No. 671,425. Patented Apr. 2, 1901.

A. E. NORRIS.

HOISTING APPARATUS.

(Application filed Oct. 27, 1900.)

(No Model.) 2 Sheets—Sheet 1.

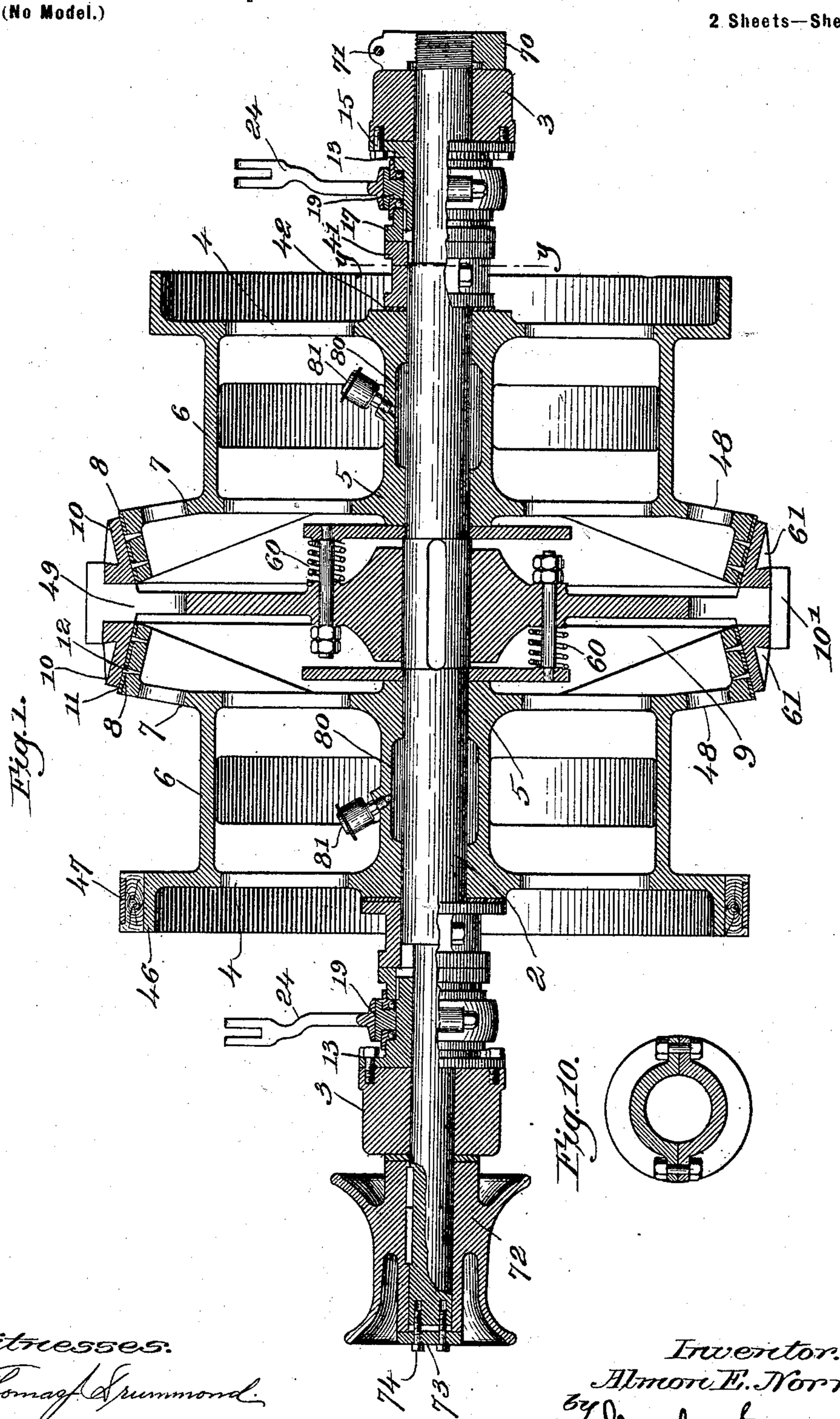

Fig. 1.

