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(54) Limit stop device for lifting cranes, particularly cranes with telescopic arms

(57) A limit stop (10) for lifting cranes (1), particularly cranes with telescopic arms (4), which is constituted by a rigid housing (11) made of metal plate which contains, so that it is freely rotatably pivoted, a pulley (8) for guiding a lifting cable (7) and has, at one end, a contact surface (12) for rigid coupling of the housing to an outer portion (4b) of a telescopic arm (4) which has an inlet (13) for the lifting cable (7) and, at the other end, an outlet (14) for the cable (7), surrounded by contact edges (15) for the abutment portion of the lifting hook (9). The profile of the contact edges (15) is shaped like an arc traced by the involute to a circle whose evolute is a circular contour which is concentric and internal or external or coincident with respect to a pitch circle of the guiding pulley (8).

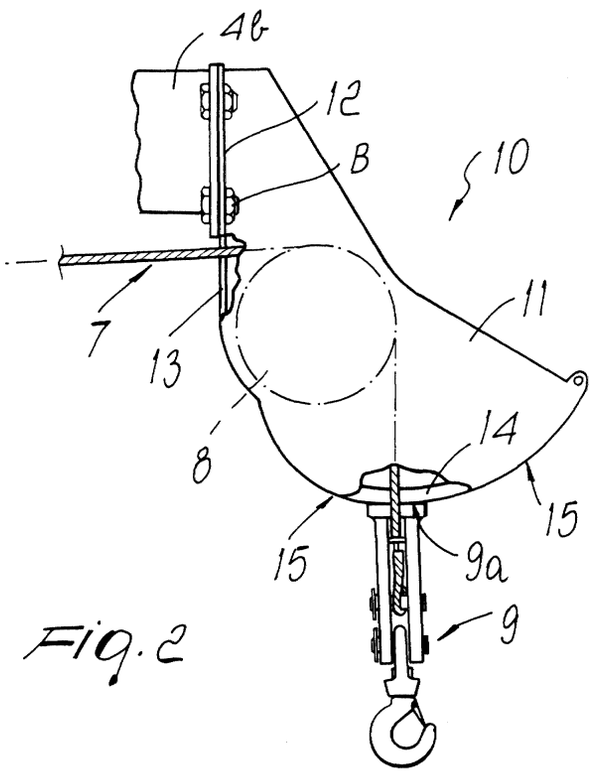

Fig. 2

EP 1 134 178 A2

Description

[0001] The present invention relates to a limit stop device for lifting cranes, particularly cranes with telescopic arms.

[0002] More specifically, the invention relates to cranes which comprise a base column to which a first rigid arm is articulated, the arm being controlled by a corresponding first hydraulic jack adapted to produce its oscillation with respect to said column, and in which said first arm typically has a second arm articulated thereto, the second arm comprising telescopic portions and being likewise controlled by a corresponding second hydraulic jack which is adapted to produce its oscillation with respect to the first one and includes additional hydraulic jacks which cause the extension and retraction of the telescopic portions.

[0003] Cranes of this type, typically used to equip trucks and transport vehicles in general, can use a cable, provided with a lifting hook, which is pulled by a winch being supported by the arm with telescopic portions, termed telescopic arm for the sake of brevity, and is guided by a pulley being carried at the free end of the outermost portion of the arm, considered in its fully extended configuration. In inactive conditions, or in particular operating conditions (for example during swiveling), in order to prevent the lifting hook from oscillating and causing damage to objects and/or to people in the vicinity of the crane, the lifting cable is moderately tensioned and the lifting hook is made to abut against a mechanical retention element, known as limit stop, which is designed to keep the hook in a stable inactive position.

