May 29, 1928. 1,671,693

L. R. ASH

ROPE ANCHOR FOR LIFT BRIDGES

Filed Oct. 30, 1926 2 Sheets-Sheet 1

Fig. 1.

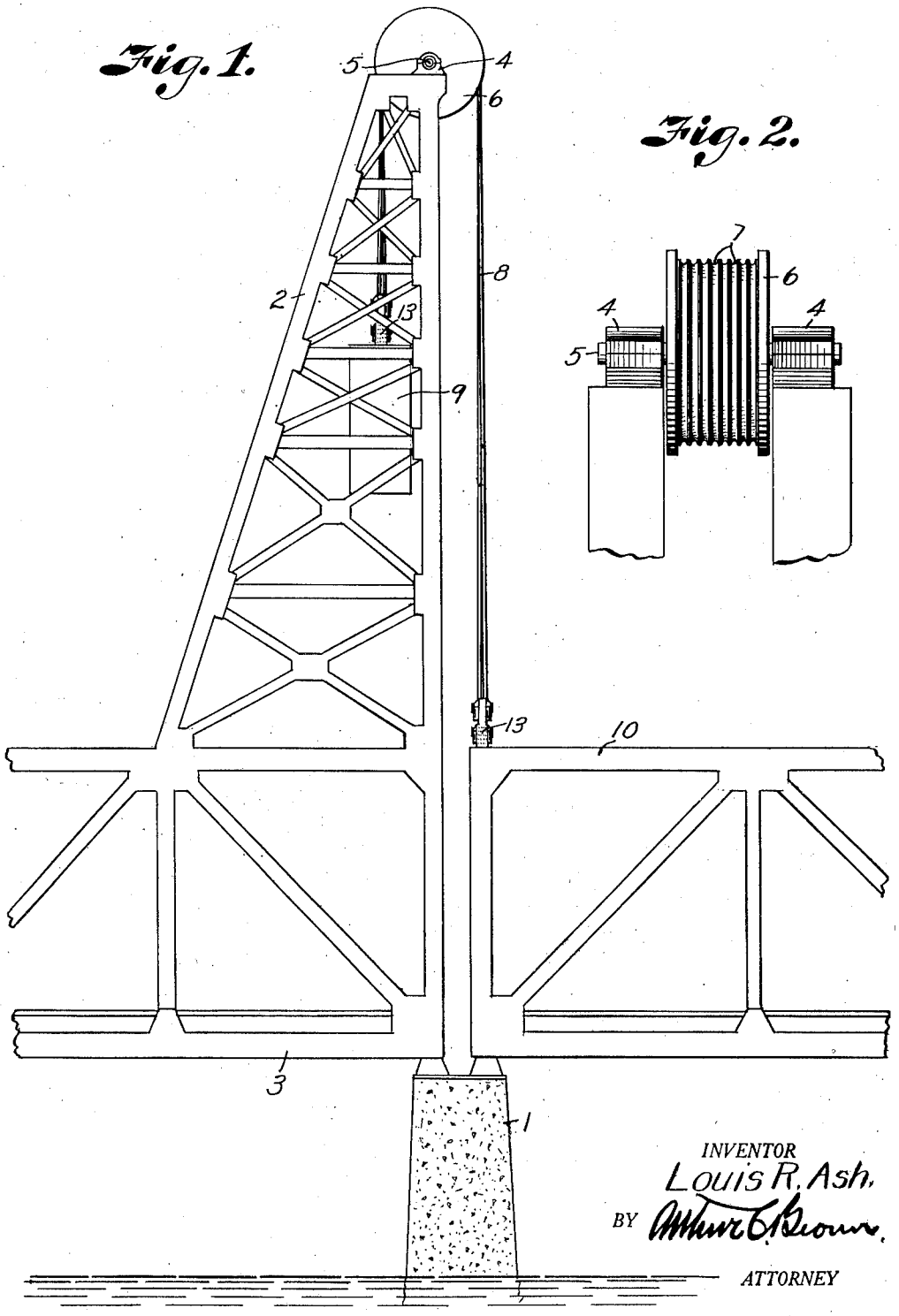


Fig. 2.