Fig. 10.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

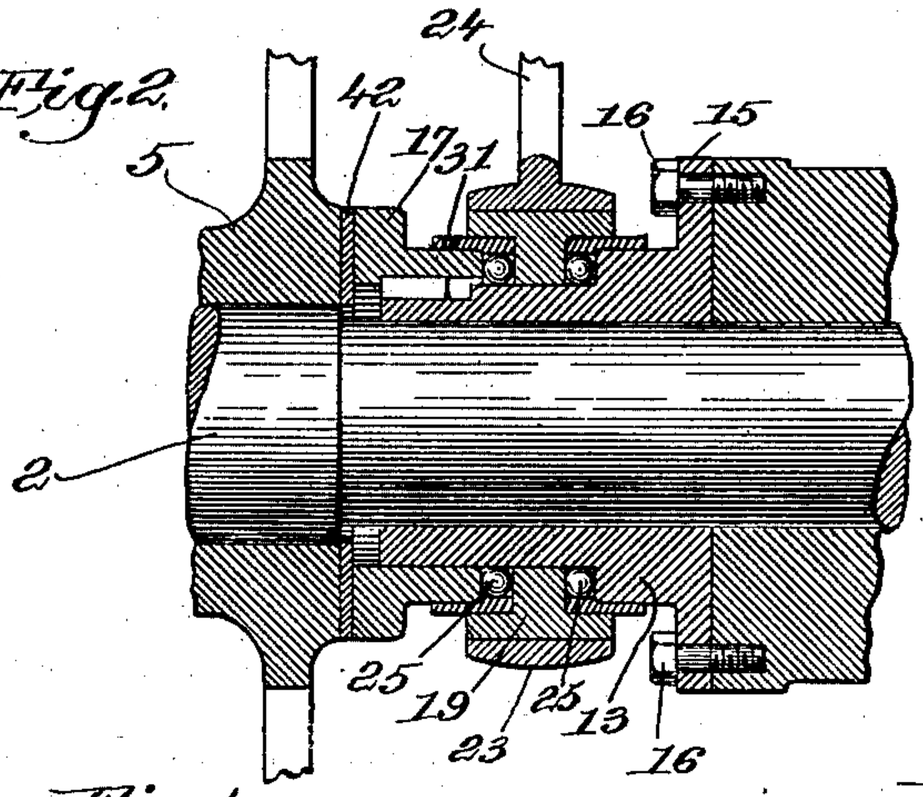

Fig. 3.

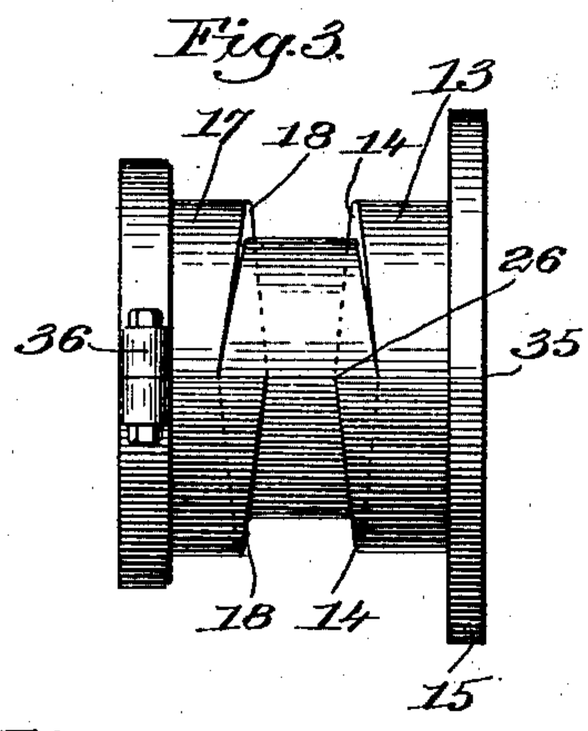

Fig. 4.

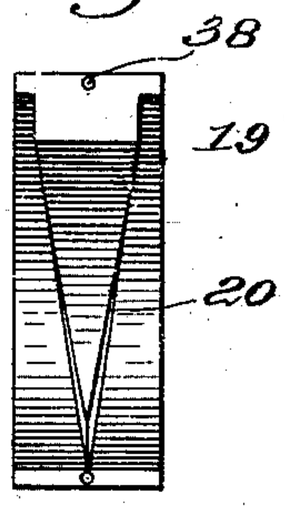

Fig. 5.

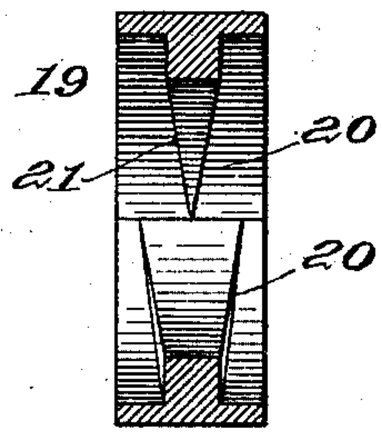

Fig. 6.

