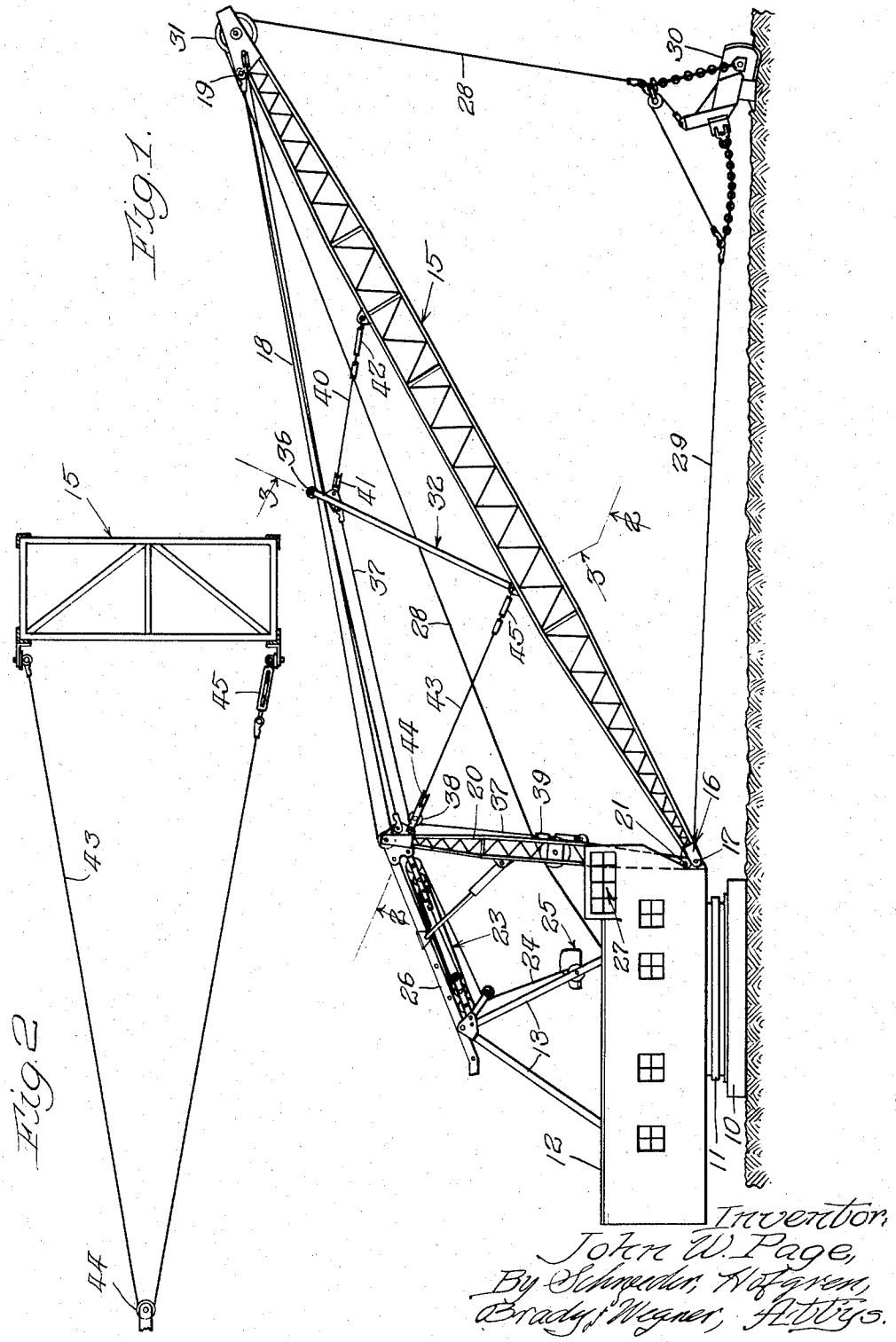
Jan. 20, 1959 J. W. PAGE 2,869,735

TRUSSING FOR BOOMS

Filed Nov. 29, 1954 2 Sheets-Sheet 1



