

Sept. 9, 1924.

C. S. PROUDFOOT

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CABLE EQUALIZER

Filed April 18, 1922

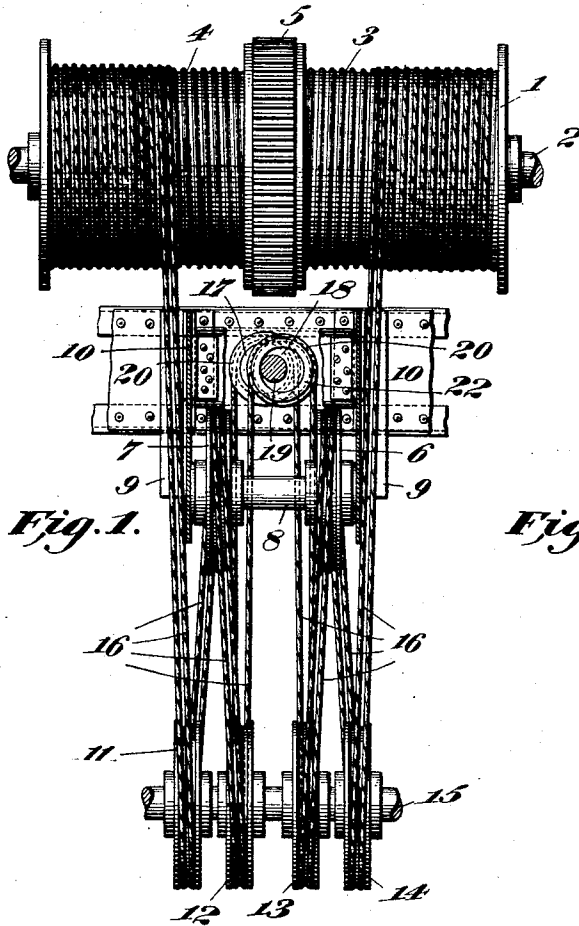


Fig. 1.

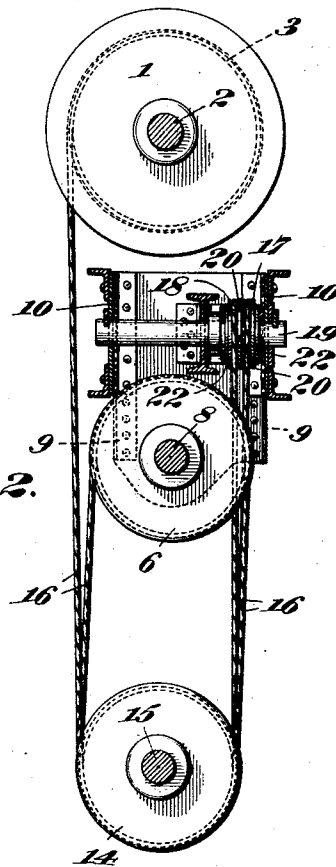


Fig. 2.

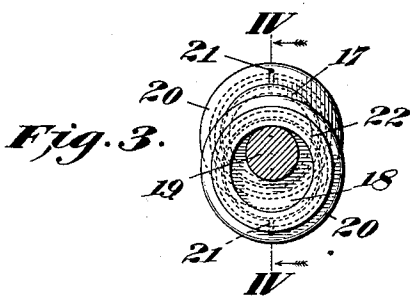


Fig. 3.

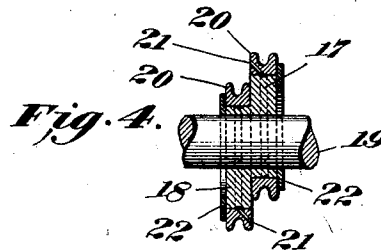


Fig. 4.

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UNITED STATES PATENT OFFICE.

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CABLE EQUALIZER.

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To all whom it may concern:

Be it known that I, CHARLES S. PROUDFOOT, a citizen of the United States, and a resident of the borough of Westmont, county of Cambria, and State of Pennsylvania, have invented certain new and useful Improvements in Cable Equalizers; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates generally to a cable equalizer or apparatus for equalizing the lengths and tension of a plurality of cables which are wound on and unwound from a drum of a hoisting mechanism, or otherwise overhauled, in order that the tension in each part of the cable shall be similar and the hoisting portion of the apparatus maintained in relative position.

My cable equalizer operates automatically and is particularly adapted for use in connection with power cranes or other hoisting apparatus, and especially so for handling heavy loads.

In hoisting apparatus of this kind the cable may be wound on or unwound from a power-operated drum or spool preferably provided with spiral grooves in which wire cables are seated, and these cables are then led downwardly and rove around a sheave or sheaves arranged in any of the well-known manners, and prior to my invention the bights of a number of cables were rove over sheaves so mounted that they could be adjusted by means of adjusting screws and nuts.