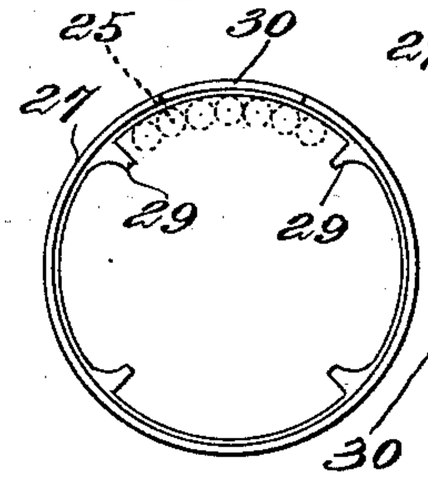

Fig. 7.

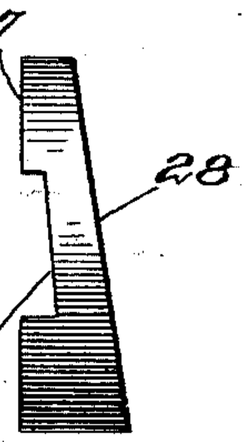

Fig. 12.

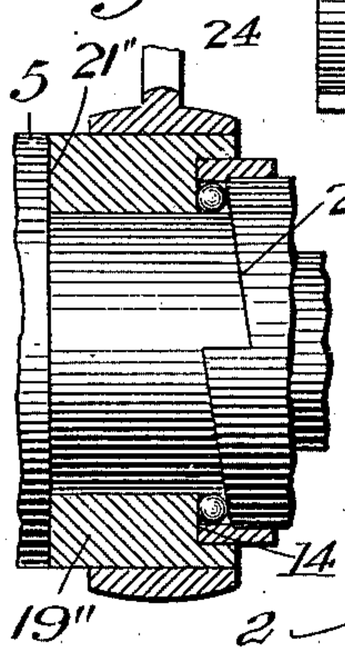

Fig. 8.

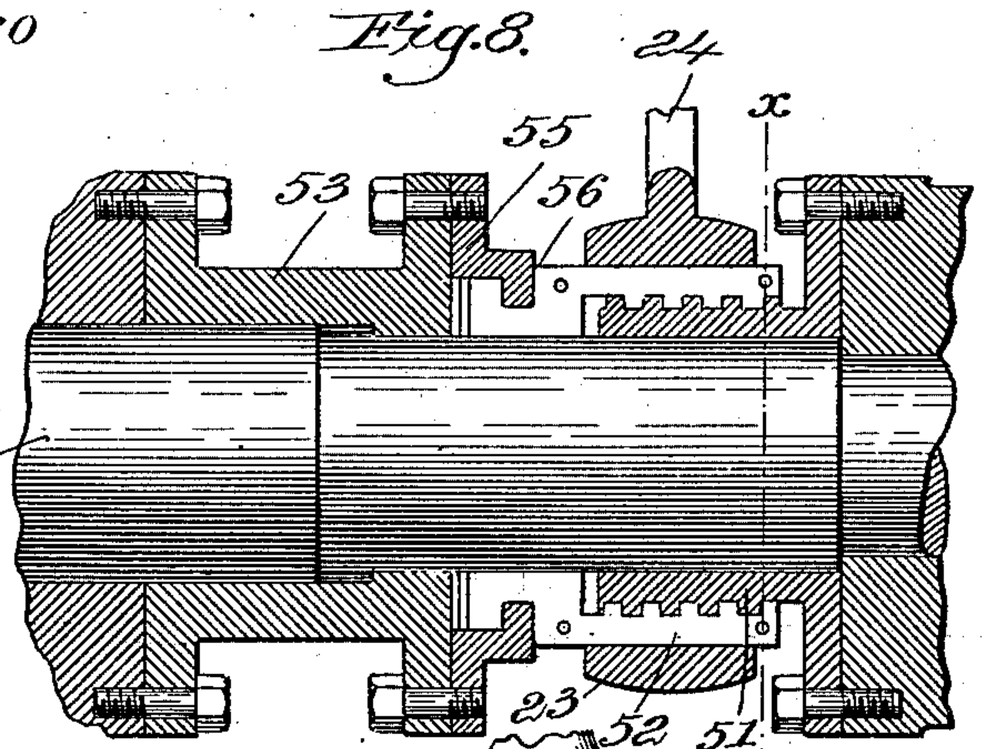

Fig. 11.