INVENTOR
Louis R. Ash.
BY Arthur C. Brown.
ATTORNEY

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Fig. 3.

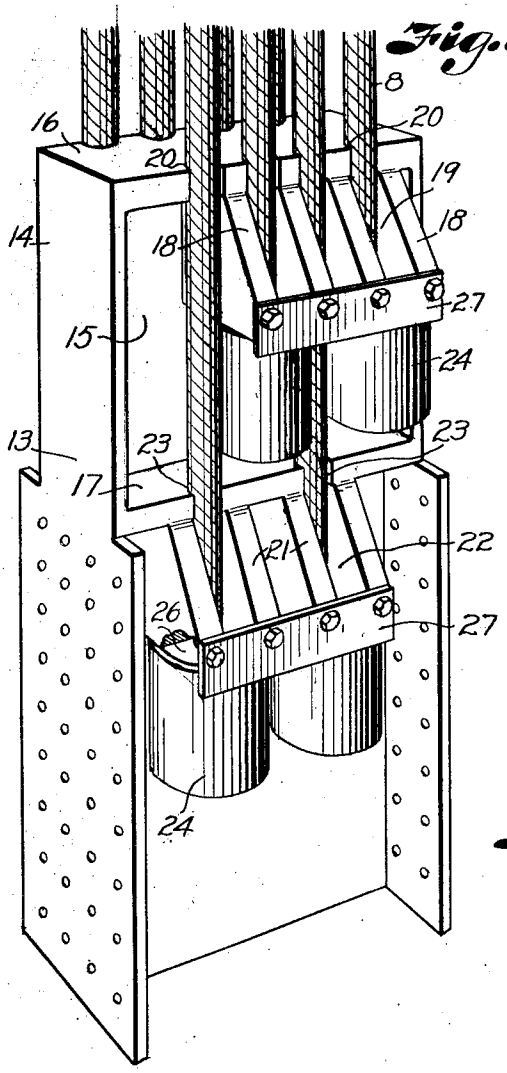


Fig. 4.

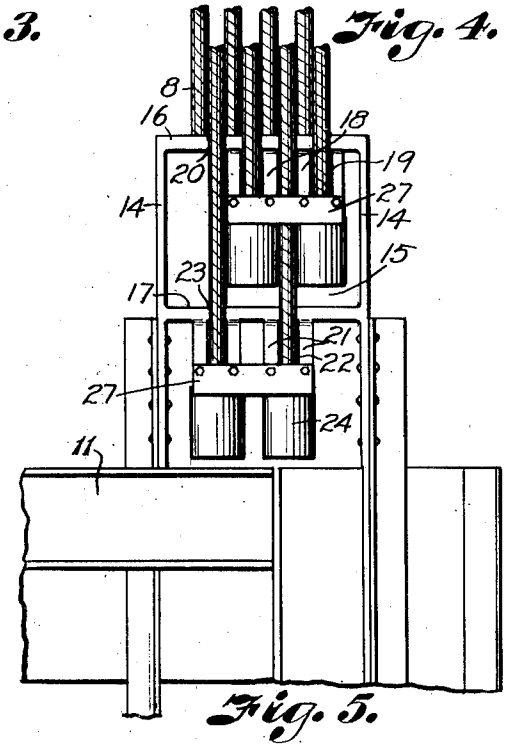


Fig. 5.

Fig. 8.

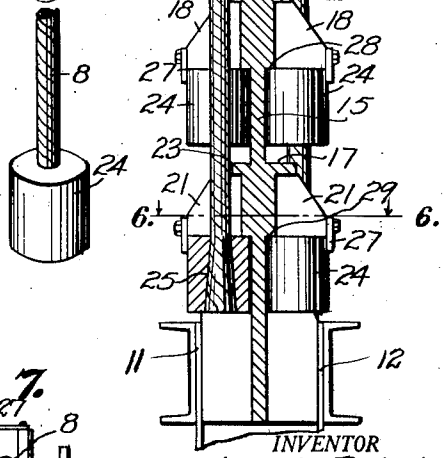


Fig. 6.

