May 4, 1943. A. A. JOHNSON 2,318,491

CRANE AND SHOVEL BOOM SAFETY STOP

Original Filed Aug. 2, 1940 3 Sheets-Sheet 1

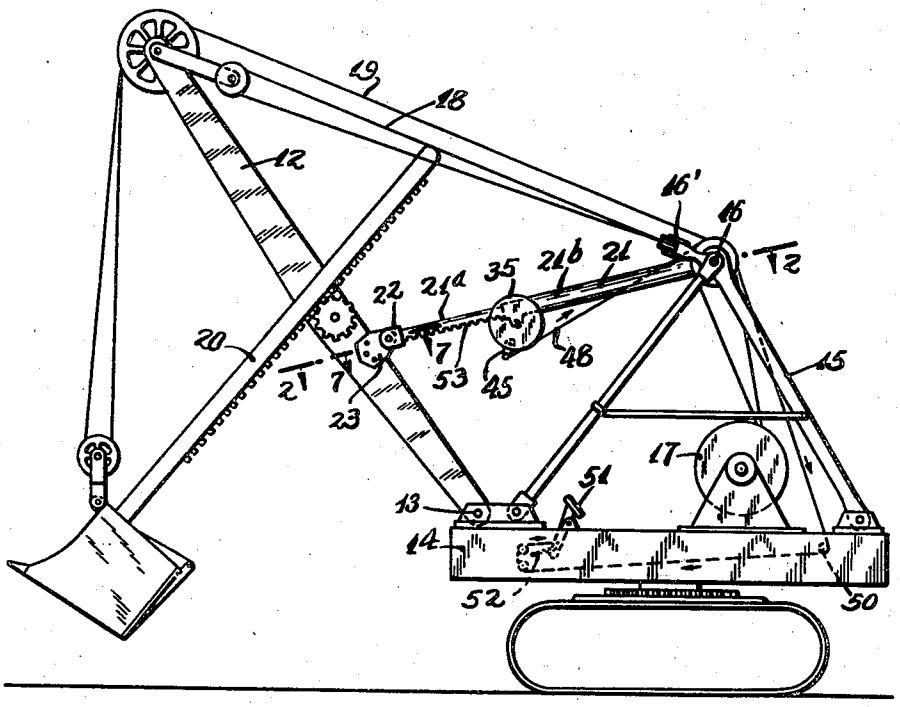


Fig. 1.

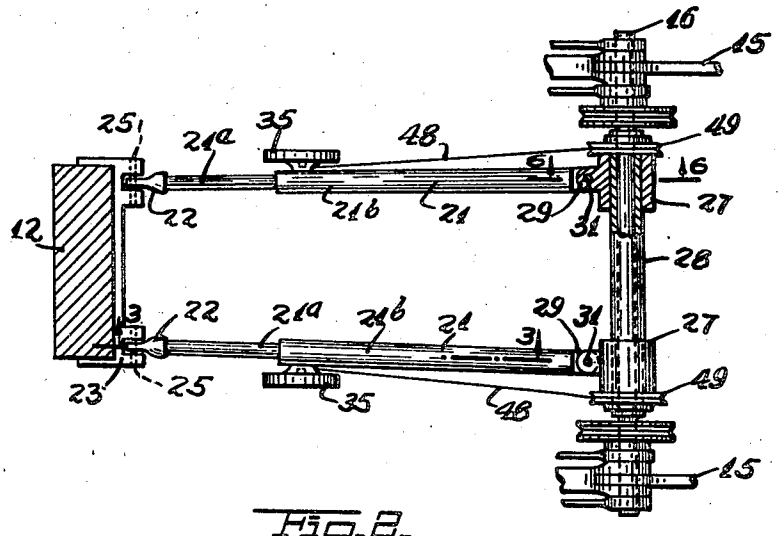


Fig. 2.