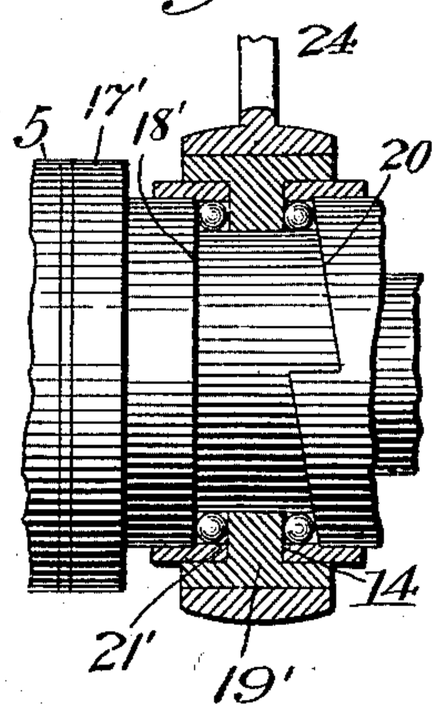

Fig. 9.

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UNITED STATES PATENT OFFICE.

ALMON E. NORRIS, OF CAMBRIDGE, MASSACHUSETTS.

HOISTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 671,425, dated April 2, 1901.

Application filed October 27, 1900. Serial No. 34,533. (No model.)

To all whom it may concern:

Be it known that I, ALMON E. NORRIS, a citizen of the United States, residing at Cambridge, county of Middlesex, State of Massachusetts, have invented an Improvement in Hoisting Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings representing like parts.

This invention relates to hoisting apparatus wherein are employed two ropes for operating an opening-and-closing bucket—as, for instance, a bucket of the clam-shell type—and especially to the winding-drums and their coöperating parts, the objects of the invention being to provide an improved form of friction-clutch-operating mechanism, to provide means whereby the winding-drums may be moved longitudinally upon the shaft in order to expose the friction-surface when it is desired to renew the same without the necessity of taking the shaft from the bearings, to provide means for adjusting the shaft in its bearings to compensate for longitudinal wear, and to also provide means whereby the friction-surfaces are prevented from getting unduly heated when in use, these objects being accomplished by the mechanism hereinafter described, and pointed out in the claims.

In the drawings, Figure 1 shows in section a pair of winding-drums and the driving mechanism therefor. Fig. 2 shows one form of cam mechanism for causing the engagement of the drums with the friction member. Figs. 3, 4, 5, 6, and 7 are detail views of the cam members forming the mechanism for causing the engagement of the friction-surfaces. Fig. 8 is a view showing a modification of the device illustrated in Fig. 2. Fig. 9 is a section on the line $x\ x$, Fig. 8. Fig. 10 is a section on the line $y\ y$, Fig. 1. Figs. 11 and 12 show different forms of cam mechanism embodying my invention.

In most hoisting apparatus of the type above specified two suitable friction-drums are used, upon which the holding-rope and the opening-and-closing rope are respectively wound, the said drums being usually mounted loosely upon a shaft, and suitable means are provided whereby either one or both of said drums may be clutched to the shaft when it is desired to operate either the holding or the opening-and-closing rope or both ropes simultaneously.

As illustrated in the drawings, the main shaft is designated by 2, the said shaft being supported in any suitable bearings 3 and having loosely mounted thereon the winding-drums 4, each winding-drum comprising a shell which is supported upon the hubs 5 by means of suitable arms, as usual in this class of devices. The central portions 6 of the shell constitute the rope-receiving portion of the drum, and each shell or drum has at its inner end the flanges 7, which are provided at their periphery with a conical friction-surface 8. The outside ends of the drums may have the brake-surface 46, on which will operate any usual brake-band 47.

Each drum is driven by means of a fixed friction member 9, said friction member being rigidly mounted upon the main shaft 2 and carrying at its periphery a flange having the conical friction clutch-surfaces 10, which coöperate with the friction clutch-surfaces on the winding-drum, and in the present instance the peripheral flange on the fixed friction member 9 is provided with gear-teeth 10′, which mesh with the gear-teeth in any suitable driving mechanism, (not shown,) though my invention would not be departed from if the shaft were driven in any other usual way. When it is desired to rotate either of the drums 4, said drum is moved longitudinally on the shaft to cause the friction clutch-surfaces 8 and 10 to engage, when the rotation of the fixed friction member will be communicated to the drums.

