(No Model.) 3 Sheets—Sheet 1.

M. JACKER.

HOISTING APPARATUS.

No. 301,125. Patented July 1, 1884.

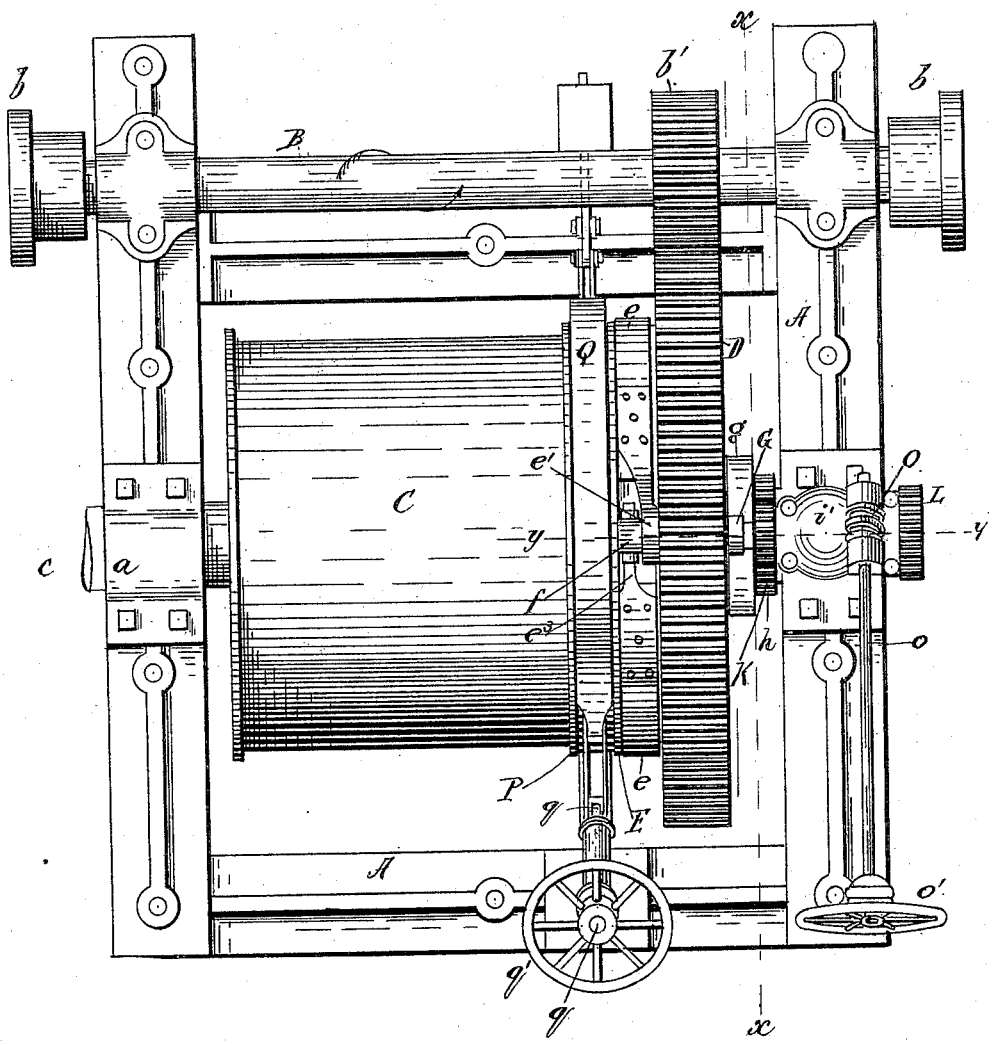

Fig. 1

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HOISTING APPARATUS.