Jan. 20, 1959 J. W. PAGE 2,869,735

TRUSSING FOR BOOMS

Filed Nov. 29, 1954 2 Sheets-Sheet 2

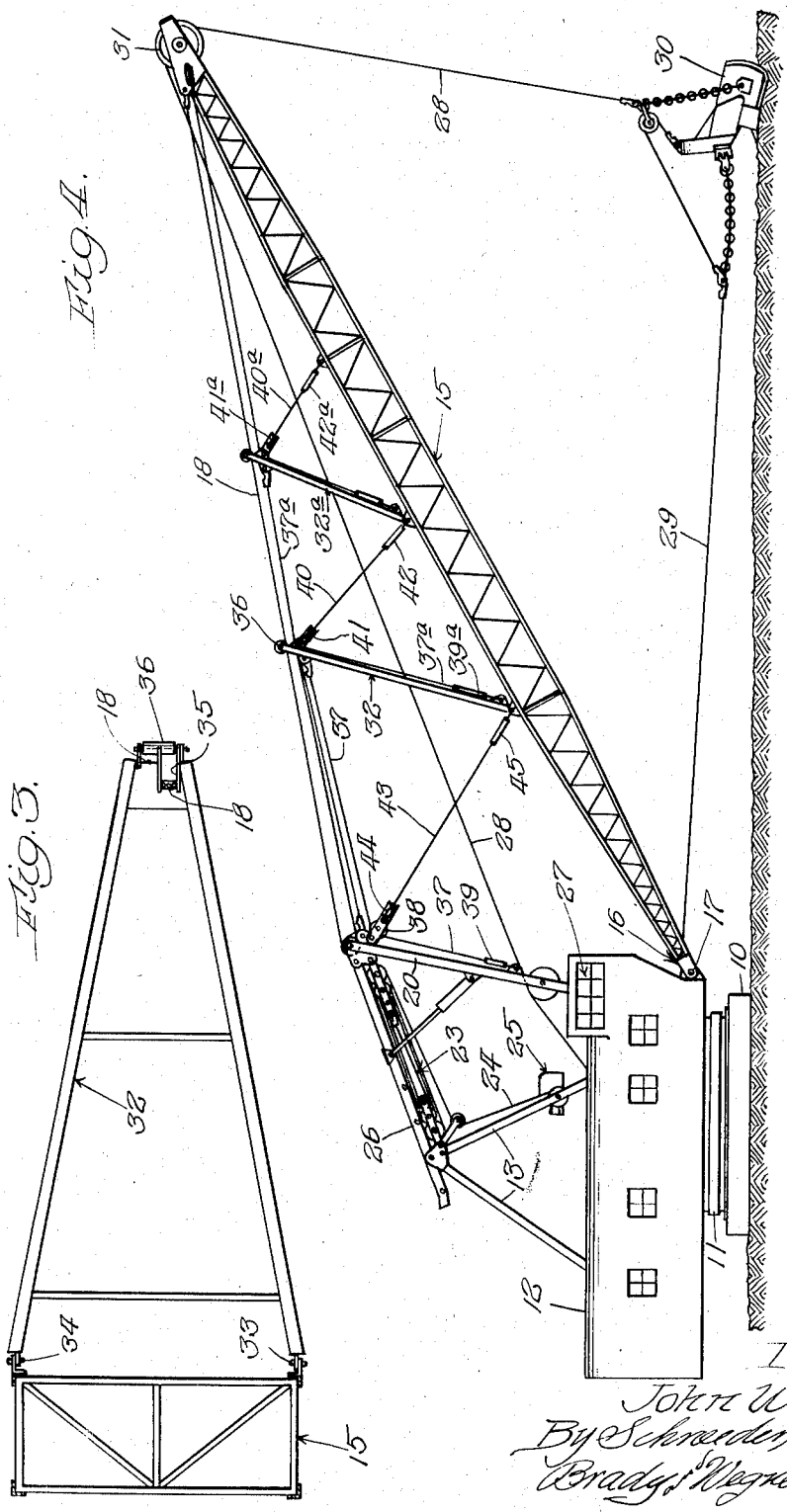


Fig. 4.