[0004] For this purpose, mechanical retention elements or limit stops are known in which a fork, oscillatably coupled to the pivot of the guiding pulley, has a flat bracket articulated thereto; the suspension cable passes through the bracket and the lifting hook abuts against the bracket, which is provided with a reaction slider which engages, by way of its active surfaces, the pulley, onto which it discharges the stress produced by the abutment contact of the lifting hook. Thanks to the ability of the fork to oscillate and to the fact that such bracket is in turn articulated to said fork, the surface of the flat bracket that acts as abutment for the supporting surface of the lifting hook is arranged substantially at right angles to the cable, at least for angular positions of the telescopic arm which are not very far from the horizontal one. This is designed to prevent, or at least reduce, the onset of torques which tend to turn the assembly constituted by the fork, the bracket and the reaction slider about the pivot of the pulley and to prevent the bracket from assuming an angle other than 90° with respect to the cable, which in this case would be subjected to excessive stress.

[0005] However, these known limit stops do not provide sufficient assurance of retention of the lifting hook and substantially are not fully reliable as to the onset of excessive tensions on the cable caused by the rotation of the pulley.

[0006] The aim of the present invention, starting from the knowledge of these drawbacks of known types of limit stop, is to eliminate them, and within the scope of this aim the important particular object of the invention is to provide a limit stop device which can ensure the correct engagement of the lifting hook by way of its abutment portion and the consequent correct application of stress to the cable regardless of the relative angular position of the arms of the crane, accordingly avoiding the disengagement of the hook from the limit stop even in the presence of considerable tensions applied to the cable by unintentional and accidental extensions of the telescopic arm of said crane.

[0007] Another important object of the present invention is to provide a limit stop device which has an extremely simplified structure and in particular does not have mutually connected and/or articulated elements and therefore ensures absolute reliability in operation and no need for maintenance.

[0008] According to the present invention, this aim and these and other objects which will become better apparent from the detailed description that follows are achieved with a limit stop device for lifting cranes with telescopic arms, having the specific features defined in the appended claims.

[0009] Substantially, the invention is based on the concept of accommodating the pulley for guiding the lifting cable inside a rigid housing which has, at one end, a contact surface for rigid coupling to the end of the telescopic arm of the crane having an inlet for the lifting cable that arrives from the winch and, at the other end, an outlet for the cable that arrives from the guiding pulley, surrounded by contact edges for the abutment portion of the lifting hook, the profile of said edges being shaped like an arc traced by the involute to a circle whose evolute is a circular contour being concentric and internal, external or coincident with respect to the pitch circle of the guiding pulley.

[0010] In this manner, by selecting a sufficiently wide angle for the involute arc, one ensures the perpendicular arrangement of the abutment contact surfaces of the lifting hook with respect to the cable and therefore the perfect stability of such hook in its inactive position for any angular position of the arms of the crane and also in the presence of excessive mechanical tensions generated on the cable by maneuvers for extending the telescopic arm performed inadvertently during work or when the lifting hook is in said inactive position.

[0011] The characteristics, purposes and advantages of the limit stop device according to the present invention will become better apparent from the following detailed description and with reference to the accompanying drawings, given by way of non-limitative example, wherein:

Figure 1 is a side elevation view of a crane with telescopic arms provided with the limit stop device ac-

cording to the present invention;

Figure 2 is an enlarged-scale view of a detail of Figure 1, illustrating the limit stop in detail;

Figures 3 and 4 are elevation views of corresponding different angular arrangements of the arms of the crane of Figure 1;

Figures 5 and 6 are partial elevation views of the telescopic arm of the crane of Figure 1, shown in the corresponding retracted and extended configurations.

[0012] In the drawings, reference numeral 1 generally designates a typical lifting crane with telescopic arms, which comprises a base column 2, a first rigid arm 3 which is articulated to the column and is controlled by a corresponding first hydraulic jack 3a being adapted to produce its oscillation with respect to the column, and a second arm 4, designated as telescopic arm, which is articulated to the arm 3 and is composed of a plurality of mutually telescopic portions 4a, 4b, etcetera. The arm 4 is in turn controlled by a hydraulic jack 5 which is adapted to produce its oscillation with respect to the arm 3 and includes additional hydraulic jacks 4k for the extension and retraction of the telescopic arms. The telescopic arm 4 further has, at the pivoting section, a winch 6, preferably of the hydraulic type, which actuates a lifting cable 7 being guided by a pulley 8 which is arranged at the end of the telescopic portion 4b that protrudes furthest (when the arm is in the fully extended configuration) and ends with the lifting hook 9. The limit stop, generally designated by the reference numeral 10, is associated with the pulley 8.

