Sept. 9, 1952 T. O. DAVIDSON ET AL 2,609,939

LOWERABLE A-FRAME

Filed Jan. 10, 1948 3 Sheets-Sheet 1

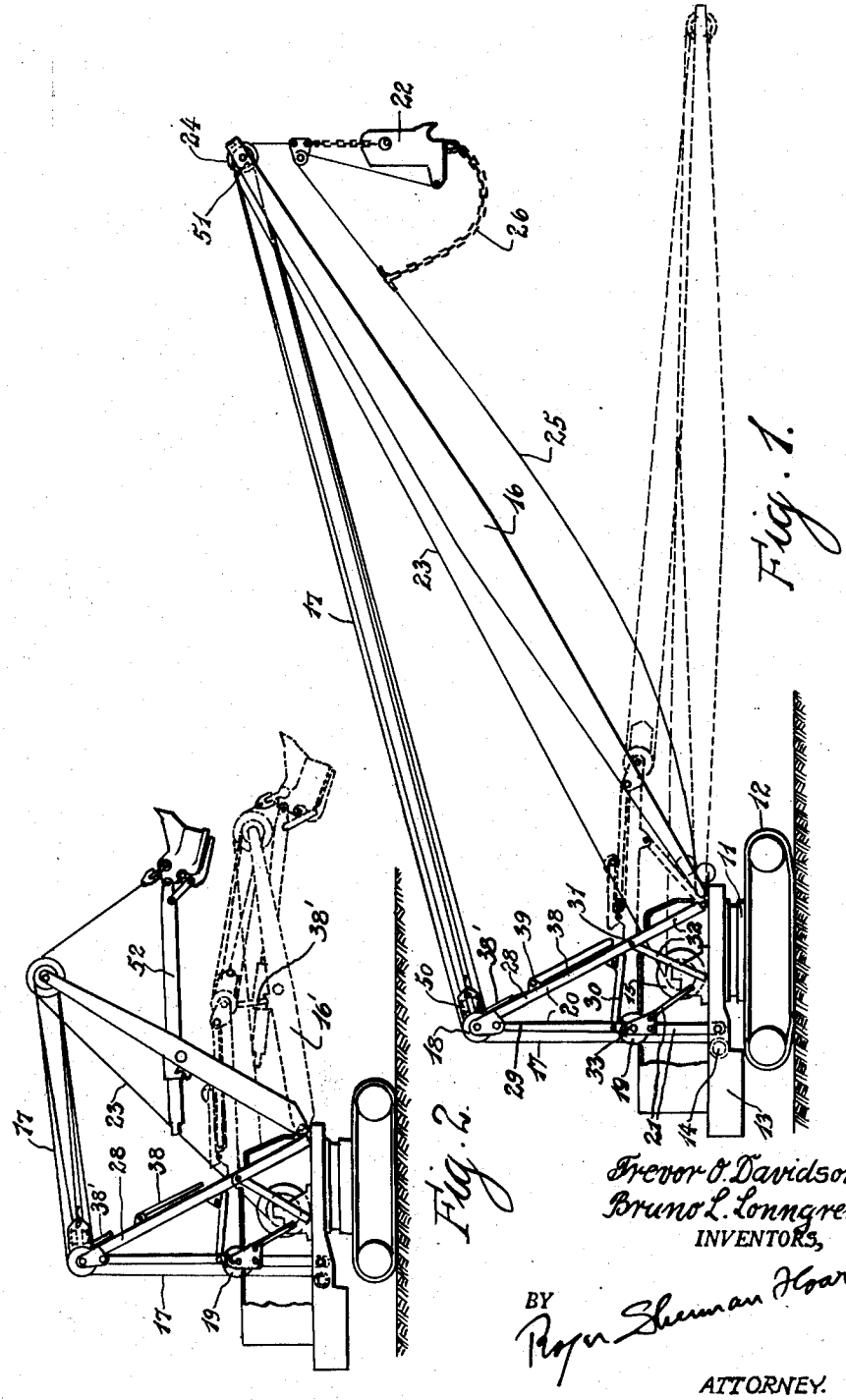


Fig. 1.