Prior types of cable equalizers are necessarily in most inaccessible locations between the upper part of the apparatus and the ground, and these are not automatic, so that their adjustments may be made at one time and they may be out of adjustment shortly thereafter, especially if heavy loads are lifted, causing one portion of the cable or one cable to stretch more than the other. As compared with these prior non-automatic equalizers, my cable equalizer is automatic in operation and requires no attention and adjusts itself at all times.

In connection with a hoisting apparatus of the general character above described, the bights of intermediate or preferably central portions of the hoisting cables are led over my apparatus, part of which comprises

two eccentrics or eccentric sheaves secured together or in a fixed relation to each other and arranged with their throws diametrically opposite or at an angle with each other. The throw of the eccentric is the distance from the shaft axis on which it is mounted to the center of the eccentric. These eccentrics are provided with grooved rims and one cable is rove in the groove of the rim of one eccentric and the other cable in the groove of the rim of the other eccentric.

These eccentrics are preferably adjusted in the first instance with their axes of throw substantially horizontal and extending in opposite directions, thus being preferably at an angle of 180 degrees with each other to fully utilize their equalizing effect, but they may be arranged at a lesser angle if desired, but with their throws non-coincident, and if one of the ropes or cables stretches more than the other one, the eccentric around which it is rove will yield in one direction while the other eccentric will move oppositely, so that the tension will thereby be equalized and so maintained at all times. This will require no attention whatever until the axis of throw of the eccentrics has become substantially vertical, or nearly in line with the cables, and with the size of equalizer I have used this will allow for a difference in stretch between the ropes of one foot or more. If these eccentrics were made solid they would operate as above described, provided the hoisting sheaves do not swing so that the axis of lift is substantially vertical at all times; but as, however, during certain hoisting operations the load is apt to swing a little at times, I provide each of my eccentrics with a slip ring so mounted that the swinging motion of the cables will permit the slip rings to creep slightly on the eccentrics to prevent chafing or rubbing the cables.

Although I prefer to use a pair of eccentric sheaves which are preferably formed integral and mounted rotatably on a shaft, I may secure them relatively by keying separate eccentrics on a shaft and permit the shaft to rotate in bearings, or I may use another form of equalizer in which the sheaves are eccentrically mounted on opposed crank arms, which crank arms form part of a shaft adapted to rotate in bearings, in which case the sheaves may also rotate on the crank pins, thereby obviating the

necessity of slip rings. This crank arm construction, however, is not so compact and is more complicated, so that I prefer the arrangement of the two eccentrics secured adjacent with their throws arranged opposite or angularly to each other.

My eccentric sheaves may be arranged with their centers opposite each other or their radii or throws, namely:—lines extending from the center of the shaft on which they are mounted to the center of the eccentric sheave, may be arranged at any angle to each other, so long as these lines are not coincident, that is, in the same plane and extending in the same direction.

Having thus given a general description of my invention, I will now, in order to make the matter more clear, refer to the annexed sheet of drawings, which form part of this specification, and in which like characters refer to like parts:—

Figure 1 is a front elevation of my improved equalizer showing a portion of the framework upon which it is mounted, broken away to more clearly show the manner of construction and operation; Figure 2 is an end elevation of the apparatus shown in Figure 1 with the framework broken away to show the shaft mounting; Figure 3 is a detail side elevation of the eccentrically mounted equalizing sheave, and Figure 4 is a vertical sectional elevation through the eccentrically mounted equalizing sheaves taken on the line IV—IV of Figure 3.

Referring now to the characters of reference on the drawings:—1 indicates the hoisting drum as a whole, carried by the shaft 2, which may be mounted in any suitable bearings, the right hand portion of the drum 3 being provided with left hand spiral grooves, while 4 is the left hand portion of the drum provided with a right hand series of spiral grooves and forming part of or attached to the drum is the gear wheel 5 adapted to mesh with a pinion to rotate it in either direction by any suitable source of power. Mounted on the framework and forming part of that on which the drum is also mounted is a shaft 8 carried in bearings on a downward extension of the framework 10 and stiffening angles 9, and on this shaft the cable sheaves 6 and 7 are mounted as illustrated. Other sheaves 11, 12, 13 and 14 are provided and may be mounted in a lifting beam or cradle, not shown, or these may be provided with hooks or any other apparatus to carry the loads to be lifted, and these sheaves are mounted upon the shaft 15. The cables, which are preferably of wire, are 16, and in order to follow their arrangement they may be said to begin at the left hand side, which shows a double cable adapted to be wound or unwound in the spiral grooves of the drum portion 4,