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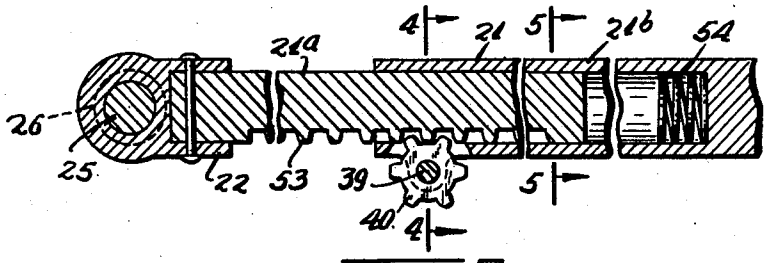


Fig. 3.

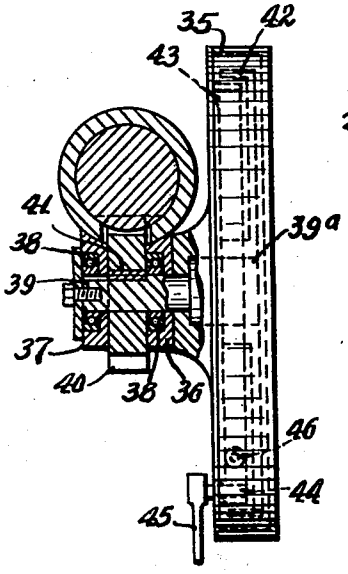


Fig. 4.

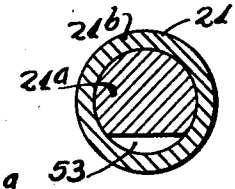


Fig. 5.

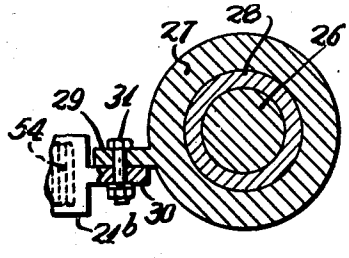


Fig. 6.

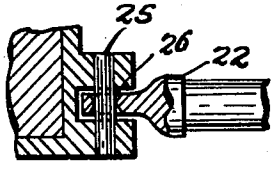


Fig. 7.

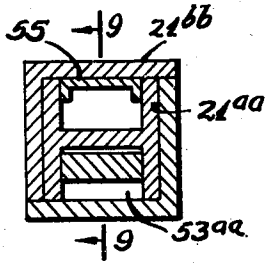


Fig. 8.

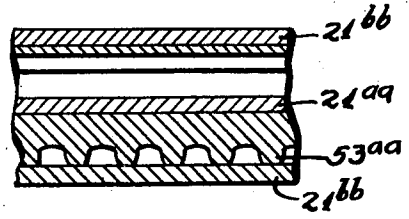


Fig. 9.

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CRANE AND SHOVEL BOOM SAFETY STOP

