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HINGED BOOM STOP

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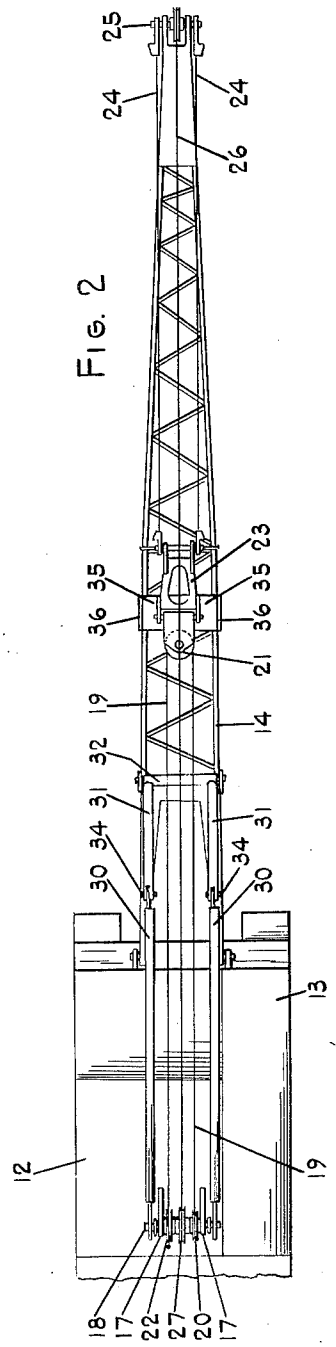


FIG. 2

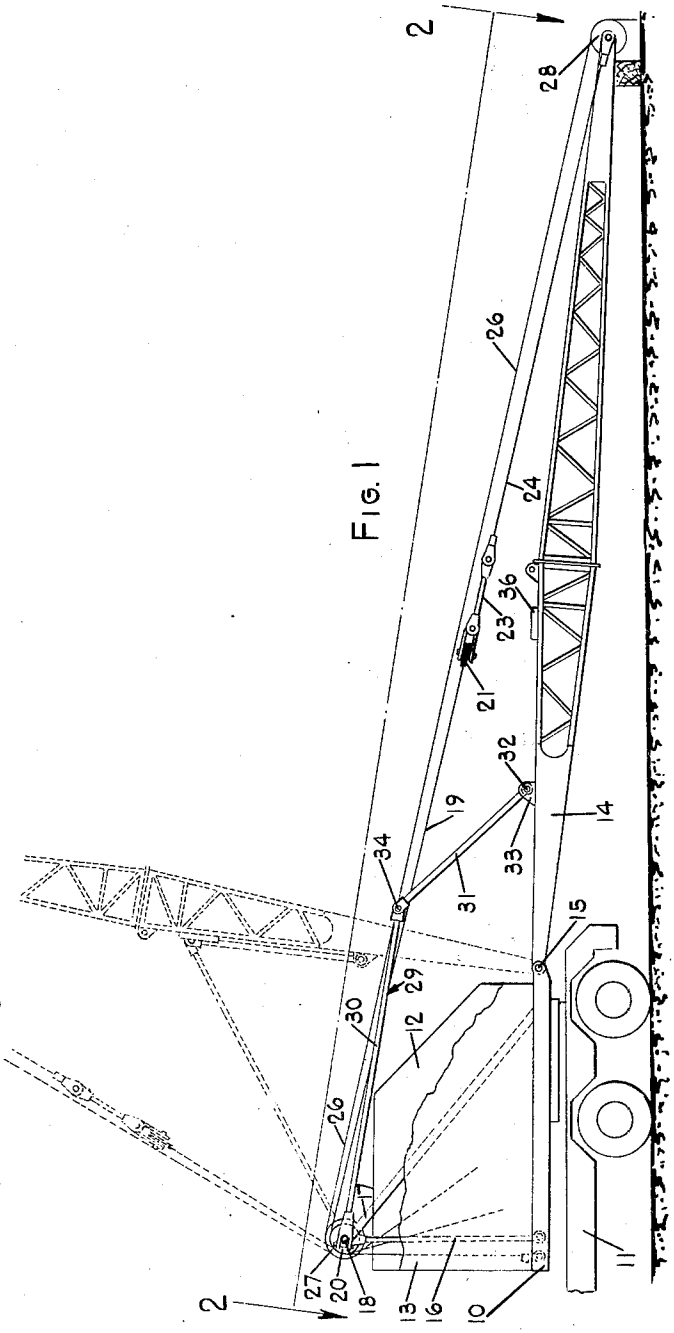


FIG. 1

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HINGED BOOM STOP

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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 overhead 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 to provide stop means to arrest 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 movement of a boom, such that this means may be mounted on the main frame, which supports the boom, at a point only slightly higher than the roof of the cab covering the main frame, and will nevertheless permit the boom to be lowered to a susbtantially horizontal position.

It is a further object of this invention to provide a 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, above stated, I have 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 boomhoist 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 **32**, 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 structs **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, inasmuch as clearance 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 unchecked, 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 by the reaction of hinged boom stop **29** on shaft **18**. The upward movement of boom **14** is thus 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 without 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.

Having now described and illustrated one form of the invention, it is to be understood that this invention is not to be limited to the specific form or arrangement of parts herein described and shown.

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 locations of said first and second 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 strut pivotally connected at one end to said anchor means and 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 strut 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 boom stop strut 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-

termined 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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