Fig. 2.

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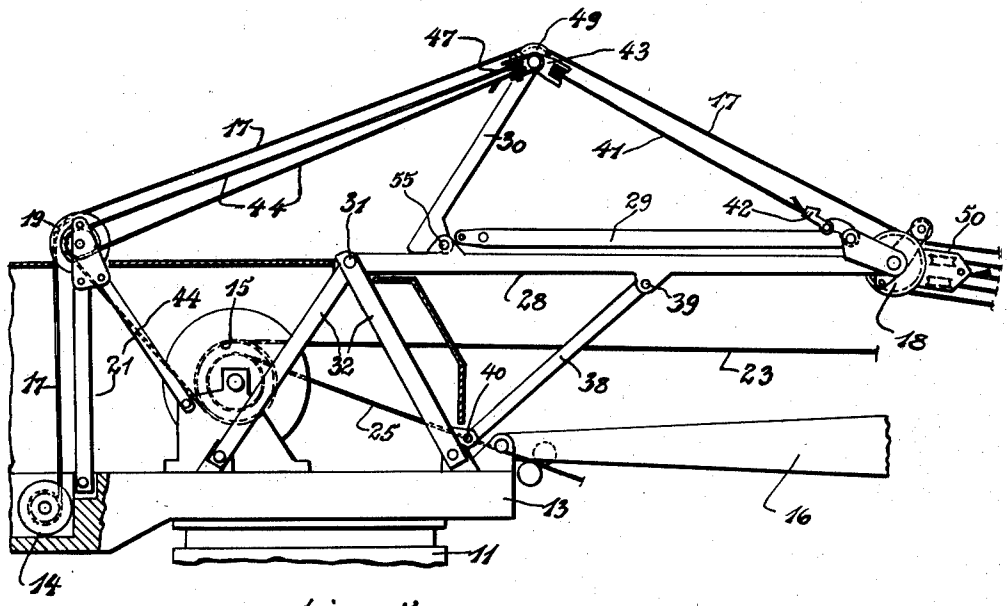


Fig. 5.

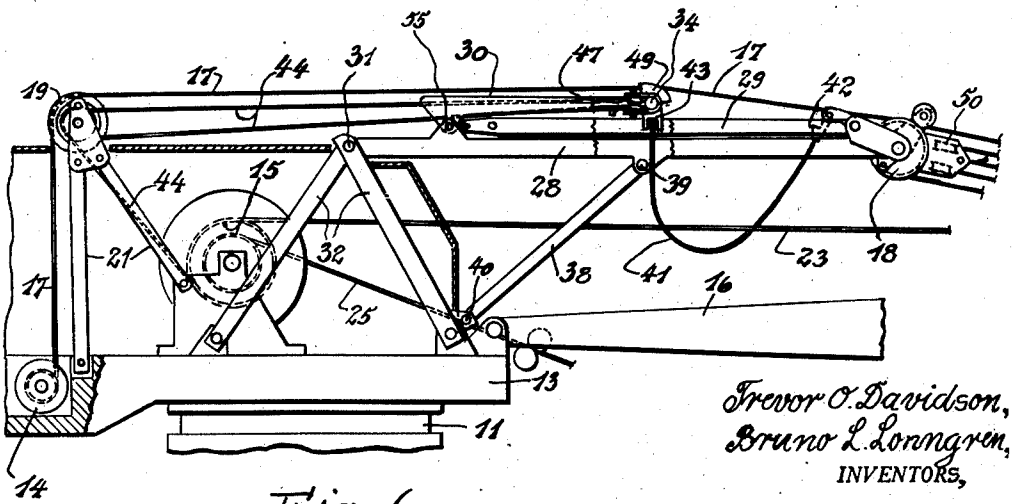


Fig. 6.

