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HINGED BOOM STOP
Filed Nov. 10, 1958
This invention relates to load-handling equipment, and more particularly to load-handling machines having a boom pivotally mounted thereon for movement in a vertical plane, such as cranes.

In such machines, the boom is normally supported by cables extending from a winch on the main frame of the machine to the outer point of the boom, and the load is raised or lowered by a cable extending from a winch on the main frame over a sheave at the outer point of the boom. When such machines are in use, there is a danger that the boom will recoil or swing upwardly past a vertical position and back over the main frame. In the event the load is suddenly released, such as by the breaking of a cable or the slipping of a sling. If this occurs, the boom and the cab or other parts of the main frame will be severely damaged, in addition to the possibility of injury to the operator.

It is, therefore, desirable to provide some means for preventing such recoil of the boom. In the past this has been done by using various types of telescoping members connected between the main frame and the boom, such as that shown in U.S. Patent No. 2,509,686 to Huston. Such methods of arresting excessive upward motion of the boom, however, are subject to certain disadvantages. It is highly desirable in machines such as cranes to be able to lower the boom to a substantially horizontal position, for purposes of transportation, ease of assembly and disassembly of the boom, and changing attachments.

If, as is common, a telescoping strut is mounted between an A-frame on the main frame and the boom, then the strut will prevent the boom from being lowered to the ground because the strut may collide with the cab. If the strut is connected to some higher point on the main frame, then the over-all height becomes excessive from the standpoint of head clearance, which is especially important in the case of truck-mounted cranes. If the strut is made longer and mounted further out on the boom so as to clear the cab, the strut must be so long that it has a tendency to sag when extended, and the telescoping sections will bind when the boom is raised from a lowered position. This tendency to sag and the consequent binding may even be so pronounced as to render the strut inoperative.

It is therefore a principal object of this invention to provide stop means for arresting undesirable excessive upward and backward movement of a boom, which will not sag or bind when the boom is in a lowered position.

It is another principal object of the invention to provide means for arresting undesirable excessive upward and backward movement of a boom, which means will also permit the boom to be lowered to a substantially horizontal position without interference between the stop means and the main frame on which the boom is mounted.

Another object of the invention is to provide means for preventing undesirable excessive upward or backward movement of a boom which will permit complete freedom of movement of the boom between predetermined extreme positions for normal operations and which will prevent any accidental travel in an upward or backward direction beyond a predetermined point.

Another object of the invention is to provide means for arresting undesirable excessive upward or backward movement of a boom which is simple and economical to manufacture and yet rugged and dependable in operation.

In addition to my principal objects, other objects of my invention have been worked out a number of novel and useful details, which will be readily evident as the description progresses.

The invention consists of the novel parts and of the combination and arrangement thereof which are defined in the appended claims, and of which one embodiment is shown in the accompanying drawings.

Throughout the description, the same reference number is applied to the same member or to similar members.

FIGURE 1 is a side elevation, with some parts broken away, of a crane embodying the boom stop of the invention, showing the boom lowered to a substantially horizontal position on the ground (full lines) and in its predetermined maximum elevated position (dotted lines).

FIGURE 2 is a plan view of the same, taken along line 2—2 of FIGURE 1, showing the boom lowered to a substantially horizontal position on the ground.

Turning now to the figures, it is seen that 10 is the main frame of a crane, which is conventionally supported for swinging rotation about a vertical axis on any suitable ground-engaging base, such as the truck frame indicated schematically at 11. The main frame 10 carries the power plant and machinery for the operation of the crane, all of which is housed in cab 12, which is designed with the minimum dimensions possible for enclosing this machinery. An operator's cab 13, shown broken away in FIGURE 1, may also be provided.