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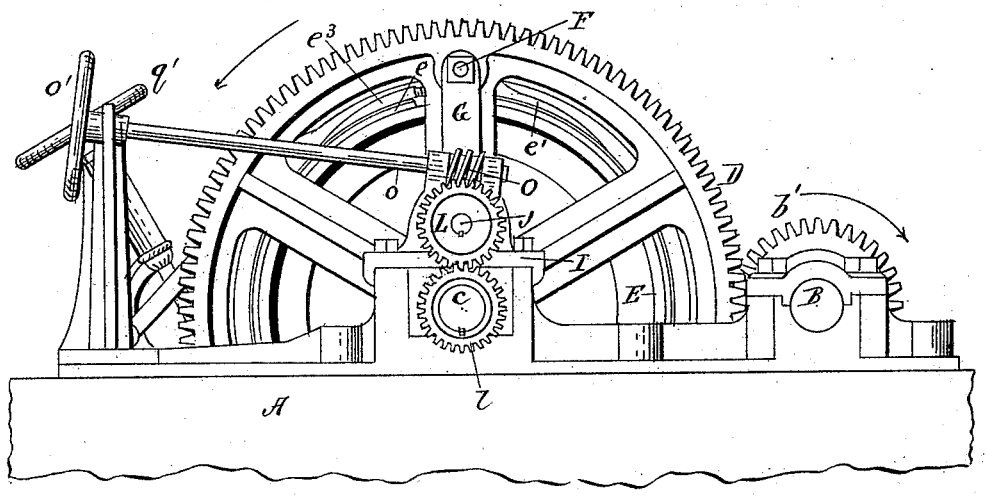

Fig 2

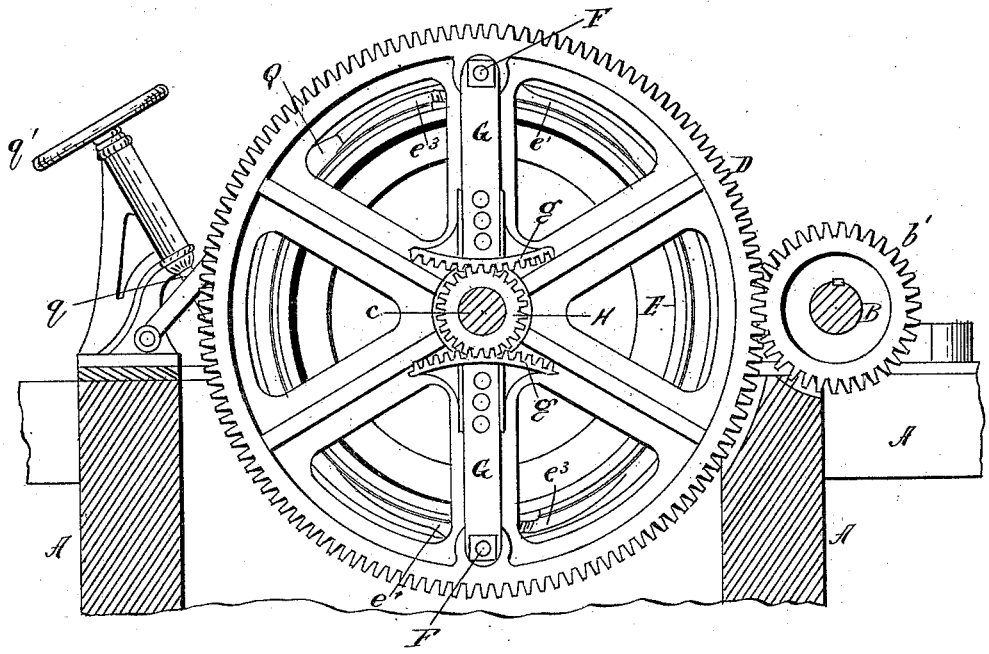

Fig 3

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(No Model.) 3 Sheets—Sheet 3

M. JACKER.

HOISTING APPARATUS.