It is the common practice in this art to provide one or both of the coöperating friction-surfaces with some suitable frictional material—such, for instance, as leather or fiber—and in the drawings I have illustrated such frictional material being secured to the friction-surface 8 in any suitable way—such, for instance, as by pegs 12.

The parts so far described are more or less common in all hoisting apparatus, and further description thereof is not deemed necessary.

As shown in Fig. 1, the apparatus comprises two oppositely-disposed winding-drums; but inasmuch as both drums and their coöperating parts are alike a description of one will

answer for both, and hereinafter the description will be confined to a single drum, it being understood, of course, that the same mechanism may be employed in connection with the other drum.

As stated above, the winding-drum 4, which with its friction-surface 8 constitutes, in effect, a movable clutch member, is moved longitudinally upon the shaft when the same is to be driven by the fixed friction member 9, which corresponds in function to the fixed member of a clutch, and in order to give to the drum 4 this longitudinal movement I have provided herein an operating mechanism, comprising two cam members, which are in the nature of thrust members, each of said cam members being concentric with and surrounding the main shaft, said cam members having coöperating cam-surfaces and one of said members being movable relatively to the other, whereby the rotation of the movable member operates to give the requisite longitudinal movement to the winding-drum.

In my preferred form of invention the fixed cam member is shown as a sleeve 13, surrounding the shaft 2, said sleeve having at one end a suitable flange 15, which may be fastened rigidly to any suitable fixed abutment—such, for instance, as the bearing 3—in any usual way, as by bolts 16. This sleeve 13 has preferably a plurality of inclined shoulders 14, forming one of the cam-surfaces, and it carries at its inner end the collar 17, which is preferably feathered thereto, the said collar 17 being in the nature of a longitudinally-moving thrust-collar, as will be presently explained, and the sleeve 13 also acting as a thrust member.

The movable cam member is in the nature of a ring or sleeve 19, surrounding the sleeve 13, the said ring having a plurality of inclined shoulders 20, which coöperate with the shoulders 14, the said shoulders 14 and 20 constituting coöperating cam-surfaces.

It will be readily understood from the above description that the rotation of the movable cam member 19 upon the fixed cam member 13 will impart to the thrust-collar 17 a longitudinal movement, and said longitudinal movement will be communicated to the hoisting-drum by any suitable mechanism.

I have herein shown the thrust-collar 17 as provided with a plurality of inclined shoulders 18, said shoulders having an opposite inclination to the shoulders 14, and the ring or movable cam member 19 has the shoulders 21, which are oppositely inclined to the shoulders 20 and which coöperate with the shoulders 18 of the thrust-collar 17, the two shoulders 20 21 forming between them a wedge-shaped projection on the interior of the cam member 19, which plays in the groove between the shoulders 14 18 on the fixed cam member. These inclined shoulders upon the thrust-collar 17 and the coöperating shoulders upon the ring 19 are not essential, however, for I may construct the thrust-collar 17 with a plane shoulder against which a suitable plane shoulder on the movable cam 19 will abut, or I may omit the collar 17 and allow the ring 19 to bear directly against the mechanism between it and the drum, these embodiments of my invention being illustrated in Figs. 11 and 12. In Fig. 11 the thrust-collar 17′, which corresponds with the thrust-collar 17 in Fig. 2, is provided with the plane shoulder 18′, with which a plane shoulder 21′ on the movable cam member 19′ coöperates. In Fig. 12 an embodiment of my invention is illustrated wherein the thrust-collar 17 is omitted, and the movable cam 19″ has the plane surface 21″, which bears directly against the hub of the drum. In both of these forms of my invention the coöperating cam-surfaces 14 and 20 are the same as in Fig. 2. I prefer, however, to make the cam members of the form illustrated in Figs. 2, 3, and 4, since I get a greater longitudinal movement on the drum for a corresponding circular movement of the movable cam member.

Although I have herein illustrated a plurality of inclined shoulders or cam-surfaces on each cam member, yet my invention is not limited thereto, as I might construct each cam member with a single inclined shoulder or cam-surface, and I consider this construction as coming within my invention.

The movable cam member 19 is surrounded by any suitable clamping-ring 23, to which the arm 24 is attached, the clamping-ring serving to clamp the operating-arm 24 to the movable cam member.

The friction developed between the coöperating cam-surfaces in bringing and holding the friction-surfaces in engagement is considerable, and to overcome this I may place a series of antifriction-balls between the said cam-surfaces, such balls being designated by 25.