Fig. 5.

Inventor:
John W. Page,
By Schroeder, Hofgren,
Brady & Wagner, Attys.

United States Patent Office

2,869,735

Patented Jan. 20, 1959

2,869,735

TRUSSING FOR BOOMS

John W. Page, Chicago, Ill., assignor to Page Engineering Company, a corporation of Illinois

Application November 29, 1954, Serial No. 471,580

3 Claims. (Cl. 212—144)

This invention relates to a stiffening arrangement for the boom of a derrick structure.

Walking dragline excavators are of such size that the boom employed is quite long and, therefore subject to considerable vibration and deflection. Ordinarily, the boom is formed as a trussed beam supported only at its ends. It has been found that these booms are so long that the main stresses in the top and bottom cords are due primarily to the dead weight of the boom itself.

The excavating buckets used with the large dragline excavators are capable of picking up several tons of material. When this material is dumped, a considerable weight or load is dropped from the end of the boom. The boom is held in generally upwardly and outwardly extending position by boom support cables extending from the end of the boom back to a mast on the derrick. These lines are quite large and heavy so that when a load is dropped from the bucket, they tend to sag like a catenary. This causes considerable vibration so that in practice the boom has nearly always been constantly in motion while in use.

The present invention provides a stiffening arrangement which eliminates in major proportion both the vibration of the boom upon the release of the load from the bucket and the sag of the boom support lines which contribute measurably to the vibration.

It is, therefore, the principal object of this invention to provide a new and improved stiffening arrangement for the booms of derrick structures.

It is a further object to provide a stiffening arrangement for a boom permitting a considerable lessening of the weight of the boom structure itself.

A further object is to provide a stiffening arrangement for booms which reduces deflection of the boom structure.

Other objects, features and advantages of the present invention will be apparent from the following description taken in conjunction with the drawings in which:

Figure 1 is a side elevational view of a dragline excavator having the structure of the present invention incorporated therein, (the drawing is diagrammatic to the extent of the illustration of the excavator cab and the machinery therein);

Figure 2 is a fragmentary sectional view taken substantially along line 2—2 in Figure 1;

Figure 3 is a fragmentary sectional view taken substantially along line 3—3 in Figure 1; and

Figure 4 is a view similar to Figure 1 of a dragline excavator showing a slightly modified form of excavator with the structure of the invention therein.

The dragline excavators referred to herein are of quite large capacity and are intended for field operation as distinguished from road vehicles. The bight of the bucket used with the excavator is of such a size that up to twenty yards of material may be picked up at one time. The present invention is concerned primarily with the boom structure so that the cab and its related machinery have been shown only diagrammatically.

Referring to both Figures 1 and 4, the excavator has a pedestal 10 upon which a turntable 11 is mounted so that the cab 12 may swing 360° in arc. Upstanding from the cab is a fixed mast structure 13 providing an anchorage from the structure to hold the boom, generally indicated 15 in an elevated position. The boom itself is a trussed beam of considerable length. The cab end or base 16 is swingably mounted on a pin 17 so that the boom may be raised and lowered relative to the ground. Cable 18 is secured at 19 to the outer end of the boom and at its inner end to the top of a movable upstanding mast 20. The cable 18 is reeved in such a manner that three lengths extend between the mast and the outer end of the boom as illustrated in both Figures 1 and 4. One difference between the dragline excavators illustrated in Figures 1 and 4 is in the particular form of the mast 20 and the trussing arrangement. In Figure 1, the mast 20 is sprung at 21 in a fixture which also secures the boom to the cab. In Figure 4, the mast 20 is sprung from a point (not shown) which is removed from the pin 17 hinging the boom to the cab. The particular laced beam structure of the mast 20 shown in Figure 1 is equivalent to the solid beam type of mast shown in Figure 4, the difference being in the point from which the mast is sprung on the dragline structure.