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Fig 4

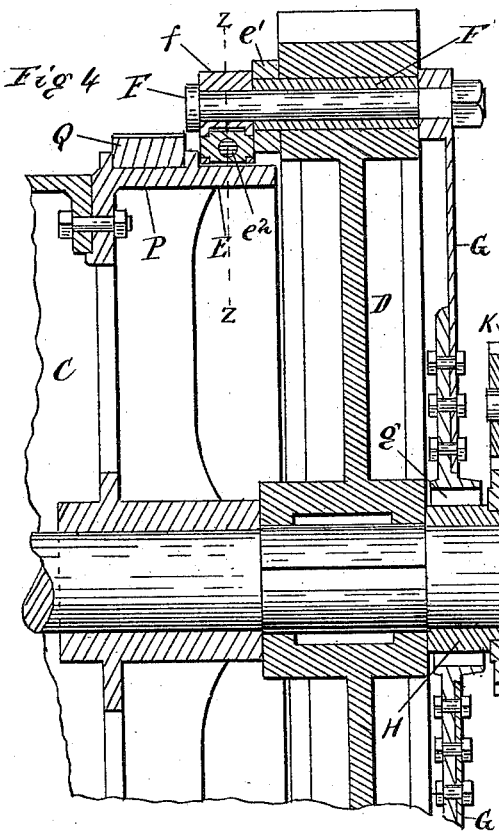


Fig 5

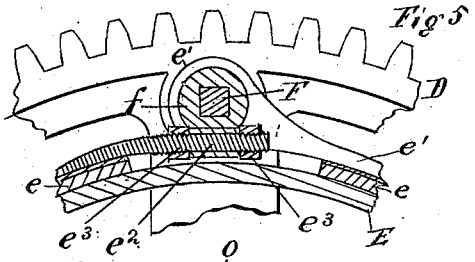
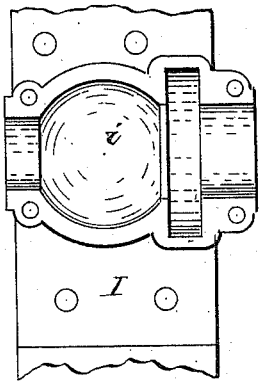


Fig 8



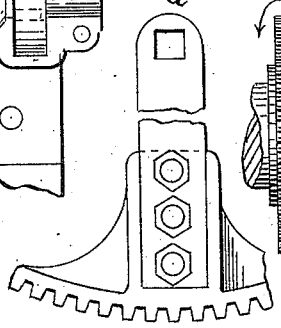
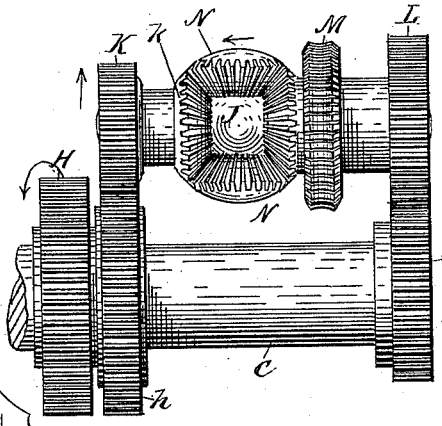


Fig 7

Fig 6



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UNITED STATES PATENT OFFICE.

MAXIMILIAN JACKER, OF FLORENCE, ASSIGNOR OF ONE-HALF TO THE MARINETTE IRON WORKS COMPANY, OF MARINETTE, WISCONSIN.

HOISTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 301,125, dated July 1, 1884.

Application filed April 7, 1884. (No model.)

To all whom it may concern:

Be it known that I, MAXIMILIAN JACKER, a citizen of the United States, and residing at Florence, in the county of Florence and State of Wisconsin, have invented certain new and useful Improvements in Hoisting Apparatus, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a plan view of a hoisting-machine embodying my improvements; Fig. 2, a right-hand end elevation of the same; Fig. 3, a section of the same taken on the line *x x*, Fig. 1; Fig. 4, a detail section taken on the line *y y*, Fig. 1; Fig. 5, a detail section taken on the line *z z*, Fig. 4; Fig. 6, a detail side elevation of the train of setting-gear; Fig. 7, a side elevation of one of the racks of the setting devices detached; and Fig. 8 a detail plan view showing a part of the bed-plate with journal, cap, and casing for the differential gears, the upper part of the casing being removed. Figs. 1, 2, and 3 are on the same scale, and the remaining figures on an enlarged scale, but the same in each from Figs. 4 to 8, inclusive.