The movement of the operating-arm 24 is a limited movement, and owing to the construction wherein a plurality of inclined cam-surfaces are employed it is necessary to confine the antifriction-balls in their movement to a limited space between the bottom and the top of each inclined shoulder in order that the balls will not work up the incline to the top and drop over the shoulder 26—for instance, to the bottom of the next incline. This is accomplished by means of retaining-rings 27, (illustrated in Figs. 6 and 7,) said retainers or retaining-rings being provided on one face with an incline 28 of the same pitch as the inclined shoulders 20 21 and having projecting inwardly the stop-lugs 29, between which the balls are confined. As illustrated, the said stop-lugs are approximately ninety degrees apart, although, of course, this angle would be varied according to the number of inclined cam-surfaces upon each cam member. When the retaining-rings are in position, they are placed one between the thrust-collar 17 and

the movable cam member 19, and the other between the sleeve 13 and said movable cam member, as shown in Fig. 2, the inclined faces 28 of said retainers following the inclined faces 20 21 of the movable cam member and the lugs 29 being over and projecting into the grooves between the coöperating cam-surfaces in which the antifriction-balls play. It will be understood, of course, that when the thrust-collar 17 is constructed with a plane shoulder instead of with the inclined cam-faces the antifriction-balls will be used only between the movable cam member 19 and the cam-surface on the sleeve 13, in which case, of course, only a single retainer will be used. As the movable cam member is rotated the balls will be given a forward motion approximately one-half that of the movable cam member, and as the balls are confined between the stop-lugs 29 each retaining-ring will move with the balls, and to limit the movement of the balls I have provided the outside edge of each ring with a notch 30, in which suitable pins 31 on the thrust-collar 17 and sleeve 13 play, the said notch limiting the movement of the retainers, and the retainers through the lugs 29 preventing the balls from becoming displaced. The antifriction-balls between the coöperating cam-surfaces are not absolutely essential to the operation of my device, but are preferable, since they reduce the friction and render the device easier to operate.

In devices of this class the lowering of the bucket is generally accomplished by loosening the friction-surfaces somewhat, so as to allow the friction-surface 8 on the drum to slip on the friction-surface 10 on the fixed clutch member, the weight of the bucket unwinding the rope, and such slipping between the friction-surfaces operates to wear the friction material 11, thus making it necessary at frequent intervals to replace the same. Heretofore in this class of devices it has been necessary to take the shaft from its bearings in order to withdraw the drum longitudinally sufficient to expose the friction-surface 8. This operation takes considerable time, and to provide means whereby the drum may be moved longitudinally on its shaft to expose the friction-surface without lifting the shaft from its bearings I may provide a longitudinally-split thrust member concentric with the shaft and located between the drum and the fixed abutment 3, whereby by removing the said split thrust member the drum may be given its requisite longitudinal movement.

In Fig. 1 I have shown one embodiment of my invention, wherein the split thrust member is in the nature of a thrust-collar separate from the cam members, said thrust-collar being designated by 41, and it being shown in section in Fig. 10. This thrust-collar may be of any suitable construction, it only being necessary that it should be split in order that it may be readily removed from the shaft, and, as shown, it bears at one end against the hub of the drum 4 and at the other end against the thrust-collar 17, suitable washers 42 preferably being provided between the thrust-collar and the drum to take the wear.

In Fig. 2 I have illustrated another embodiment of my invention, wherein the split thrust member is part of the cam mechanism, the thrust members 13 and 19 being split on a line parallel with the axis of the shaft, the two parts of each thrust member being detachably secured together in some suitable way whereby they may be readily removed from the shaft.

As illustrated in Fig. 3, the thrust member 13 is split on the line 35, the two parts of said member being held together by the means for securing it to the fixed abutment. The thrust-collar 17 is also split on the same line and is preferably provided at each side with lugs 36, which are clamped together by means of bolts in the usual manner. The movable cam member 19 is also split, as shown in Fig. 4, each half thereof having one wedge projection thereon, this manner of splitting being preferable because of the greater facility with which the two parts of said member can be constructed.

The clamping-ring 23 of course is split, as shown in Fig. 9, the two parts being clamped together in any usual way.

Preferably the two parts of the thrust member 19 will be held in position by means of the dowel-pins 38 in one part, which project into suitable recesses in the other part. In this form of the invention the separate thrust member 41 is not necessary, and hence the thrust-collar 17 is shown as bearing directly against the hub 5 of the drum, a suitable wearing-washer 42 of course being interposed between said parts.