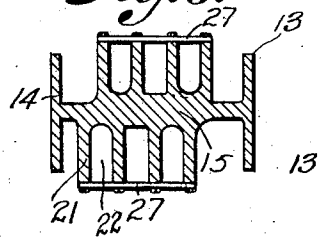
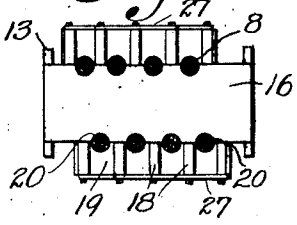


Fig. 7.



INVENTOR

Louis R. Ash.

BY Albert G. Brown

ATTORNEY

Patented May 29, 1928. 1,671,693

UNITED STATES PATENT OFFICE.

LOUIS R. ASH, OF KANSAS CITY, MISSOURI.

ROPE ANCHOR FOR LIFT BRIDGES.

Application filed October 30, 1926. Serial No. 145,268.

My invention relates to rope anchors and more particularly to a device of that character for connecting the ends of supporting ropes or cables with the movable span and counter-weights of a lift bridge; the principal object of the invention being to eliminate unequal tension on the ropes as the span or counter-weights approach the sheave at the top of the tower when the span is raised or lowered, and to accomplish such elimination without the aid of rope clamps, thereby making it possible to shorten the towers.

The lift span of a bridge of this type, being of substantial weight, requires relatively heavy counter-weights (one at each end) which, together with the span, are suspended from ropes run over sheaves at the tops of towers located on piers or abutments which support the ends of adjacent fixed spans and also the movable span when the latter is in load carrying position.

Because of the great weight of the span and counter-weights, a single rope at each end of the movable span is insufficient to support the load, and a number of ropes must necessarily be employed. These ropes are run over sheaves on the towers and in accordance with present practice are spread at their ends to permit attachment to the span or counter weights.

If the spread is transverse of the span and sheave, the ropes are led from the sheaves to the span and counter-weights out of the planes of the sheave grooves, and there is a tendency to draw the ropes from the grooves as the span or weights approach the sheave when the span is raised or lowered to its limit of movement. If the spread is longitudinal of the span and unequal between various ropes, the ropes are unequally tensioned under the same conditions, with the result that an overload is placed on some of the ropes and other ropes practically relieved of duty, due to their unequal inclination to their neutral plane. In some cases clamps have been employed to group the ropes adjacent the span or counter-weight, but this shortens the effective length of the ropes without entirely obviating the unequal tension or the compensation that must be made for it.

With my improvements, however, the ropes are led from the sheaves to the span and counter-weights in the same planes as the grooves in the sheaves and with longitudinal spread the same for all of the spans, and unequal tension on the ropes is avoided without use of a clamp or other like device, thereby permitting shortening of the towers and affording a more uniform and dependable support for the span and counter-weight than is possible with the use of ropes as heretofore employed.

In accomplishing the objects of my invention, I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevation of a portion of a lift bridge equipped with my improvements.

Fig. 2 is an elevation of a portion of a counter-weight rope sheave.

Fig. 3 is an enlarged details perspective view of a rope anchor embodying my improvements, illustrating application of ropes thereto.

Fig. 4 is an end elevation of the anchor attached to a lift span of double-web, lifting-girder type.

Fig. 5 is a vertical section of the anchor, particularly illustrating assembly of the ropes therewith.

Fig. 6 is a horizontal section on the line 6—6, Fig. 5.

Fig. 7 is a horizontal section on the line 7—7, Fig. 5.

Fig. 8 is a detail perspective view of a rope end and its socket.

Referring more in detail to the drawings:

1 designates a pier or abutment; 2 a tower here shown as resting on a fixed span 3 having its outer end supported on the pier 1, and of a construction ordinarily employed in bridges of this type. On the top of and usually at each corner of the tower 2 are bearings 4 for the shaft 5 of a sheave wheel 6, having grooves 7 for guiding the ropes 8 from which a lift span and counter-weight are suspended; the front edge of the sheave projecting vertically beyond the face of the tower so that the ropes 8 clear the tower during their operative travel, and the rear edge of the sheave terminating in a perpendicular line running through the tower so that the counter-weight 9 suspended therefrom may move vertically within the tower.