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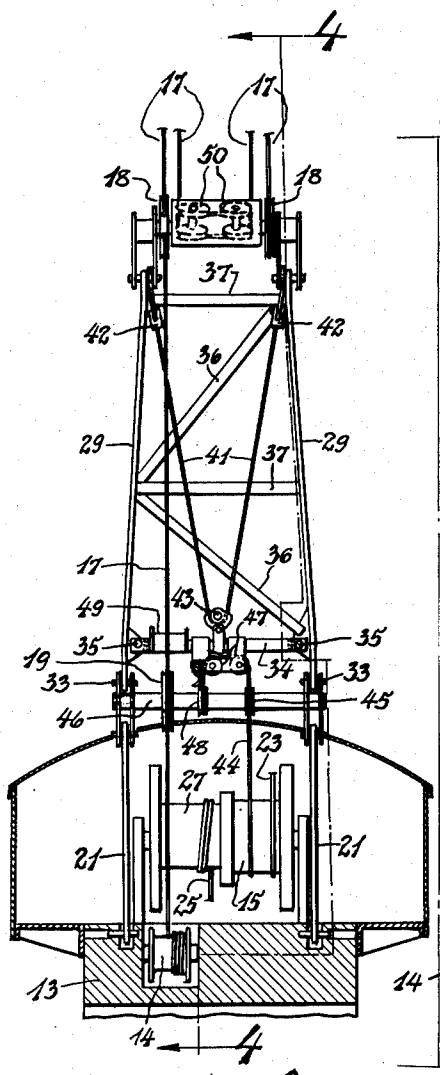


Fig. 3.

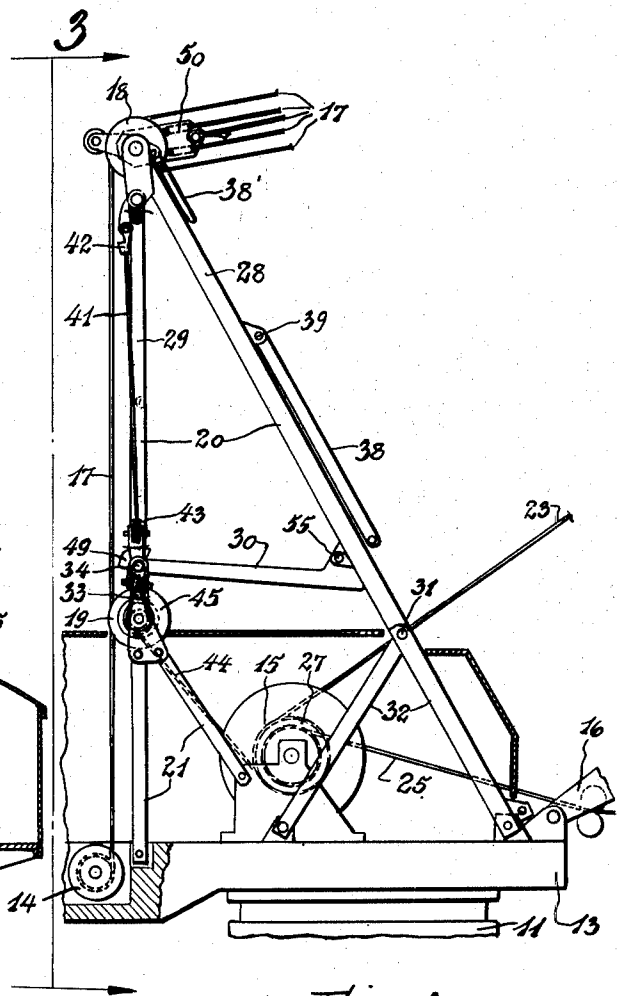


Fig. 4.

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Patented Sept. 9, 1952

2,609,939

UNITED STATES PATENT OFFICE

2,609,939

LOWERABLE A-FRAME

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Application January 10, 1948, Serial No. 1,617

3 Claims. (Cl. 212—59)

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Our invention relates to new and useful improvements in lowerable A-frames for excavating machines or other machines equipped with booms.