In Figs. 8 and 9 I have illustrated a modification wherein the cam-surfaces are in the nature of coöperating screw-threads, the concentric sleeve 51 having exterior screw-threads and the sleeve 52 having coöperating interior screw-threads, the sleeve 52 being clamped to the operating-arm 24 by means of a clamp-ring 23. In this form the movable cam member 52 is connected to the hub of the drum 5 by means of a separate thrust member 53, said thrust member 53 being similar to the thrust-collar 41 in Fig. 1, excepting that it is bolted fast to the hub of the drum 5 and is also rigidly secured to the split ring 55, having an annular flange 56, which plays in a suitable groove in the movable cam member 52, as shown. The advantage of this form of mechanism is that it serves to give a positive longitudinal movement to the drum in either direction.

As shown in Figs. 8 and 9, I may make the fixed cam member 51 and the movable cam member 52 split, the said parts being preferably held in place by suitable dowel-pins 57, in which case the split thrust-collar 53 will not be essential.

In the form of operating mechanism shown in Fig. 1 the usual springs 60 are employed to disengage the friction members.

In the lowering of the bucket the friction between the friction-surfaces generates considerable heat, and it frequently happens that the friction material 11 becomes so heated as to be practically destroyed, to overcome which objection I have provided means for establishing a current of air over the interior of said friction-surfaces during the rotation of the drum, such current of air aiding in the carrying away of the heat generated, and to assist in radiating heat I preferably provide the periphery of the fixed friction member with a series of radiating-ribs. The flange 7 of the drum is provided with a series of apertures 48, which communicate with the interior of the drum, and it has been found that during the rapid rotation of said drum a strong current of air is established through the center of the drum and out through the apertures 48, this current of air helping to dissipate by convection the heat generated by friction. To further assist in the convection of the heat, I may provide the flange on the fixed friction member 9 with apertures 49, leading to the interior of the drum, the current of air passing out through said apertures, as well as through the apertures 48. The outside of the peripheral flange on the friction member 9 has a series of radiating-ribs 61, which form a larger radiating-surface, and thus assist in radiating the heat.

The above-described cooling devices form no part of this invention, but are fully described and claimed in my copending application, Serial No. 34,532, filed October 27, 1900.

To compensate for longitudinal wear and to provide means for taking up the slack of the shaft in its bearings, I provide said shaft, preferably at its end, with a suitable shouldered member which is movable longitudinally of the shaft, said shouldered member being limited in its movement by a fixed abutment, and I provide means whereby the said shouldered member may be secured to the shaft when in its adjusted position. At the right in Fig. 1 I have illustrated one form of adjusting means, which consists of a split collar 70, screw-threaded onto the end of the shaft, said collar bearing against the fixed abutment or bearing 3. By turning up the collar 70 and clamping it by means of the bolt 71 in its adjusted position it will be obvious that the shaft may be adjusted in its bearings and held against any longitudinal movement, it being understood that the shaft has thereon at its opposite end a fixed collar bearing against the outside of the opposite abutment. On the left-hand side of Fig. 1 I have illustrated a slightly-different form of adjusting means which may be employed, if desired, in place of that above described, wherein a suitable sleeve 72 is feathered on the end of the shaft, said sleeve projecting slightly beyond the end of the shaft and being held in place by the cap-plate 73, which is adjustably secured to the shaft in any suitable way, as by bolt 74. By turning up the bolts 74 the shaft can be drawn longitudinally in the bearings, and thus adjusted for wear.

As shown, the sleeve 72 is in the nature of a winch-head; but of course this particular form of sleeve is not essential.

The central portion of the hub 5 of each winding-drum is provided with a suitable annular oil-chamber 80, which is fed with oil from the oil-cup 81, the oil-chamber furnishing means for feeding a considerable quantity of oil to the shaft at once, thus avoiding the necessity of frequent lubrication.

The structure may be modified in various ways without departing from the spirit of the invention.

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

1. In a hoisting apparatus, a shaft, a friction-drum loosely mounted thereon, a clutch member fixed to said shaft, a fixed non-rotating abutment, and thrust devices concentric with the shaft between the abutment and the friction-drum, said thrust devices including a split and separable thrust member and cooperating cam-surfaces, one of which is rigid with the abutment, and means to turn the other cam-surface about the shaft, whereby the drum is moved longitudinally to cause its engagement with the clutch member, the split thrust member when removed from the shaft permitting the separation of the friction-drum and the clutch member without taking the shaft from the bearings.