Boom 14 is pivotally mounted at 15 to main frame 10 for movement in a vertical plane throughout the range of positions from substantially horizontal to a predetermined maximum elevated position, as indicated respectively in full and dotted lines in FIGURE 1. An A-frame is provided on main frame 10, which comprises two pairs of legs 16, 17, secured to main frame 10, and shaft 18 mounted between said legs at their elevated point of intersection, which is slightly higher than the roof of cab 12. Boom 14 is raised and lowered by means of a boomsboist cable 19, which extends from a winch (not shown) on main frame 10 over a sheave 20 on shaft 18, thence around sheave 21, thence over sheave 22 on shaft 18, and is finally dead-ended on main frame 10. Sheave 21 is carried by bridle 23, and fixed length pendants 24 extend from bridle 23 to the outer point of boom 14, where they are pivotally connected at 25. A load-handling means is provided, consisting of cable 26, which extends from a winch (not shown) on main frame 10, over sheave 27 on shaft 18 and thence over sheave 28 at the outer point of boom 14 from whence it is adapted to be connected to a load.

The invention provides means for arresting excessive upward movement of boom 14 beyond a predetermined maximum elevated position, such as that shown in dotted lines in FIGURE 1, as follows. A hinged boom stop, indicated generally at 29, is interposed between main frame 10 and boom 14. As shown here, hinged boom stop 29 consists of first strut means, preferably comprising a pair of struts 30, which are pivotally connected at one end to shaft 18, which serves as an anchor means for hinged boom stop 29, and second strut means preferably comprising a pair of struts 31, which are pivotally connected at shaft 18, to lugs 33 on boom 14. The other ends of struts 30, 31 are pivotally interconnected by pins which form hinged connections 34. Struts 30 are preferably pivotally connected to an elevated rearward portion of main frame 10, such as shaft 18, to provide...
a sufficient moment arm from boom pivot 15 to enable hinged boom stop 29 to arrest the upward moment of boom 14 and also to permit boom 14 to be lowered to a substantially horizontal position without interference of hinged boom stop 29 with cab 12.

To prevent damage to the boom in fully raised position, an engaging means for the hinged boom stop 29 may be provided at a predetermined location on the boom. The engaging means is preferably a plate 35 secured to boom 14. Upstanding flanges 36, which are substantially parallel to the longitudinal axis of the boom and adjacent each lateral edge of the plate, may be provided on plate 35 to insure proper engagement of the boom stop 29 with the boom 14.

Assuming struts 30 to be connected to shaft 18, as in the embodiment here shown, the dimensions of hinged boom stop 29, and the locations of lugs 33 and plate 35, are so arranged that when boom 14 is in the maximum elevated position desired, hinged boom stop 29 will contact plate 35 and, by its reaction against shaft 18, prevent any further upward travel of boom 14 (dotted lines in FIGURE 1). These elements are further so arranged that when boom 14 is in its lowest desired position, such as shown in full lines in FIGURE 1, hinged boom stop 29 will not contact cab 12.

The relative dimensions of the struts 30, 31 may be proportioned adjacent the hinged connection in such a manner that the engaging plate 35 may contact either of the struts or both of said struts simultaneously. It is preferred that the struts 30 contact the engaging plate 35 to prevent any high shearing stresses in the hinged connections 34.

Plate 35 may be omitted and hinged boom stop 29 so designed that it will contact boom 14 directly when boom 14 is in its desired maximum elevated position, boom 14 itself then serving as the strut engaging means. However, employment of plate 35 and flanges 36 is preferable, the latter serving to prevent any tendency of the pairs of struts 30, 31 to spread when hinged boom stop 29 contacts plate 35.

In operation, boom 14 may be lowered to a substantially horizontal position for transport or for assembly or disassembly or for changing attachments, as shown in full lines in FIGURE 1. In this position, hinged boom stop 29 is in its maximum extended position and yet will not sag or bind or interfere with cab 12, since the struts 31 support and stabilize struts 30. Boom 14 may then be raised to any desired elevated position for operation. It will be noted that there is no interference by hinged boom stop 29 with the operation of boom hoist cable 19 in any boom position. The range of movement is provided between the pairs of struts 30, 31 in all positions.

In the event of a sudden release of load, boom 14 will recoil upwardly; if uncheckered, the boom will continue to rotate counterclockwise about pivot 15 (FIGURE 1) until it collides with cab 12. Hinged boom stop 29, however, prevents such action. As boom 14 moves up, hinged boom stop 29 folds or jackknifes at hinged connections 34 until boom 14 reaches its predetermined maximum elevated position, as indicated in dotted lines in FIGURE 1. At that time hinged boom stop 29 contacts plate 35 on boom 14, and the upward motion of boom 14 is arrested before damage to the boom, cab, or operator can occur.