My invention relates to hoisting-machines which are intended for heavy work, and especially such as are used at mines for hoisting ore, though not intended to be limited to machines for this special purpose.

The invention applies particularly to hoisting-machines in which an external friction-band is used for starting and driving the hoisting-drum; and the objects of my present improvements are to connect this friction-band directly with the driving-gear wheel, and to drive the drum without subjecting the drum-shafts to torsion; and a further object is to dispense with all such devices as sliding collars and levers, which have frequently been used in machines of this class for starting and stopping the drum, and for which I substitute devices having a rotary movement, which afford a wider range of motion, require no adjustment, and assist by their friction in starting the drum.

I will proceed to describe in detail the construction and operation of devices by means of which I have carried my invention into practical form in one way, and will then point out definitely in the claims the special improvements which I believe to be new and wish to protect by Letters Patent.

It has been customary in hoisting-machinery to run a number of drums mounted on one line of shafting by transmitting power through a gear-wheel keyed to the shaft, and by taking off power for each drum by disk-shaped or two-armed drivers keyed to the same shaft, thus using the torsional strength of the shaft to drive the several drums. It is evident that with this arrangement the single main shaft must be made sufficiently strong to bear the torsional strain required for the entire number of drums arranged thereon, and which may be used simultaneously. Under this arrangement, if an accident occurs at the first drum, either to the shaft, gear-wheels, or coupling, the whole plant will be disabled, causing serious delay.

In the drawings, A represents the main or supporting frame, one of which is provided for each drum. The main or driving shaft B is mounted in suitable boxes at one end of the frame, the sections of the shaft being connected by suitable couplings, *b*, between the frames, so as to constitute a continuous shaft, to which motion is communicated in the direction of the arrows by the engine or other motor. A pinion, *b'*, is keyed to the main shaft at each drum-frame at a suitable point to engage with the main wheel of the drum. The drum C is mounted loosely on a shaft, *c*, which in turn is mounted in suitable boxes, *a*, on the frame A, this shaft being arranged parallel to the main or driving shaft. The main or driving wheel D is keyed to the drum-shaft, and the pinion *b'* engages with it to communicate motion thereto and to the drum-shaft. A friction-wheel, E, is made fast to one end of the drum in any suitable way, but of course is loose on the drum-shaft. This friction-wheel is surrounded by a suitable friction-band, *e*, the friction-wheel and its band being next to the driving-wheel. A short shaft, F, (which may be called the "lever-shaft,") is mounted in the main wheel, through which it extends from side to side. This shaft is inclosed in a sleeve or thimble, F', which is inserted in the wheel, and projects a little beyond the inner face thereof, as shown in Fig.