Original Filed Aug. 2, 1940 3 Sheets-Sheet 3

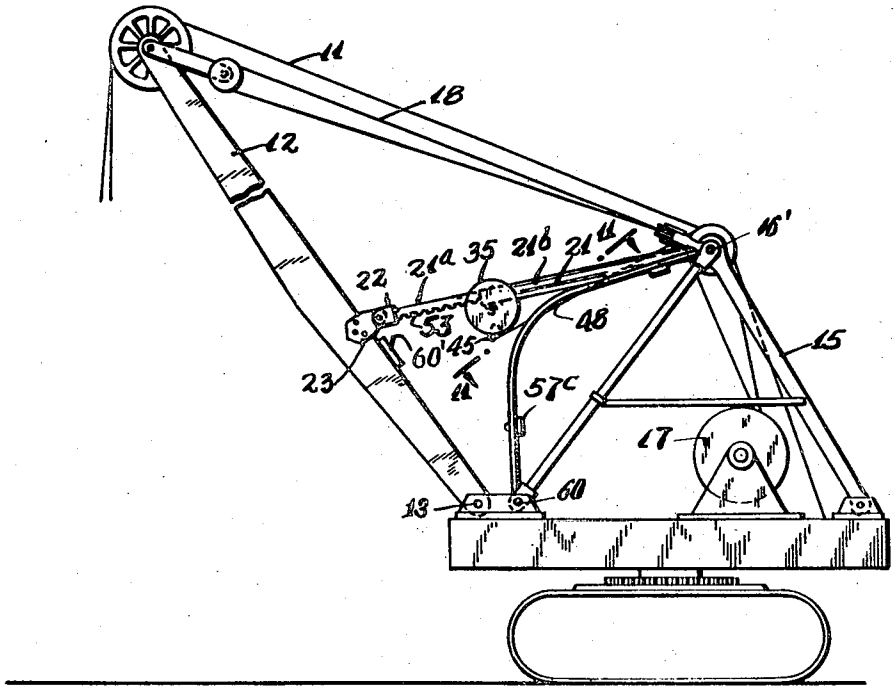


Fig. 10.

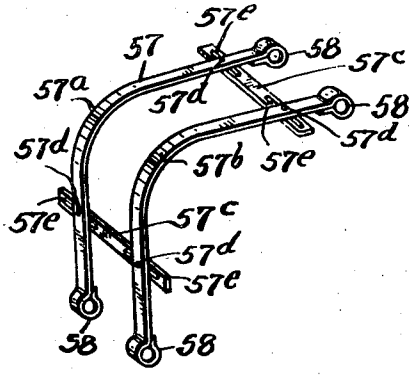


Fig. 11.

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Patented May 4, 1943

2,318,491

UNITED STATES PATENT OFFICE

2,318,491

CRANE AND SHOVEL BOOM SAFETY STOP

Albert A. Johnson, Grahamsville, N. Y.

Substituted for abandoned application Serial No. 349,445, August 2, 1940. This application July 27, 1942, Serial No. 452,509

3 Claims. (Cl. 214—135)

This invention relates to new and useful improvements in a crane and shovel boom safety stop. This is a refile of my original application, filed on August 2, 1940, Serial Number 349,445.

There is an inherent defect and weakness in present crane and shovel boom constructions. The boom is supported, raised and lowered with cables which allow it to fall backwards whenever such an opportunity would present itself, and there is no provision to arrest any backward motion. Such opportunities do present themselves more frequently than is generally known. One of the conditions which would cause the boom to move backwards is as follows: when the crane is working with high angle boom lifting heavy loads (pulling piling, for example), causing the rear of the apparatus to tilt upwards, if the cable or hitch, shackle, or chain should break, the lifted back portion of the apparatus will settle back to the ground, whipping or throwing the boom rearwards, and often the boom moves rearwards with sufficient momentum to pass its 90 degree position, and then falls upon the mast or gantry of the apparatus. Such accidents have in the past caused injury to persons, as well as damage to the apparatus. There are many other conditions under which the boom would be thrown rearwards past its 90 degree vertical position.

This invention particularly proposes a mechanism, or means for limiting pivoting of the boom rearwards so that it cannot possibly pass its 90 degree vertical position.

Still further the invention proposes to characterize this means, in one form, by the fact that it comprises a mechanism cooperative between the mast and the boom. In another form of the invention, it is contemplated that the means be characterized by telescoping members connected between the boom and the mast, and associated with a novel arrangement whereby the telescoping members may be instantly locked together in any position in which they may be, so as to stop the boom in whatsoever position it may be.

Still further the invention proposes the construction of a safety stop which may be readily mounted on present day booms, in the nature of an attachment.

Still further the invention proposes to so construct the safety stop that it may be mounted on the usual horizontal shaft which is at the top of the gantry or mast. In another form of the invention, in which the stop is constructed of telescoping members, it is proposed that the outer member, the one which is mounted on the horizontal shaft, have an L-shaped offset portion so that the members clear the usual saddle assembly which is mounted on the horizontal shaft and which pivots according to the boom angle.

Still further the invention proposes the construction of stops as mentioned which are simple and durable and which may be manufactured and sold at a reasonable cost.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a side elevational view of a shovel boom with a safety stop arrangement thereon in accordance with one form of this invention.