As the parts just described are duplicated at each end of the movable span, but one end of the span and one set of parts is illustrated and described with the understanding that the illustration and description relates

equally to the parts at either end of the span.

The movable span, designated 10, may be of any ordinary construction but is here shown (Fig. 4) to be of the double-web, lifting-girder type, one of the girders being indicated by the webs 11—12 (Figs. 4 and 5).

Located between the webs 11—12 and fixed thereto by rivets or bolts is a frame 13 preferably of cast metal, although it may be of structural steel, comprising the sides 14, a central longitudinal web 15, a top cross-plate 16 and an intermediate cross-rail 17, the latter spaced below the top plate 16. The frame is provided below and adjacent each edge of the top rail with a number of spaced lugs 18 which project outwardly beyond the plane of the frame to form pockets 19, of a total number equalling the number of individual ropes employed for suspending the span and counter-weight from a corresponding sheave and, as the ropes are usually of even number, the pockets being equally divided on opposite edges of the frame, the device being here shown as adapted for an eight rope suspension and having four lugs at each edge of the top plate, forming eight pockets 19, those at one end of each side series being open or, if desired, an additional lug 18 may be provided to close it.

The spacing of the pockets from center to center on either side of the top plate is twice the spacing of the grooves in the sheave on which the ropes are adapted to travel and the pockets are staggered at opposite sides of the plate so that the ropes extend alternately at the front and back of the plate, thereby permitting their close arrangement in the grooves on the sheave, and their spaced relation in the anchor frame. The edges of the plate 16 are preferably provided with vertical grooves 20 arranged centrally of the pockets 19 and within which the ropes may seat to center them in the pockets and in the planes of the sheave grooves.

The frame is provided below and adjacent the lower rail 17 with lugs 21 corresponding to the lugs 18 adjacent the plate 16 and forming pockets 22 registering with pockets 19 in the upper series, the rail 17 having vertical grooves 23 arranged centrally of some of the pockets and in registration with corresponding grooves 20 in the top plate. While the lugs in each lower series register with those in the corresponding upper series, the lower series is stepped relative to the upper series, so that an end rope passing through a laterally open pocket 19 in the upper series will be confined in a pocket of the lower series, as presently described.

Attached to each end of each of the ropes is a socket 24 having a central, conical bore 25 in which the end of a rope is fixed, preferably by running the end of the rope through the bore, splaying the strands, drawing the splayed strands into the bore and pouring the bore with zinc to embed the strands and form a slug which will prevent withdrawal of the ropes from the sockets under the weight imposed thereon when the span and weight are under suspension as presently described. The sockets may be applied to the ropes at the factory and the ropes furnished to specifications with the sockets attached, all of the ropes for the same bridge being of equal length.

When a bridge embodying my improvements is to be erected, the towers are built up at each end of the movable span opening, the movable span fabricated or set in place between the towers, the sheaves mounted on the corners of the towers, the counter-weights set and one of the anchor frames attached to each corner of the span and to the ends of the counter-weights, with the pockets in the frames in the planes of the grooves in the sheaves.

Ropes, all of the same proper length and with sockets on their ends, are then hung on the sheaves and the span or counter-weights set so that the ends of the ropes may move through the pockets between and at the ends of the frame lugs into the grooves in the upper cross plate, when the plate is grooved, or against the edges of the plate if no grooves are provided, the ropes being located alternately at the front and back of the frame to provide a spread at the anchor without interfering with close arrangement of the ropes at the sheave. Consequently, if eight ropes are used at each corner of the span, the span ends of four of the ropes will be located at one side of the anchor frame on the span and four on the opposite side thereof; the opposite ends of the ropes having the same arrangement on the corresponding frame on the counter-weight.

While the ropes are all of the same length, the end of each alternate rope at one side of the frame is extended beyond the ends of the other two ropes sufficiently to allow the ends of the extended ropes to seat in the pockets between it at the sides of the lugs adjacent the lower rail, so that the sockets on the short ends may seat under the upper lugs and the sockets on the long ends may seat under the lower lugs, thereby providing for such further lateral spread of the ropes as to afford space for the sockets, but still without interfering with close arrangement of the ropes on the sheaves or taking the ropes out of the planes of the sheave grooves.