[0013] According to the present invention, the device 10 (Figure 2) is constituted by a sturdy rigid housing 11 made of metal plate, which contains the guiding pulley 8, being pivoted so that it can rotate freely; the housing has, at one end, a contact surface 12 for the rigid coupling of said housing, by way of bolts B, to the outer portion 4b of the telescopic arm; the contact surface 12 is provided with an inlet 13 for the lifting cable 7. At the other end, the housing 11 has an outlet 14 for the cable 7 which is surrounded by contact edges 15 for the abutment portion of the lifting hook 9; the profile of the edges is shaped like an arc traced by the involute to a circle whose evolute is a circular contour being concentric and internal or external or coincident with respect to the pitch circle of said guiding pulley. In this manner, the contact edges 15 are, at the involute arc, strictly perpendicular to the cable 7, and the contact force between said contact edges and the abutment surface 9a of the hook 9 also is strictly perpendicular to the surface and therefore has no transverse components which can move the hook from the inactive position in abutment against the edges 15.

[0014] The involute arc covers a convenient angle, typically a center angle of 160°. This ensures that the abutment surfaces of the lifting hook are perpendicular with respect to the cable, and therefore ensures that said hook is perfectly stable in its inactive abutment position, for any angular position of the arms of the crane 1. Figures 3 and 4 clearly illustrate the stable condition of the hook 9 in limit stop conditions for two extreme configurations of the crane, designated by the reference numerals 1' and 1" respectively, and even in the presence of excessive mechanical tensions on the cable, caused for example by inadvertent extensions of the telescopic arm 4 (Figures 5 and 6).

[0015] Without altering the concept of the invention, the details of execution and the embodiments may of course vary extensively with respect to what has been described and illustrated by way of non-limitative example, without thereby abandoning the scope of the appended claims.

[0016] The disclosures in Italian Patent Application No. T02000A000220 from which this application claims priority are incorporated herein by reference.

[0017] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. A limit stop device (10) for lifting cranes (1), particularly cranes with telescopic arms (4), **characterized in that** it is constituted by a rigid housing (11) made of metal plate which contains, so that it is freely rotatably pivoted, a pulley (8) for guiding a lifting cable (7) and has, at one end, a contact surface (12) for rigid coupling of said housing (11) to an outer portion (4b) of a telescopic arm (4) which has an inlet (13) for the lifting cable (7) and, at the other end, an outlet (14) for the lifting cable (7), surrounded by contact edges (15) for the abutment portion of a lifting hook (9), the profile of said edges being shaped like an arc traced by the involute to a circle whose evolute is a circular contour which is concentric and internal or external or coincident with respect to a pitch circle of said guiding pulley (8).

2. The device according to claim 1, **characterized in that** the arc traced by the involute to a circle of said contact edges (15) that surround the outlet (14) of the cable (7) covers a convenient angle, typically a center angle of 160°.

3. The device according to claims 1 and 2, **characterized in that** said rigid housing (11) that contains the guiding pulley (8) is rigidly coupled to the outer portion (4b) of the telescopic arm (4) by way of a series of bolts (B).

4. The device according to the preceding claims, **characterized in that** said lifting hook (9) has an abutment surface (9a) adapted to adhere, by strictly perpendicular contact engagement, to the contact edges (15) that surround the outlet (14) of said lifting cable (7).