Fig. 2 is a fragmentary enlarged horizontal sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary enlarged sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary transverse sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a fragmentary transverse sectional view taken on the line 5—5 of Fig. 3.

Fig. 6 is a fragmentary enlarged vertical sectional view taken on the line 6—6 of Fig. 2.

Fig. 7 is a fragmentary enlarged horizontal sectional view taken on the line 7—7 of Fig. 1.

Fig. 8 is a transverse vertical sectional view of the telescoping members of a safety stop constructed in accordance with a modified form of the invention.

Fig. 9 is a fragmentary vertical sectional view taken on the line 9—9 of Fig. 8.

Fig. 10 is a side elevational view of a shovel boom with a safety stop constructed in accordance with a modified form of this invention.

Fig. 11 is a perspective view of the safety stop used in Fig. 10, this view being taken in the direction of the line 11—11 of Fig. 10.

In the form of the invention disclosed in Figs. 1 to 7 inclusive, the safety device is shown applied to a shovel boom of standard construction characterized by the usual boom 12 which is pivotally mounted at the bottom point 13 upon a platform 14. The usual mast 15 is mounted on this platform and supports the usual horizontal top shaft 16, see Fig. 2, upon which the usual saddle assembly 16 is mounted. A hoisting winch is mounted on the platform 14. This hoisting

winch 17 has the usual cable 18 for raising and lowering the boom 12. The usual cable means 19 is provided for assisting in the operation of the shovel 20 which is mounted on the boom 12. This brief description roughly defines the shovel boom and those having knowledge of the art will readily recognize the same and understand its construction and operation without further explanation.

The safety device in accordance with this invention includes a pair of spaced arms 21 pivotally connected with the boom 12 and with the said horizontal shaft 16. Each of the arms 21 is formed from telescoping members or sections 21a and 21b, and means is provided for instantly locking these telescoping sections in fixed positions in any of their extended or retracted positions.

The telescoping section 21a comprise the front sections, and in this particular form of the invention they are of solid cylindrical formation. The front end of each section 21a is provided with a bracket 22 which is loosely connected with a bracket 23 secured to the boom 12. The loose connection is formed by a pin 25 which engages through an opening 26 formed in the bracket 22. The opening 26 has a reduced central portion and inclined sides. The arrangement is such that each front section 21a may pivot slightly laterally on the pins 25. The bracket 23 is shown mounted across the back of the boom 12. Each side of the bracket 23 is of identical construction, and the side portions are used to support the said front telescoping sections 21a.

The telescoping sections 21b engage over the sections 21a and comprise the outer or rear sections. They are of tubular forms. The rear ends of the section 21b are connected with collars 27 which are fixedly mounted on a tube 28 which is turnably mounted on the shaft 16. Each collar 27 has an offset lug 29 arranged below its center line. Each telescoping section 21b is provided with a complementary lug 30. Pintle bolts 31 engage through these lugs for pivotally connecting each rear telescoping section 21b with its collar 27. The offset arrangement of the arms 21 relative to the collars 27, set the telescoping arms downwards so that they do not interfere with the operation of the usual saddle assembly 16 of the boom. The offset lugs 29 make the rear ends of the arms 21 substantially L-shaped with the short arms of the L extending upwards and connected with the tube 28. When the saddle does not interfere the connection between these parts may be straight, instead of offset.

The arms 21 are not parallel to each other but are arranged at an inclination, as illustrated in Fig. 2. The purpose of this arrangement resides in the fact that the boom 12 is much narrower than the available space between the usual sheaves and other mechanism mounted upon, or connected with the shaft 16. Moreover, the inclined non-parallel construction comprises a formation of greater rigidity than a parallel arrangement. However, the boom 12 is free to pivot about the pivot point 13 with the telescoping sections 21a and 21b engaging into each other, because of the pintle bolts 31 and the loose arrangement of the brackets 22 upon the pins 25.

