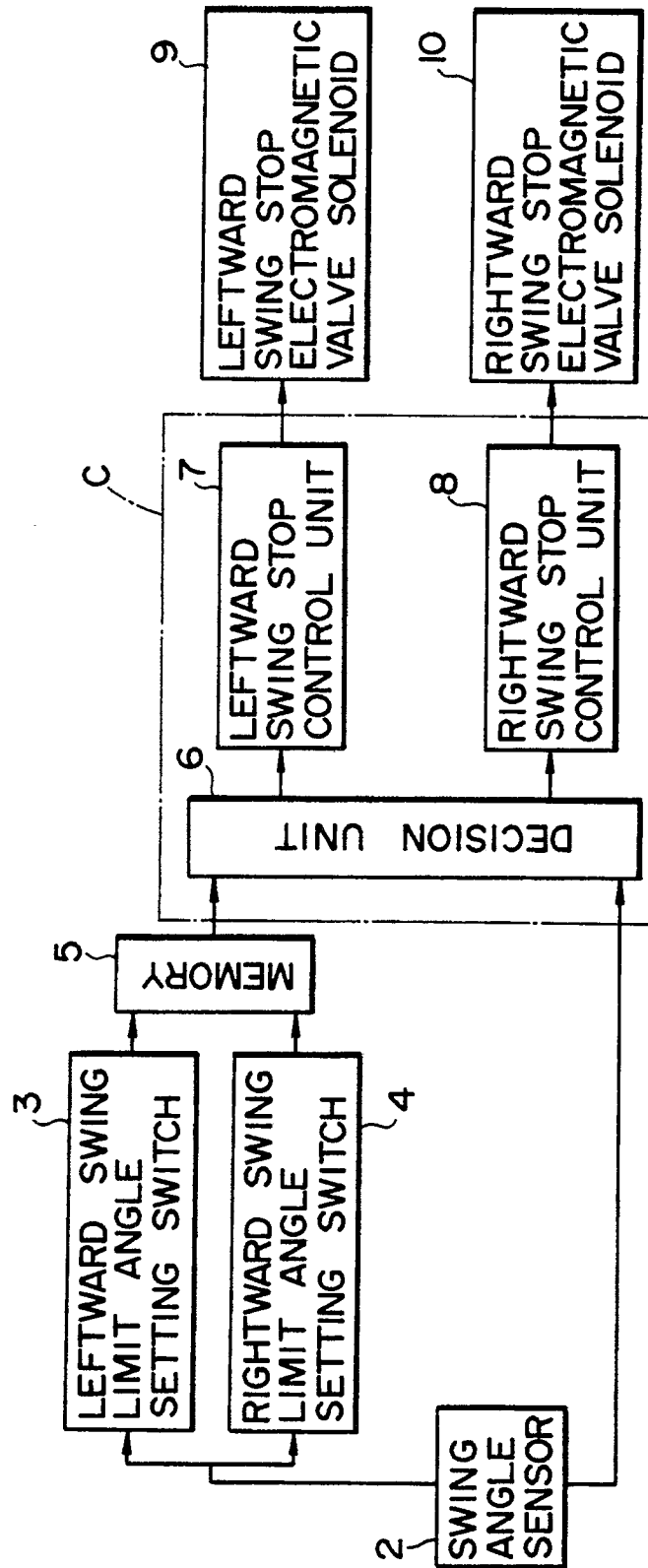
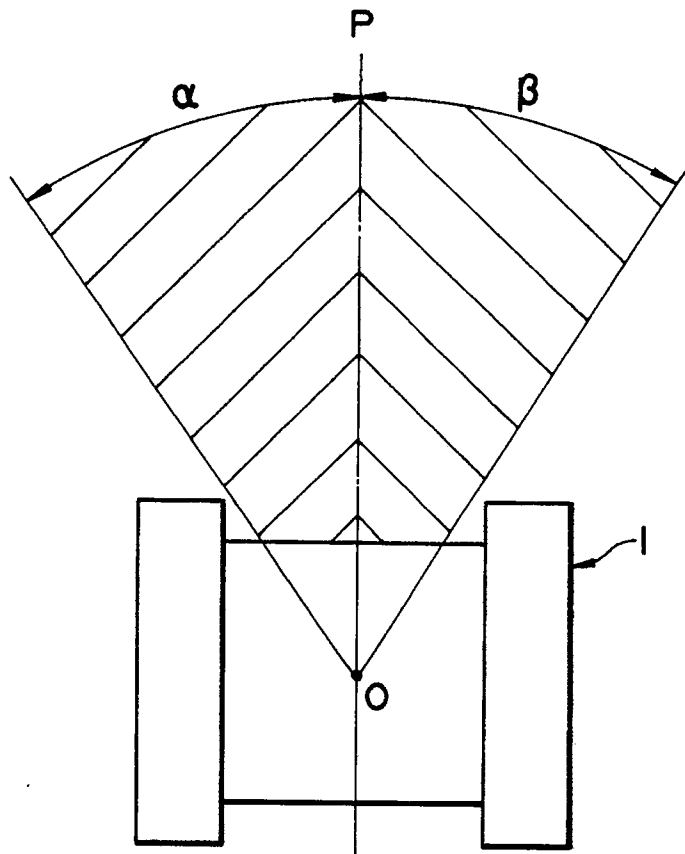


FIG. 2





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EUROPEAN SEARCH REPORT

Application Number

EP 89 30 9084

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-4 833 615 (BITNER et al.) * Abstract; figures 1,2; column 4, line 47 - column 5, line 19; column 8, lines 7-23; column 11, lines 9-60 *	1-3	B 66 C 15/04 E 02 F 9/24 E 02 F 9/20
Y	FR-A-2 550 520 (CAUSSE) * Abstract; page 3, line 3 - page 4, line 21; figures 1-3 *	1-3	
Y	US-A-4 084 247 (BALL) * Figures 1-5; column 5, lines 30-47; column 5, line 64 - column 6, line 10; column 6, lines 39-54; claims 1,2 *	1	
Y	FR-A-2 495 593 (SETRI) * Page 4, lines 17-22; page 5, lines 2-12; page 6, lines 6-19; page 6, line 35 - page 7, line 1; figures 2-4 *	1	
A	GB-A-2 204 014 (SCOTT JCB LTD) * Abstract; figures; page 3, line 3 - page 4, line 19 *	1,3	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	FR-A-1 605 206 (EATON YALE & TOWNE INC.) * Page 2, lines 15-36; claims 1,2; figures 1-3 *	1	B 66 C E 02 F B 67 D
A	GB-A-2 068 890 (K.K. KOMATSU SEISAKUSHO) * Abstract; figures *	1	
A	FR-A-2 517 659 (SOCIETE DE MATERIEL INDUSTRIEL ET D'EQUIPEMENT) * Figures 1,2 *	1	
A	FR-A-2 458 504 (SIMON)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 27-04-1990	Examiner GUTHMULLER J.A.H.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			