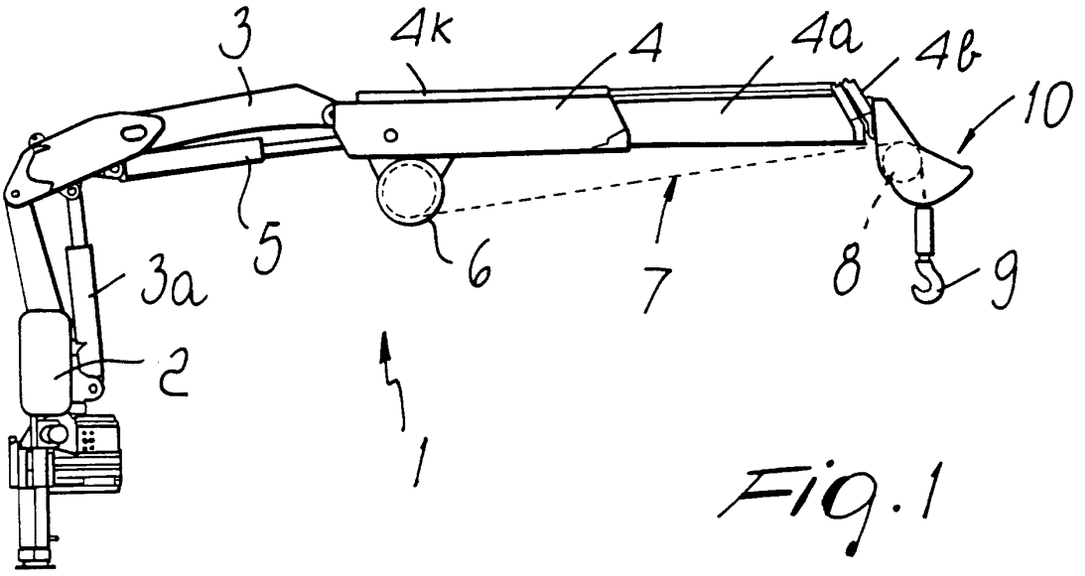

Fig. 1

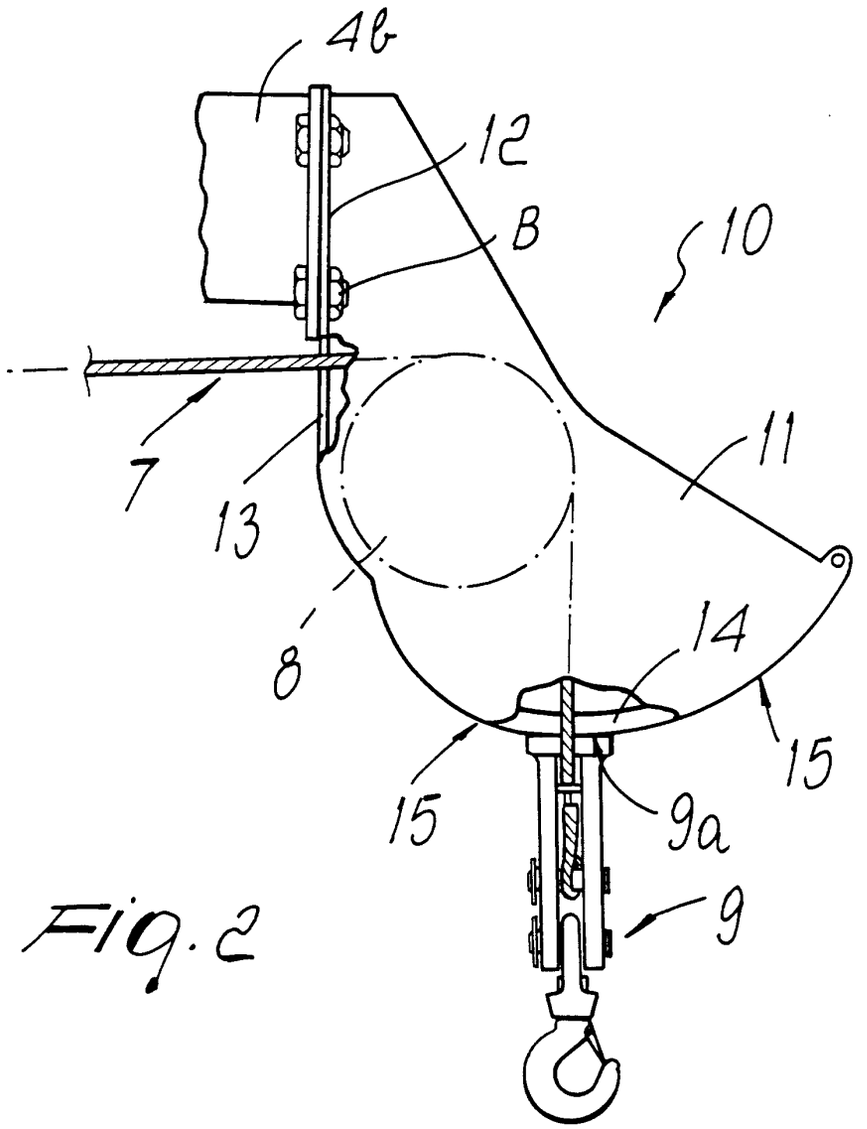

Fig. 2