In power shovels, draglines, cranes, and other machines employing a forwardly and upwardly inclined boom adjustable at different inclinations, the boom is raised and lowered by a hoist cable which passes from the point of the boom over a sheave on top of an A-frame mounted relatively high above the main machine and thence to a hoisting drum on the main platform of the machine. On the one hand, it is desirable to have the A-frame of such height that the angle of incidence of the hoist cable to the boom will be sufficient to avoid high stresses in the hoist cable and the boom. On the other hand, a high stationary A-frame is impractical since it must be removed to permit the machine to pass under bridges and like obstructions when it is transported on the highway. Hence the upper portion (above the cab) of the A-frame is frequently designed so that it can be lowered into a horizontal position when the boom has been lowered for transport.

It is the principal object of our invention to provide a lowerable A-frame:

(1) That in raised position will provide a large angle of inclination between the boom-hoist cable and the boom in all operating positions of the boom.

(2) That can be easily and quickly lowered to permit the machine to pass under overhead obstructions, and then can be easily and quickly restored to raised position.

(3) That can be raised and lowered with a minimum number of detachments, connections, and/or change-overs.

(4) That can be raised and lowered without requiring workmen to climb up the lowerable portion of the A-frame to detach and/or connect parts.

(5) That can be lowered without the boom hoist cable becoming disengaged from any of its guide sheaves.

(6) That has folding parts which automatically fall by gravity into their lowered or raised positions as the case may be.

(7) That will not interfere with the boom or associated dipper handle in any position of the A-frame.

(8) That can in lowered position be braced so as to support the boom in a substantially horizontal position just clear of the ground.

In addition to our principal objects, above

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stated, we have worked out a number of novel and useful details, which will be readily evident as the description progresses.

Our invention consists in the novel parts and in the combination and arrangement thereof, which are defined in the appended claims, and of which two embodiments are exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

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

Figure 1 is a side elevation of a dragline excavator, partly broken away, showing the first embodiment of our lowerable A-frame installed thereon, the boom and A-frame being shown by full lines in raised position, and by dotted lines in lowered position.

Figure 2 is a side elevation of a power shovel, partly broken away, showing a second embodiment of our lowerable A-frame installed thereon, the boom and A-frame being shown by full lines in raised position, and by dotted lines in lowered position.

Figure 3 is an enlarged rear elevation partly in section, taken along the line 3—3 of Figure 4, showing the lowerable A-frame of our first embodiment in fully-raised position.

Figure 4 is an enlarged side elevation, partly in section, taken along the line 4—4 of Figure 3, showing the lowerable A-frame of Figure 3 in fully-raised position.

Figure 5 is an enlarged side elevation showing the A-frame of Figure 4 in partly-lowered position.

Figure 6 is an enlarged elevation showing the A-frame of Figures 4 and 5 in fully-lowered position.

Turning now to Figure 1, we see a conventional dragline comprising a base 11 carried by creeping traction 12 and having mounted thereon a rotatable platform 13 on which are mounted various conventional driving and control mechanisms, including boom-hoist drum 14 and dragline hoist drum 15 which are driven by conventional machinery not shown. Boom 16 is pivotally mounted at its foot at the front end of platform 13, and is supported by boom-hoist cable 17, connected with the boom and extending about sheaves 18 and 19 respectively on upper lowerable A-frame 20 and lower stationary A-frame 21 to boom-hoist drum 14 which controls movement of the cable and thereby the position of the boom. Dragline bucket 22 is supported from the boom point by dragline hoist cable 23 which extends

about sheave 24 on the boom and thence to dragline hoist drum 15, and is moved toward the machine by drag cable 25 which extends from drag chain 26 on the bucket to a dragline drum (Figure 4) on platform 13.

Turning now to Figures 3 and 4 we see that in order to maintain the boom-hoist cable at a sufficient height to maintain a broad angle to the boom in operating positions of the latter, and yet not interfere with overhead structures when the machine is transported on the highway, we provide the following described supporting structure.