It is thus seen that the hinged boom stop embodied in the invention permits the boom stop means to be connected to the boom near the foot of the latter, thus substantially decreasing the length of the boom-stop which would otherwise be required to clear the cab. Because of this decrease in length, boom-stop sag is eliminated.

The hinged connections 34 eliminate binding between struts 30, 31 and also permit boom 14 to be lowered to a substantially horizontal position on the ground with out interference between hinged boom stop 29 and cab 12. At the same time, hinged boom stop 29 is connected at an elevated point on main frame 10 which is only slightly higher than the roof of cab 12, so that the boom stop does not create any problem with respect to overhead clearance while traveling.

What is claimed is:
1. In a load-handling machine having a main frame, including an elevated portion, and a boom pivotally mounted on the main frame for movement in a vertical plane, means for arresting upward movement of the boom, comprising: first pivot means mounted on the elevated portion of the main frame; first strut means, connected at one end to said first pivot means; second pivot means, mounted on the boom; second strut means, connected at one end to said second pivot means; third pivot means, interconnecting said first and second strut means adjacent their other ends; the respective effective lengths of said first and second strut means and the location of said pivot means being such that, when the boom is in a predetermined elevated position, at least one of said strut means engages a portion of the boom above said second pivot means.
2. In a load-handling machine having a main frame, including an elevated portion, and a boom having a boom foot pivotally mounted on the main frame to permit movement of the boom in a vertical plane through a range of movement between a substantially horizontal position and a predetermined elevated position, means for arresting movement of the boom beyond said predetermined position, comprising: anchor means on the elevated portion of the main frame; a boom stop pivotally connected at one end to said anchor means in contact with said boom when the boom is in said predetermined elevated position; and a stabilizing strut pivotally connected at one end to said boom stop and pivotally connected at the other end to said boom at a point intermediate the boom foot and that portion of the boom engaged by the boom stop strut.
3. The construction according to claim 2, further characterized by the fact that the boom carries strut engaging means to contact said strut means when the boom is raised to said predetermined elevated position.
4. The construction according to claim 3, further characterized by the fact that said strut engaging means comprises a plate mounted on the boom, said plate having upstanding flanges substantially parallel to the boom and adjacent the lateral edges of said plate.
5. In a load handling machine having a main frame, including an elevated portion, and a boom having a boom foot pivotally mounted on the main frame to permit movement of the boom in a vertical plane through a range of movement between a substantially horizontal position and a predetermined elevated position, means for arresting movement of the boom beyond said predetermined position, comprising: anchor means on the elevated portion of the main frame; boom-engaging means including a strut pivotally connected at one end to said anchor means and in contact with the boom when the boom is in said predetermined elevated position; and stabilizing strut means pivotally connected at one end to said boom-engaging means and pivotally connected at the other end to said boom at a point intermediate the boom foot and that portion of the boom in contact with said boom-engaging means.
6. In a load handling machine having a main frame, including an elevated portion, a boom having a boom foot pivotally mounted in the main frame to permit a range of movement of the boom in a vertical plane between a substantially horizontal position and a prede-
terminated elevated position, and cable means connected between the said frame and an outer portion of the boom for raising and lowering the boom through said range of movement, means for arresting upward movement of the boom beyond said predetermined elevated position, comprising: a pair of anchor means mounted on the elevated portion of the main frame and laterally spaced on opposite sides of a vertical plane passing through the longitudinal axis of the boom; a pair of laterally spaced boom stop struts, each having one end pivotally connected to its respective anchor means; a pair of laterally spaced stabilizing struts pivotally connected at one end to the boom, one on each side of the longitudinal axis of said boom, and each stabilizing strut having its other end pivotally connected to its respective boom stop strut, the respective effective lengths of both pairs of said struts being such that, when the boom is in said predetermined elevated position, at least one of said pairs of struts engages a portion of the boom above the pivotal connection between the stabilizing struts and the boom; and the lateral spacing of both pairs of said struts being such that when the boom is lowered to said substantially horizontal position, said cable means is received between the laterally spaced portions of the boom arresting means.

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