The same arrangement is effected in the duplicate frame on the counter-weight, ropes having short ends at the span having long ends at the counter-weight; consequently all of the ropes may be of equal length, but should there be any slight difference in length, it may be absorbed by shims 26 interposed between the sockets and lugs (Fig. 3).

While the weight on the sockets will prevent their displacement after their installation, I prefer to attach keeper plates 27 to the lugs to close the rope pockets, after the ropes are in place.

In Fig. 5 I have shown the top cross plate 16 and the cross rail 17 built up adjacent the lugs 18 and 21, forming shoulders 28 and 29 against which the sockets 24 bear. While these built up portions provide additional bearing surfaces for the sockets, they are provided primarily to strengthen the frame at these points of shear and bending.

It is apparent from the foregoing that, with a bridge equipped with my improvements, there is no transverse spread of the ropes taking them out of the planes of the sheave grooves, although space is afforded for secure attachment of the ropes to the anchor frame, and that, while there is a slight longitudinal spread of the ropes equal to the effective width of the cross plates on the frames at the extreme ends of the ropes, this is not of a nature to produce unequal tension on the ropes nor to a degree to prevent elevation of the anchor frames to substantially the level of the sheaves, thereby permitting use of shorter towers than are possible under previous practices.

What I claim and desire to secure by Letters Patent is:

1. In a rope-supported device of the character described, a frame having upper and lower series of pairs of lugs forming upper and lower series of rope pockets, each of the pockets in each series being adapted for independently receiving the lifting strain of respective supporting ropes.

2. In a device of the character described, a frame having an upper series of lugs on each of its opposite sides, spaced to form intervening rope pockets and arranged to stagger the pockets at one side of the frame with the pockets at the opposite side of the frame, and having a lower series of lugs on each of its opposite sides, each of the pockets in a lower series registering with a pocket in the corresponding upper series.

3. In combination with an anchor frame, a set of counterweight ropes having their ends arranged alternately at opposite sides of the frame, alternate ropes at the same side of the frame being extended beyond the other ropes at that side of the frame, and means anchoring the ends of the ropes to the frame.

4. In combination with an anchor frame, a set of counterweight ropes extended along the frame, alternate ropes being extended beyond the other alternate ropes, and means securing the ropes to the frame.

5. In combination with a frame comprising vertically spaced pairs of lugs, forming upper and lower rope pockets, a set of counter-weight ropes having their ends extended through selected pockets, and sockets on the ends of the ropes engaging the lugs to support the frame.

6. In combination with a frame comprising an upper series of lugs at each side of the frame, spaced to form rope pockets and arranged to stagger the pockets at opposite sides of the frame, a lower series of lugs at each side of the frame spaced and arranged to form rope pockets in registration with upper pockets on the same side of the frame, a set of counter-weight ropes arranged alternately at opposite sides of the frame and successively in said staggered pockets, alternate ropes at the same side of the frame having sockets on their ends in supporting engagement with lugs of the lower series.

7. In combination with a bridge tower, a movable span and a counterweight, a sheave on the tower, having rope grooves, ropes in said grooves having their ends extended to the movable span and to the counterweight, an anchor frame on the span having an upper series of spaced lugs at each of its sides, forming rope pockets, staggered at opposite sides of the frame, and having a lower series of lugs at each of its sides forming rope pockets in registration with upper pockets at the same side of the frame, a similar anchor frame on the counterweight, the ends of the ropes at one side of the sheave being arranged alternately at opposite sides of the frame on the span and successively in said staggered pockets, alternate ropes at the same side of the frame being extended beyond the other ropes at that side of the frame and through pockets formed by the lower series of lugs, sockets on the ends of said ropes in supporting engagement with said lugs, the ends of the ropes at the opposite side of the sheave being similarly connected with the frame on the counterweight, the ropes having short ends at the span side and having long ends at the weight side.

In testimony whereof I affix my signature.

LOUIS R. ASH.