Lowerable A-frame 20, which supports boom-hoist cable 17 at its peak, comprises mast 28 (forming the front legs of the A-frame), braced vertical struts 29 (forming the rear legs of the A-frame), and horizontal struts 30 (forming the base of the A-frame). Mast 28 is pivotally supported at 31 on lower stationary A-frame 32 mounted at the front of platform 13. Vertical struts 29 are detachably supported by pins 33 on lower stationary A-frame 21 mounted at the rear of platform 13. Horizontal struts 30 are at one end pivotally connected (preferably by removable pins or bolts 55) to the feet of mast 28, and at the other end are rigidly secured (as by welding) to transverse brace 34 (Figure 3), which is in turn detachably connected by pins 35 to the foot and rear of vertical struts 29. Vertical struts 29 are likewise pivotally connected at the apex of lowerable A-frame 20 to mast 28 and braced by transverse diagonal braces 36 and transverse horizontal braces 37. Struts 38, which are at one end pivoted on mast 28 as at 39 and hang against the mast when lowerable A-frame 20 is in raised josition (Figure 4), are pinned to the platform as at 40 (Figures 5 and 6) at the foot of A-frame 32 and thereby serve to support mast 28 in a horizontal position when the lowerable A-frame 20 has been fully lowered (Figure 6).

Turning now to the tackle which controls the raising and lowering of A-frame 20. Fixed-length bridle 41 (Figure 3), connected at its feet 42 to the top of mast 28 and at its apex 43 to transverse brace 34, serves as a tension member between these points when pins 33 and 35 are withdrawn to release vertical struts 29. A-frame lowering rope 44, connected (temporarily) to dragline hoist drum 15, or other suitable drum on the main machine, extends from that drum around sliding sheave 45 on cross shaft 46 at the apex of stationary A-frame 21, thence around sheaves 47 on transverse brace 34, thence around sheave 48 on cross shaft 46 and then is dead-ended preferably on transverse brace 34. Bridle 41 and lowering rope 44 serve to control the lowering of and to raise lowerable A-frame 20. Boom-hoist cable 17, connected to boom-hoist drum 14, and extending thence around sliding sheave 19 on cross-shaft 46 and deflector 49 on transverse brace 34, thence several times around sheaves 18 and 50 at the apex of lowerable A-frame 20 and sheaves 51 at the boom point and finally dead-ended preferably on the A-frame, serves to initiate lowering and to control raising of lowerable A-frame 20, as well as to support and raise and lower the boom when the lowerable A-frame is fixed in either fully raised position (Figure 3) or fully lowered position (Figure 6).

The procedure for lowering the A-frame is as follows. First boom 16 is lowered by paying out boom-hoist cable 17, until the boom rests upon the ground. Then lowering rope 44 is temporarily connected to dragline hoist drum 15 and reeved as described in the preceding paragraph and pins 33 and 35 are withdrawn to release struts 29 and 30 (with their transverse brace 34) respectively of the lowerable A-frame 20.

Then by taking up on boom-hoist cable 17 and paying out lowering rope 44, mast 28 is pivoted forwardly about its support 31 until it is in horizontal position (Figure 5). As mast 28 is thus lowered, vertical struts 29 swing by gravity toward the mast until they rest against it, and struts 38 fall by gravity into a vertical position where they are swung back and pinned on the platform as at 40 (Figure 5). Then lowering rope 44 is paid out further to permit struts 30 (which have provided a moment arm for the lowering rope) to fall by gravity from their erect position (Figure 5) to a horizontal position (Figure 6) resting on the mast. It is to be noted that this horizontal position is not quite in toggle, with respect to rope 44. As struts 30 fall into place, bridle 41 slackens and descends. Mast 28 now being supported by struts 38, the boom 16 can be raised from the ground to the travelling position shown in Figures 1 and 6 by taking up on boom-hoist cable 17.

The reverse procedure is employed to raise A-frame 20. The boom is lowered to the ground, struts 30 are raised by means of rope 44 to the position of Figure 5, struts 38 are unpinned at 40, the mast 28 is raised by means of rope 44 to the position of Figure 4, struts 29 and 30 are pinned in place, and the boom is raised to operating position.