2. In a hoisting apparatus, a shaft, a clutch member fixed thereto, a friction-drum loosely mounted thereon, and means for causing the engagement of the friction-drum and fixed clutch member, said means comprising coöperating cam members concentric with the shaft, a fixed non-rotating abutment to which one of said cam members is fixedly secured, and means to turn the other cam member about the shaft, one of said cam members being split and separable whereby it may be removed from the shaft to permit the separation of the drum and clutch member without taking the shaft from the bearings.

3. In a hoisting apparatus, a shaft, a clutch member fixed thereto, a friction-drum loosely mounted thereon and constituting a movable clutch member, and means concentric with the shaft for causing the engagement of the clutch members, said means comprising fixed and movable coöperating cam members, one of said cam members surrounding the other, and both of said members being split and separable, whereby they may be removed from the shaft to permit the separation of the clutch members.

4. In a hoisting apparatus, a main shaft, a drum loosely mounted thereon, said drum having a friction-surface, a clutch member fixed on said shaft having a coöperating fric-

tion-surface, means for moving the drum longitudinally of the shaft, said means comprising coöperating cam-surfaces concentric with the main shaft, means to move one cam-surface relative to the other, antifriction-balls between said cam-surfaces, means to retain said balls in their operative position, a fixed abutment limiting the longitudinal movement of one of said cam-surfaces, and a split and separable thrust member between the abutment and the drum.

5. In a hoisting apparatus, a main shaft, a drum loosely mounted thereon, and having a friction clutch-surface, a clutch member fixed to the main shaft, and having a coöperating friction clutch-surface, means to move the drum longitudinally of the shaft, said means including fixed and movable cam members concentric with the shaft, said fixed cam member comprising a sleeve having an inclined shoulder, a thrust-collar longitudinally movable on said sleeve, and a movable cam member having an inclined shoulder, the said cam members both being split and separable, whereby they may be removed from the shaft, the rotation of the movable cam member serving to give the drum the requisite longitudinal movement.

6. In a hoisting apparatus, a main shaft, a drum loosely mounted thereon, said drum having a conical friction-surface, a clutch member fixed on said shaft, and having a cooperating friction-surface, means for moving the drum longitudinally, said means including fixed and movable cam members concentric with and surrounding the shaft, said fixed member comprising a sleeve having an inclined shoulder, and a thrust-collar movable longitudinally on said sleeve, and having an oppositely-inclined shoulder, and a movable cam member having a wedge-surface, and fitting between the oppositely-inclined shoulders of the fixed cam member, and antifriction-balls between the engaging surface of said cam members, whereby the rotation of the movable cam member forces the thrust-collar longitudinally and occasions the engagement of the clutch members.

7. A shaft, a clutch member fixed thereon, a friction-drum loose thereon and constituting a coöperating clutch member, means to cause the engagement of said clutch members, said means comprising fixed and movable cam members concentric with the shaft, antifriction-balls between the cam-surfaces of said cam members, and retainers to hold the balls in place and limit their movement.

8. A shaft, a clutch member fixed thereon, a friction-drum loose thereon and constituting a coöperating clutch member, means to cause the engagement of said clutch members, said means comprising fixed and movable cam members concentric with the shaft, antifriction-balls between the cam-surfaces of said cam members, and a movable retaining-ring having lugs projecting into the path of travel of the balls.

9. A shaft, a clutch member fixed thereon, a friction-drum loose thereon and constituting a coöperating clutch member, means to cause the engagement of said clutch members, said means comprising fixed and movable cam members concentric with the shaft, antifriction-balls between the cam-surfaces of said cam members, a movable retaining-ring having lugs projecting into the path of travel of the balls, and means to limit the movement of said ring.

10. In a hoisting apparatus, a horizontal main shaft, bearings therefor, a clutch member rigidly fixed thereon, winding-drums loosely mounted on said shaft at either side of said clutch member and adapted to be moved longitudinally to be clutched to said clutch member, said shaft having at one end outside of the bearings a fixed collar, and at the opposite end outside the bearings an adjustable member having a shoulder adapted to engage the bearing, whereby the shaft may be tightened against longitudinal movement in the bearings.

11. In a hoisting apparatus, a horizontal main shaft, bearings therefor, a clutch member fixed thereon, drums loosely mounted on said shaft at either side of the clutch member, means to couple either or both of the drums to the clutch member when desired, said shaft having at each end outside of the bearings a collar, one of said collars being fixed to the shaft, and the other adjustable thereon, whereby the shaft may be tightened against longitudinal movement.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALMON E. NORRIS.

Witnesses:
JOHN C. EDWARDS,
LOUIS C. SMITH.