4 of the drawings. The sleeve is of course fastened in its place in the wheel. On the inside of the main wheel one end of the friction-band is fastened directly to the inner end of the sleeve F′ by means of a collar, *e′*, passing around it, as shown in Figs. 1 and 5 of the drawings. On the inner end of the lever-shaft is a short arm, *f*, fastened to it in any suitable way. In the drawings it is shown secured in place by making the end of the shaft rectangular and setting the arm on the section by means of a similar opening therein. The other end of the friction-band is secured to the outer end of this short arm *f* in any suitable way. In the drawings it is shown as fastened to the arm by passing the end e^2 through the arm and securing it in position by nuts e^3 on each side thereof, which not only fasten the band to the arm, but also afford means for adjusting its length within certain limits. It is obvious that the oscillation of the lever-shaft will vibrate the short arm on the inner end thereof, which movement will tighten and loosen the friction-band on its wheel, and thereby connect and disconnect the drum and its drive-wheel. In the tightening of the band in this way it will be seen that no additional strain or pressure is brought upon the lever-shaft to subject it to torsion. As the fixed end of the friction-band is fastened to the sleeve which surrounds the shaft, the strain will be taken by the sleeve without affecting the shaft, which has its bearing within the sleeve and is still left free to move easily without any binding effect. If the collar of the friction-band were placed directly on the lever-shaft, it is evident that the tightening of the band would bring a pressure directly on the shaft, subjecting it to torsion and causing it to bind in its bearing. The use of this thimble or sleeve is therefore quite important in its practical effect on the easy operation of the mechanism. To effect the oscillation of the lever-shaft, I mount a long arm, G, on the other end of the lever-shaft outside of the driving-wheel, and secure it thereto in any suitable way. In the drawings it is shown fastened to the shaft in the same way as the inner or short arm. This arm G extends inward radially nearly to the drum-shaft, and carries on its inner end a gear-segment, *g*, with which a central gear-wheel, H, mounted loosely on the drum-shaft, is arranged to engage. Obviously the rotation of this central gear-wheel in either direction will vibrate the rack-arm, and so oscillate the lever-shaft to effect the result just mentioned above.

In the description just above given the parts have been mentioned as though a single friction-band were used entirely surrounding the friction-wheel. I prefer, however, to make this band in two parts, each part covering only about one-half of the wheel, and fastened at their respective ends to duplicate arms on duplicate lever-shafts arranged on opposite sides of the drum-shaft, as shown in Fig. 3 of the drawings. It will be understood, of course, that the segment-arms and segments will also be duplicated, and that the central gear-wheel will engage with both segments, as shown in the same figure. I thus obtain an equalization of the force required to tighten the band on opposite sides of the drum-shaft, and a differential movement, whereby a less range of the central gear-wheel is required to produce the tightening of the band, for the movement of this wheel will vibrate one segment-arm in one direction and the other in the other, and so produce a tightening strain to the same degree on each side of the friction-wheel, or double what it would be with the same movement of the wheel if only one lever-shaft and lever-arm were used.

I have devised a peculiar mechanism for imparting the required movement to the central gear-wheel, in which there is nothing but rotary movement of the several parts. Just outside of the central gear-wheel, H, is a gear-wheel, *h*, which is fastened to the former in some suitable way, so as to turn with it. In the drawings I have shown the hub of the wheel H extended outward to the gear-wheel *h*, keyed or otherwise fastened to this hub. A bed-plate, I, is mounted above the box of the drum-shaft, and is projected upward, so as to provide suitable bearings for a short shaft, J, which is enlarged near the middle of its length and provided with studs or pins *j* on opposite sides thereof. On the inner end of this shaft is a gear-wheel, K, loose on the shaft, and arranged to engage with the gear-wheel *h*. In one piece with or fastened to the gear-wheel K is a miter-wheel, *k*, adjacent to the enlargement at the center of the shaft. On the outer end of this short shaft is a gear-wheel, L, which is secured to the shaft, and with which a gear-wheel, *l*, on the end of the drum-shaft secured thereto, is arranged to engage, as shown in Figs. 5 and 6 of the drawings. Just inside of the wheel L is a worm-wheel, M, which is either fastened to or made in one piece with a miter-wheel, *m*, arranged inside of the worm-wheel and loose on the short shaft J. These two miter-wheels already described are opposed to each other on opposite sides of the pins on their shaft, and on these pins are loosely placed miter-wheels N, which engage with each of the miter-wheels on the shaft, as shown in Fig. 6 of the drawings. The upper portion of the bed-plate I is constructed so as to provide a seat or lower casing, *i*, for the miter-wheels, and a cap, *i′*, is constructed of similar form, which is placed over them and fastened to the bed-piece, thereby providing a casing around the miter-wheels and holding the loose ones in position. A worm, O, on a shaft, *o*, is arranged to engage with the worm-wheel M, by means of which the latter is fixed or held in any position to which it may be adjusted, and the worm-shaft is provided with a hand-wheel, *o′*, by means of which the worm and worm-wheel may be turned.