It will be seen that by this arrangement it is possible to lower the upper A-frame to fully horizontal position by merely unpinning two sets of pins which are readily accessible at cab height, all freed parts falling automatically by gravity into lowered travelling position as the mast is lowered. Then by pinning in place a pair of supporting struts which have unfolded, again by gravity, it is possible to provide a temporary support for the mast in its lowered position so that the boom can be raised from the ground to travelling position and its full weight carried while the machine moves along the highway.

If desired, pins or bolts 55 can then be removed, and struts 30 (together with their transverse brace 34) can be slid back onto the roof of the cab, out of the way of boom-hoist cable 17. The length of bridle 41 will permit this.

Of course, the bridle 41 could be omitted, in which event only pins 33 would be removed right after boom 16 is lowered to the ground, struts 29 remaining pinned in place by pins 35. Thus struts 29 take the place of bridle 41. When mast 28 has become supported by struts 38, pins 35 can be unpinned, and struts 29 can be lowered by hand to the position shown in Figure 5.

In raising, struts 29 would be raised by hand and pinned in place, as soon as struts 30 have been raised to the position shown in Figure 5, and thereafter struts 29 would take the place of bridle 41 in raising the A-frame.

But it is believed that the presence of bridle 41 is nevertheless worthwhile, as avoiding the need to have men clamber up onto mast 28 to remove and replace pins 35, and to lower and raise by hand such heavy members as struts 29. The presence of bridle 41 renders the disassembling and the reassembling of our A-frame that much more automatic.

Turning now to our second embodiment, shown in Figure 2, we see our invention adapted for use

with a power shovel which may be provided as variable front-end equipment for use with the main machine and lowerable A-frame above described. Here it will be noted that short struts **38'** take the place of struts **38** to support the mast **28** in lowered position. Struts **38'** rest directly on boom **16'**, instead of (like struts **38**) being connected to a point on the main platform. Although the construction of Figure 1 can be used with shovels as well as with draglines, yet if a very high lowerable A-frame be used, the substitution of struts **38'** for struts **38** is preferable. This is due to the fact that the shortness of the shovel boom **16'**, as compared with the dragline boom **16**, would impose a considerable downward bending movement on the outer half of mast **28**, if struts **38'** be used, requiring the mast and the struts to be of stronger and heavier construction than if struts **38** were used. Provision of both struts **38** and **38'** on the A-frame permits change-over from dragline to power shovel without altering the lowerable A-frame design.

The procedure for raising and lowering the A-frame and boom is similar to that described for our first embodiment.

Having now described and illustrated two forms of our invention, we wish it to be understood that our invention is not to be limited to the specific form or arrangement of parts herein described and shown.

We claim:

1. In a machine of the class described, the combination of: a boom; a cable to support the boom; means for taking in and paying out the cable to raise and lower the boom; a stationary structure; a mast, having its foot pivotally supported by the stationary structure for pivotal movement toward the boom, from an elevated position to a lowered position; means for retaining the mast normally in elevated position, said retaining means being supported by the stationary structure by means removable to release the mast for lowering; tension means for controlling the lowering of the mast; a sheave carried by the mast to support the cable; and a compression member extending from a connection with the tension means to a pivotal support located adjacent the foot of the mast and supported by the stationary structure, the compression member being constrained by its connection with the tension means to rotate with the mast as the mast is lowered, and thereby maintain the tension means at a substantial angle with the mast during the lowering of the mast.

2. A machine according to claim 2, further characterized by the fact that the retaining means comprises a strut pivotally connected at one end to the mast and releasably connected adjacent its other end to the compression member.

3. A machine according to claim 1, further characterized by the fact that the tension means is in two parts, one of which parts is of fixed length extending from the outer end of the mast to the outer end of the compression member, and the other of which parts is of variable length extending from the compression member to a winch on the stationary structure, this second part being so reeved that, when the mast is in its foremost lowered position, the compression member will rest upon the mast, and this second part will have an upward component on the outer end of the compression member.

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