The boom is raised and lowered by the use of boom falls 23 which extend between the top of the movable mast 20 and the top of the fixed mast 13. One portion 24 of the line extends to a cable drum and motor structure 25 which may be used to vary the position of the movable mast and thus of the boom structure. An interconnecting member 26 may fix the adjustable mast 20 with relation to the fixed mast 13 once the adjustment has been made to position the boom where desired.

In the dragline excavator illustrated, the operator may control the apparatus from a cab portion 27, the main controls being in the swinging of the excavator about its base 10 and the control of a lift line 28 and a pull line 29, both attached to the excavating bucket 30. The lift line 28 passes over a sheave 31 on the end of the boom and then into the drum winding machinery within the cab of the excavator.

In the past, there has been some strengthening of the boom structure by placing cables between the top of the movable mast and intermediate points on the boom. While these cables tended to support the boom intermediate its ends, there was no elimination of vibration when the heavy load was dropped from the excavating bucket. In the present invention, a trussing arrangement is provided which eliminates undue vibration and at the same time permits a savings in weight in the boom structure. To avoid the catenary effect of the boom support lines, a support generally at the midpoint of the lines is provided to take out the sag.

The support is provided by an A-frame or becket staff 32, hingedly secured at 33 and 34 to the top cords of the boom structure. This A-frame is relatively light in weight and made only heavy enough to withstand the compressive forces applied to it by the compression cables forming a part of the trussing structure. At the top of the staff 32, a pair of channels 35 are formed for the reception of the boom support cables 18. A roller 36 extends across the top of the channels and blocks the cables from leaving the channels. Ordinarily, a rubber lining may be provided in the channels to reduce wear on the cables passing through. When the staff is applied to the boom, the support cables are reeved through the channels and under the roller so that when the boom is first raised, the staff will also be raised by the roller riding upon the support cables.

The becket staff is held in an upstanding position relative to the boom so that the channels support the cables

18 at their midpoint substantially in line with the ends of the cables. One cable 37 extends from the top of the staff over a sheave 38 secured to the top of the adjustable mast 20 and is attached to a turnbuckle 39 near the top of the excavator cab so that it may be conveniently reached for adjustment. A bridle cable 40, similar to the bridle cable illustrated in Figure 2 extends from one side of the boom over a sheave 41 on the upper end of the staff to a turnbuckle 42 at the other side of the boom. This bridle cable thus opposes the pull af the cable 37 and by adjustment, the two cables determine the position of the staff 32 relative to the boom. It will be noted that the bridle cable 40, the staff 32 and the boom form three sides of one triangle in the trussing arrangement.

To complete the trussing arrangement, a bridle cable 43 extends between the bottom of the becket staff 32 and over a sheave 44 secured to the top of the adjustable staff 20. This cable is shown in Figure 2 and it will be noted that it also is secured at one end to a turnbuckle 45 so that adjustments may be made in its length. The bridle cable 43, cable 37 and staff 32 thus form another triangle in the trussing arrangement. The third triangle is formed by the boom, bridle cable 43 and adjustable mast 20. The trussing arrangement thus described strengthens the boom against deflection and vibration, permitting the cords and bracing members within the boom to be built of lighter weight sections than would otherwise be required. A considerable savings is thus accomplished by utilizing the bracing structure just described. In addition, the trussing device, including the becket staff, provides a means for supporting the boom support lines at their midpoint, reducing catenary action when a load is dropped from the boom. This also minimizes vibration of the boom structure.