Now it is obvious from this description that

motion is communicated from the drum-shaft to the short shaft J, which carries around with it the loose miter-wheels. These miter-wheels N turn on the miter-wheel *m*, which is held fast by the worm, and so communicate motion to the miter-wheel *k* and gear-wheel K; but if the gear-wheel K engage with the gear-wheel *h*, which is fast to the central gear, H, it might be expected to impart movement to the latter, which would operate the friction-band, as already described. To prevent this, except when required for the work of hoisting, it will be noticed that the gears in the train just described are arranged to rotate in the direction of the arrows, respectively, as shown in Fig. 6 of the drawings, from which it will appear that the wheel K revolves in a direction opposite to that of the drum-shaft, and consequently would impart a movement to the wheel *h* in the same direction as that of the drum-shaft. Now, furthermore, these gears are of such size and so arranged that the speed of the wheel K will give the same speed to the wheel *h* as that of the drum-shaft, and consequently in ordinary adjustment there would be no difference between the movement of the drum-shaft and that of the wheels *h* and H. In other words, when revolving freely and with the full motion due to the construction and arrangement of the gears, the wheel K will simply turn in the wheel *h* without turning the latter on the shaft. But suppose now the worm-wheel is moved by turning the worm. Obviously the miter-wheel to which it is attached will also be turned in one direction or the other, and this adjustment will affect the motion of the two loose miter-wheels, either retarding or accelerating their revolution, according as the adjustment turns the miter-wheel *m* with or against the direction in which these loose wheels are moving. This change of motion will at once be transmitted to the wheel K, and of course will at once produce a differential movement between this wheel and the wheel *h* as carried by the shaft, whereby the wheel *h* will either be retarded and turned backward slightly on the shaft or accelerated and turned forward on the same. In either case this turning of the wheel will operate the segment-arms and tighten or loosen the friction-band on the friction-wheel, as described above.

Of course it will depend upon the arrangement of the parts whether, in order to tighten the band on the wheel, it is necessary to retard or accelerate the central gear-wheel, which being known when the machine is running with the drum idle and the moment comes for hoisting, it is only necessary to turn the hand-wheel on the worm-shaft in the proper direction to produce the movement of the central gear-wheel in the required direction to tighten the friction-band; and it will be seen that at once the drum is connected to its drive-wheel, and the work of hoisting will begin. This work will begin gradually, for it must be evident that the movement of the central gear-wheel and consequent tightening of the friction-band will be gradual—a mode of action in the operation of devices for connecting the drum to its driver which is very desirable. When the work of hoisting is completed, it is only necessary to set the worm-wheel in the opposite direction, and obviously the friction-band is loosened and the movement of the drum ceases.

It will be noticed that the action of the gearing described above for operating the central gear-wheel will have a natural tendency to produce the differential movement required for this purpose, for if the worm-wheel were left free to move, there would be a strong tendency in the miter-wheel connected therewith to revolve, which would produce a differential movement of the loose miter-wheels that, transmitted to the gear-wheel K, would effect the result already described. In fact, it is probable that if left free the gearing would operate naturally and without assistance of the setting-worm to tighten the friction-band on its wheel. It is evident, then, that the only force required to set the friction device for the purpose of hoisting is what is sufficient to simply turn the worm-shaft, and so the operation of the devices is effected with the greatest ease. The hoisting-drum is also provided with an ordinary brake-wheel, P, arranged just inside of the hoisting friction-wheel, to which is applied a friction-brake band, Q, operated in any usual way. In the drawings I have shown a shaft, *q*, provided with a hand-wheel, *q'*, which has a threaded section arranged to operate in a well-known way to draw together or separate the ends of the brake-band for the purpose of applying it to the brake-wheel or releasing it therefrom in the usual way. The brake hand-wheel is arranged near to the worm hand-wheel, so as to be readily reached by the attendant, and when the hoisting is completed a few turns back of the worm-wheel will ease the friction-band sufficiently to permit it to slip, and the drum will stop, when the attendant may at once apply the brake-band to hold the drum firmly in place, and then the driving-friction may be further released at will. The lowering of the skip is accomplished by means of the brake in the usual way.