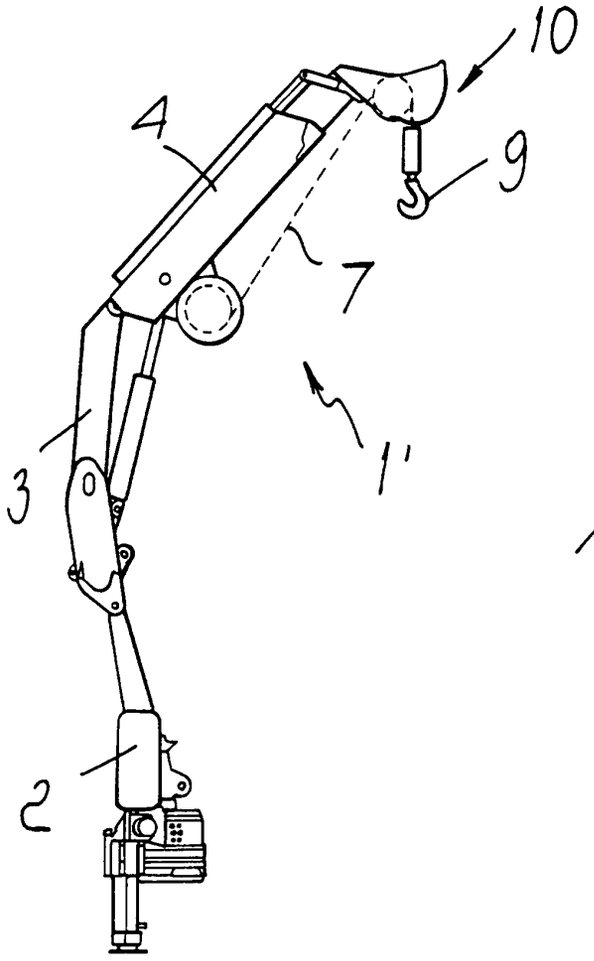

Fig. 3

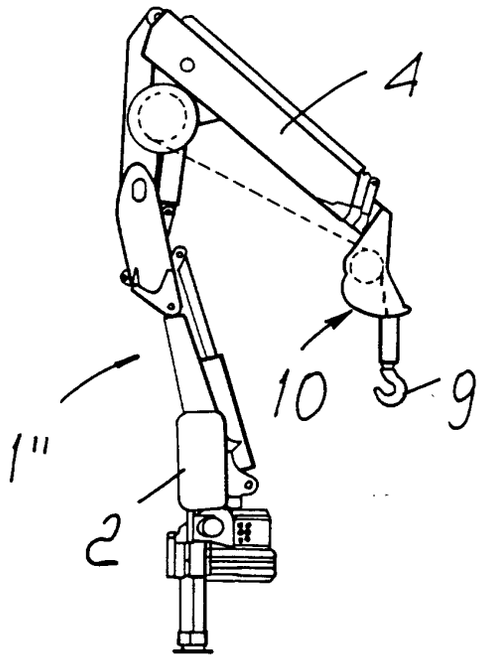

Fig. 4