It is preferred to construct the excavating dragline with a movable mast sprung from the base of the boom as illustrated in Figure 1. It will be noted that when the mast 20 has its base at the base of the boom, the boom falls 23 may be used to lower or raise the boom without disturbing the relationship of the trussing triangles formed by the strengthening structure. Many dragline excavators are, however, formed as shown in Figure 4, where the mast 20 is not sprung from the base of the boom but at a point removed therefrom. In these instances, a raising or lowering of the boom will require a readustment in the length of both bridle cables 40 and 43 as well as in the length of the cable 37. This will be required to insure that the becket staff 32 supports the cables 18 at the proper elevation and also to accommodate the change in the sides of the triangles making up the boom strengthening structure. In either instance, the employment of the presently described structure has many advantages both to the operator and to the manufacturer of the dragline excavator.

Boom structures up to 150 feet in length may be adequately braced by the trussing arrangement shown in Figure 1 using a single becket staff 32. For booms longer than 150 feet and up to 200 feet, it is desirable to duplicate the becket staff 32 in the manner illustrated in Figure 4. The becket staff 32 is placed closer to the cab in relation to the total length of the boom than is illustrated in Figure 1 and an additional staff 32*a* is placed outwardly toward the end of the boom. Staff 32*a* is swingably secured to the boom and held in place by cable 37*a* anchored to a turnbuckle 39*a* attached to the becket staff 32 near the boom so that it can be reached. On the opposite side, a bridle cable 40*a* is secured to the boom and passes over a sheave 41*a* as well as being provided with an adjustable turnbuckle 42*a*. The becket staff 32*a* is in all respects similar to staff 32.

The boom support lines 18 have been shown herein as having three parts whereas it should be understood that more as well as fewer cables are sometimes used. The roller 36 at the top of the becket staff performs an important function of maintaining the staff in an upright position should any of the lines holding the staff in place part. In either of the structures of Figures 1 and 4, triangles of a trussing arrangement are made by the stiffening structure described and illustrated. A larger number of becket staffs may be employed where the boom is of greater length and the one described herein is to be taken as exemplary of the invention.

While I have shown and described particular embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. In a derrick structure having a boom and boom support lines connected to a mast, a boom stiffening arrangement comprising: a becket staff swingably attached to the boom and extending upwardly to the boom support lines intermediate their ends, said staff having lines intermediate their ends, said staff having a U-shaped channel in its upper end in which said boom support lines rest, a roller secured to the staff and closing the upper end of the channel above the lines to maintain the lines in the channel, said channel forming a support for said boom support lines; a support member connecting the staff with a portion of the derrick structure to hold the staff in position to support said intermediate portion of the boom lines substantially in line with the ends of the boom lines, said staff holding the lines against undue sag upon removal of a load from the end of the boom.

2. In a derrick structure having a boom and mast extending in an upwardly direction and boom support lines connected to the mast and end of the boom, a boom stiffening arrangement comprising: a becket staff swingably attached to the boom intermediate its ends and extending upwardly to support said boom support lines intermediate their ends; and flexible tension members, one connecting the upper end of the becket staff with the boom and another connecting the upper end of the becket staff to the upper end of the mast to hold the staff in a predetermined position supporting the boom lines, said another tension member being secured to the mast intermediate its ends and extending from the upper end of the mast to the upper end of the becket staff, said another tension member being mounted to have equal tension throughout its length; and a flexible cable connecting the upper portion of the mast with the lower portion of the becket staff adjacent the attachment of said staff to said boom, said mast, staff, tension members and cable forming truss triangles with the boom having only the boom, staff and mast as compression members for stiffening the boom against vibration.

3. A boom stiffening arrangement as specified in claim 2 wherein a plurality of becket staffs are attached to the boom and extend upwardly to support the boom support lines at spaced points, and each becket staff has tension members connected to each end thereof supporting the staffs in desired position.

References Cited in the file of this patent

UNITED STATES PATENTS

951,433	Carey	Mar. 8, 1910
2,031,549	Ruff	Feb. 18, 1936
2,168,837	York	Aug. 8, 1939
2,378,915	Davidson	June 26, 1945
2,382,767	Zeilman	Aug. 14, 1945
2,545,937	Armstrong	Mar. 20, 1951