Means is provided for instantly locking said telescoping sections 21a and 21b in fixed positions in any of their extended or retracted positions. This means comprises a brake device mounted on each arm 21. Each brake device includes a brake housing 35 which is stationarily mounted on a bracket 36 mounted on the extreme outer end of the telescoping section 21b. A bracket 37 is spaced from the bracket 36 and is also mounted upon the section 21b. These brackets are provided with bearings 38 which rotatively support a stud shaft 39. This stud shaft is mounted across the brackets 36 and 37 and is provided with a pinion 40. This pinion 40 is secured on the stud shaft 39 by a key 41 or other similar construction. The shaft 39 extends into the housing 35. The inner end of the shaft 39 is provided with an enlarged portion 39a which supports a brake drum 42. This brake drum is cooperative with brake shoes 43 which are mounted upon the adjacent wall of the housing 35. The brake shoes 43 are operated by the usual cam 44 controlled by an external lever 45. A tension spring 46 is connected between the brake shoes 43 for disengaging them from the drum 42.

The lever 45 of each brake is connected with a cable 48 which extends over a sheave 49 mounted upon the tube 28 which is mounted on the shaft 16. The cables 48 extend downwards over guiding elements 50 and connect with a foot pedal 51. A spring 52 is connected with the foot pedal 51 for normally urging it forwards into a position in which the brakes are off. The arrangement is such that the operator may press the pedal 51 forwards and downwards for simultaneously stopping the brakes of the said arms 21. The levers 45 controlling the brakes may be operated with a hand quadrant lever in reach of the operator at all times, or with other means.

Each pinion 40 extends into a telescoping section 21b and engages rack teeth 53 formed along one side of the telescoping section 21a. Coil springs 54 are mounted upon the inner ends of the outer telescoping sections 21b and form bumpers for the outer sections 21a when the boom 12 reaches substantially its vertical position. The rack teeth 53 terminate a short distance from the ends of the telescoping sections 21a so that they form stops in conjunction with the pinions 40, preventing complete disengagement of the sections of the telescoping arms 21. It is proposed that the parts be so designed that the boom 12 is free to reach a position slightly forwards of its true vertical, 90 degree position, preferably the parts should be so arranged that when the boom reaches the 85 degree position the telescoping sections 21a strike the springs 54. Then the springs 54 may compress a small amount so that the boom may reach an 87 degree position. This arrests the boom. This construction prevents the boom from passing the 90 degree position and falling rearwards.

The operation of the device is as follows:

The boom is used in the usual way. When the operator wishes to stop the boom 12 from swinging rearwards, or whenever the operator wishes to lock the boom 12 in a fixed position for any reason whatsoever, he steps on the brake pedal 51. This immediately applies the brakes so that the brake shoes 43 engage the brake drum 42 locking them from further turning. Indirectly this locks the pinions 40 which in turn lock the telescoping sections 21a and 21b.

The telescoping arms 21 have been illustrated of circular construction merely for descriptive reasons. However, they may be of other cross sections. In Figs. 8 and 9 a modified form has been disclosed. This form shows the outer telescoping sections 21bb of square form in transverse cross section. It is constructed by a pair of angle members set into square formation and secured

together preferably by welding. The inner telescoping section 21aa is constructed from an H-beam. The flanges on one side are reinforced by a channel member 55 which is welded across them. A rack 52aa is set into and welded between the other arms of the H-beam. In other respects this form of the invention is identical to the previous form and it is believed that the construction and operation will be understood without additional description.