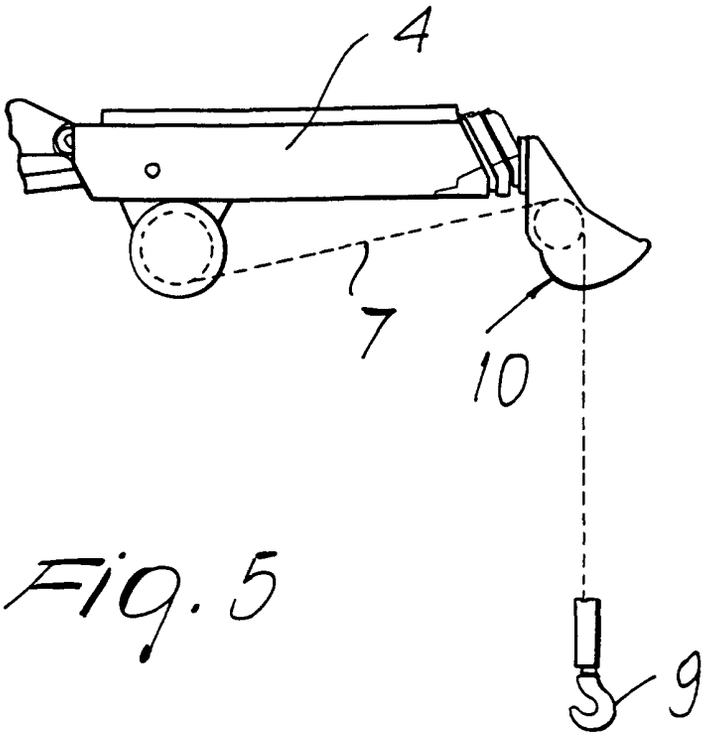

Fig. 5

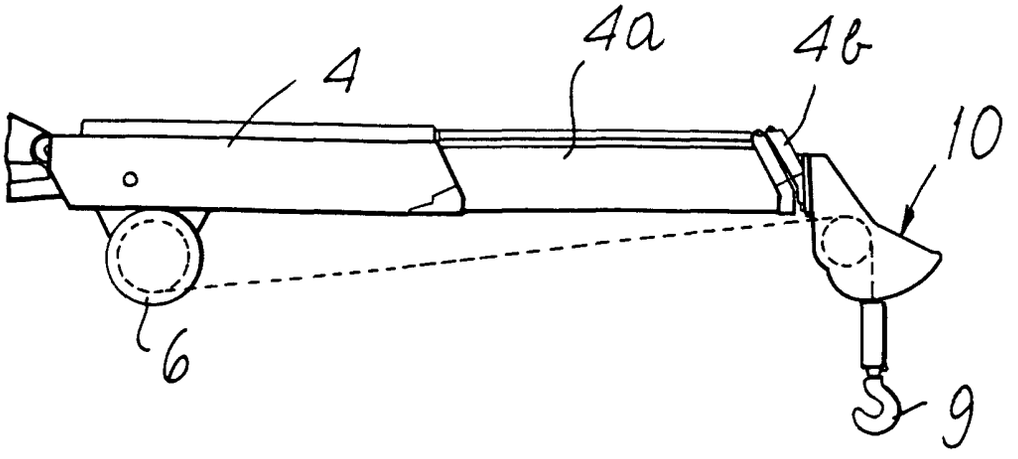

Fig. 6