thence passing downwardly around the sheave 11, thence upwardly around the sheave 7, thence downwardly around the sheave 12 and thence one of these cables passes upwardly with its bight around the eccentrically mounted equalizing sheave 17, while the bight of the other cable passes around the other eccentrically mounted equalizing sheave 18, each of these sheaves being mounted upon the shaft 19 with their axes of throw fixed oppositely or at an angle of about 180 degrees or substantially in the same line. The two cables after passing around the equalizing sheaves 17 and 18, respectively, thence lead downwardly around the lower sheave 13, thence upwardly and around the upper sheave 6, thence downwardly and around the lower sheave 14, and thence upwardly and into the spiral grooves of the right hand portion 3 of the drum, all ends of the cables being secured to the drum in any customary manner. The equalizing sheaves 17 and 18 are preferably formed integral and rotatably mounted on the fixed shaft 19, or they may be separate and keyed to the shaft, which in that case would be adapted to rotate in the bearings. The shaft 19 is mounted in the framework 10 and firmly secured therein by keys as illustrated, or otherwise, and each of these eccentric equalizing sheaves 17 and 18 may be made integral and provided with a groove in its circumference, or each sheave may have a center portion provided with a separate grooved slip ring 20 mounted thereon with oil holes 21 for lubricating the bearing surfaces, and after these rings are in place they may be secured by the washers 22, and in order to avoid the use of loose parts the washers may be electrically welded to the eccentric sheave centers 17 or 18, or they may be secured thereto in any desired manner.

During the operation of the crane or lifting apparatus the drum is rotated in one direction to lower the load and in the other direction to raise the load, and owing to the inequalities of the cables or to the differences of the load on the different parts, one of these cables may stretch more than the other, but as the bight of one of these cables passes around one eccentric sheave, such as 17, and the other around the other eccentric sheave 18, their own tensions will automatically adjust the position on the sheaves, and if one rope is longer, or has less tension than the other, its sheave will rise a little and the other sheave will correspondingly lower, so that the tensions and lengths of the two ropes are adjusted automatically. The equalizing sheaves are preferably located to receive intermediate or central bights of the cables. If the lifting sheaves mounted on the shaft 15 and attachments should swing slightly during the lifting or lowering op-

eration, the cables 16 would swing slightly and have a tendency to rub or chafe on the sheaves 17 and 18, but this is obviated by the use of the slip rings 20, which allow a slight creeping of these rings due to the swinging action, so that the cables will not be chafed at any time.

Although I have shown and described in detail a pair of sheaves with their throw arms relatively fixed opposite, or at an angle with each other, adapted to equalize one pair of cables or I may use a plurality of these adapted to separately equalize any number of pairs of cables desired.

Although I have shown and described my invention in considerable detail, I do not wish to be limited to the exact and specific details thereof, as shown and described, but may use such modifications in, substitutions for, or equivalents thereof as are embraced within the scope of my invention or as pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A cable equalizer comprising a pair of sheaves eccentrically mounted on a shaft which extends through them and within their peripheries with their throw arms relatively angularly disposed.

2. A cable equalizer comprising a pair of sheaves directly and eccentrically mounted on the same shaft which extends through them and within their peripheries, with their throw arms extending oppositely.

3. A cable equalizer comprising a pair of sheaves directly and eccentrically mounted on the same shaft which extends through them and within their peripheries, with their throw arms relatively angularly disposed.

4. A cable equalizer comprising a pair of sheaves directly and eccentrically mounted on the same relatively fixed shaft which extends through them and within their peripheries, with their throw arms oppositely arranged.

5. A cable equalizer comprising a shaft

and a pair of integral sheaves rotatably and eccentrically mounted thereon, with their throw arms oppositely fixed.

6. A cable equalizer comprising a pair of sheaves rotatably and eccentrically mounted on the same fixed shaft and secured together with their throw arms oppositely arranged.

7. A cable equalizer comprising a pair of sheaves rotatably and eccentrically mounted and secured together with their throw arms oppositely disposed, and a slip ring rotatably mounted on each sheave.

8. A cable equalizer comprising a pair of eccentric sheaves integrally formed with their throw arms oppositely disposed, a grooved slip ring mounted on each sheave and means for rotatably securing said slip rings in position thereon.

9. A cable equalizer comprising a plurality of sheaves eccentrically mounted on a common shaft with their throw arms relatively angularly fixed, and a grooved slip ring mounted on each sheave.

10. In a hoisting apparatus, a rotatable drum, power cables rove thereon, hoisting and leading sheaves around which said cables are rove, an equalizing device comprising a pair of sheaves directly and eccentrically mounted on the same shaft which extends through them and within their peripheries, with their throw arms oppositely fixed and over which the bights of the cables are rove.

11. A hoisting apparatus, comprising a rotatable drum, a pair of cables adapted to be wound or unwound therefrom, hoisting sheaves around which said cables are rove, an equalizer mounted on the framework comprising a common shaft, a pair of eccentrically mounted sheaves on said common shaft which extends therethrough, the throw arms of said sheaves being oppositely fixed and around each of which the bight of one of said cables is rove.

In witness whereof I hereunto affix my signature.

CHARLES S. PROUDFOOT.