In Figs. 10 and 11 a modified form of the invention has been disclosed in which a crane is provided with a safety stop capable of preventing the crane from passing its 90 degree position and falling rearwards. The stop comprises a frame 57 permanently mounted on the mast of the crane. The frame includes a pair of side rails 57a and 57b which are held in adjusted spaced positions by transverse spacer members 57c and bolts and slots 57d and 57e respectively. These side rails have their top ends formed with socket portions 58 which encircle the horizontal shaft 16 of the mast and serve to firmly secure the frame thereon. The bottom portions of the side rails 57a and 57b are provided with socket portions 59 which engage upon the pintles 60 which hold the front bottom portion of the crane mast on the platform 14. Thus, the frame 57 is rigidly held in position. A transverse bumper 60' is mounted on the boom 12 and is adapted to strike the side rails 57a and 57b of the frame 57 for limiting rearward pivoting of the crane 12. Preferably the bumper 60' and frame 57 are so designed that the crane may reach an upright position of approximately 87 degrees.

In place of bolt 57d and slot 57e arrangement, the spacing members may be adjustably secured to the side members 57a and 57b by any other suitable manner, such as by means of side clamps, gripping braces, etc., to adjustably reinforce the safety device. In other respects this form of the invention is identical to the prior forms, and identical parts may be recognized by identical reference numerals.

The modified form as shown in Fig. 10 and Fig. 11 may be used as a safety stop to arrest the travel of the boom rearward only beyond its vertical position and not used in connection with the telescoping form of my invention.

The safety stop is useful on many occasions in addition to the one described. The preferred form of the invention prevents the boom from falling down frontwards in the event that the hoisting cable breaks. The boom may only fall down to a position in which the telescoping sections are fully extended, then the pinions 40 engage the last teeth of the racks 53, preventing further extension of the telescoping member. This arrests the fall of the boom. Quite frequently falling booms have killed people. But with the present arrangement, the boom cannot completely fall on a person so as to crush him to death. In those instances where the operator sees that the boom is going to fall frontwards or rearwards, he can apply the brakes and arrest the fall before any damage has been done.

Additional points of advantage may be understood from the following:

On shovel booms a unit for crowding the shovel arm out is employed to work the bucket into the earth. Now then, when hard digging is encountered, the crowding devices tend to jack up the boom. In such cases the instant safety device may be used to apply more power to the crowding device merely by locking the boom to the mast, thereby adding more force to the crowding features of the shovel units and adding more life to the booming cables.

Another use of the device is when the crane is climbing a very steep grade. The crowding device of the shovel unit when locked by the telescoping arms provides added power to traction. Also this provides safety should a drive link of the traction unit break. The crowding device is useful in conjunction with the brake device as a safety feature. When shovels travel in very hazardous places and get stuck and mire down, the safety device may again come into play. Since the shovel boom is locked to the mast when the brakes are applied in accordance with this invention, it is obvious that now the power of the machine unit may be used to jack up the low side by using the crowding feature.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and the right is reserved to all changes and modifications coming within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. In combination with a crane or shovel boom having a mast for the boom, means mounted on said mast for limiting pivoting of said boom rearwards of a certain point, comprising a stationary frame mounted on said mast, said stationary frame including side rails held in spaced positions with braces, and a bumper mounted upon the boom and engageable against said side rails.

2. In combination with a crane or shovel boom having a mast for the boom, means mounted on said mast for limiting pivoting of said boom rearwards of a certain point, comprising a stationary frame mounted on said mast, said stationary frame including side rails held in spaced positions with braces, and a bumper mounted upon the boom and engageable against said side rails, said side rails being formed with a curved central area against which said bumper engages.

3. In combination with a crane or shovel having a pivotal boom and a fixed mast supporting a horizontal top shaft, an arm having one of its ends pivotally attached to said boom and its other pivotally attached to the shaft of said mast, said arm being formed of separate sections slidably engaging each other to be extended and retracted as said boom pivots relative to said mast, a shaft freely rotatively supported on the outer section of said arm adjacent its free end, means on said outer section of said arm and engaging one end of said latter shaft for locking said latter shaft against rotating when desired, rack teeth formed on a portion of the inner section of said arm in close proximity to the other end of said latter shaft, a gear fixedly mounted on the said other end of said latter shaft, and having a portion extended through an opening formed in one side of the outer section of said arm to mesh with the rack teeth of the inner section of said arm in all pivoted positions of said boom.

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