It will be understood from the description above that the miter-wheels are all out of sight, and are inclosed in a strong casing, which also forms the bearing for the train of gears, and should be well provided with facilities for convenient lubrication. All the gears are of small diameter and rotate slowly and with little noise. The pressure to be borne by their respective teeth is insignificant in comparison with their strength, and the arrangement is such that the wearing down of the drum-shaft in its bearings cannot affect the gears.

As stated at the outset, the design of my machine is to use two or more drums—as many as are required—each being separate and independent from the others. I have shown in the drawings but one, as this is sufficient for

the purpose of illustrating my improvements. It will be understood, of course, that the drum-frames are to be arranged along by the side of the main driving-shaft, one after the other, each frame by itself, with the mechanism applied thereto described above and shown in the drawings, and, as hereinbefore stated, the main shaft will be coupled between these frames, so as to constitute one continuous shaft.

Preferably I arrange the friction devices on two adjacent frames on opposite ends, respectively, so as to bring them adjacent to each other, for in this way one operator will be able to attend to a pair of drums. It will also be desirable to construct and arrange the drums so that they can be slipped on their respective shafts laterally, so as to throw them out of gear with the main shaft when not in use to prevent useless wear of the bearings. This may be done by taking out a filling-piece behind each bearing of the drum-shaft without removing the caps. The same result may be effected by making the driving-pinions on the main shaft adjustable laterally, so that they may be moved into and out of gear with the drive-wheel on the drum-shaft. The division of the driving friction-band into two parts, connected to the driving-wheel on opposite sides of its shaft, and the dupliction of the devices for applying the band to the friction-wheel on the drum, arranging them on opposite sides of the drum-shaft, is attended with beneficial results. It equalizes the force used for this purpose, distributing it on both sides of the drum-shaft, so that the latter is subjected to no torsional effect when the band is tightened on its wheel; but the relation between the drum and its shaft remains substantially unchanged.

I do not claim to be the first to employ an external rotating friction-band for the purpose of connecting the hoisting-drum with its drive-wheel, for this is an old device, and my improvements relate to means for applying or operating this band.

In many particulars the details of construction of the several parts described above and shown in the drawings may be greatly modified and other devices substituted for some of those herein specified without departing from the principal features of my invention. I do not wish to be understood, therefore, as limiting myself to the particular devices and details of construction as herein shown and described, but I wish to be understood distinctly as claiming the main features of the improvement wherever and however applied. Especially do I wish it understood that I do not confine myself to the use of gear-segments at the ends of the lever-arms for operating the lever-shaft, for I may obtain the same result by jointing the ends of the levers to a rotating disk on the main shaft, or any other construction and arrangement of devices for working the lever-shaft which may be operated by the train of gears, as described and shown; and, furthermore, I do not confine myself to the use of this train of gears in connection with an outside friction-band for the purpose of tightening and releasing it on its wheel, for this same mechanism may be used in connection with some other clutching device—for instance, an internal or other friction-clutch, such as are now known and in use, and which any one familiar with machines of this class will see at once may be connected with and operated by the train of gears without difficulty. I therefore contemplate applying this gear mechanism to other mechanism for connecting and disconnecting the drum and its drive-wheel, and wish to be understood as claiming it in such relation or any other to which it may be applied.

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

1. In a hoisting-machine, a drum mounted on its shaft, in combination with a friction-wheel fastened to the drum, a drive-wheel mounted on the drum-shaft, a sleeve or thimble inserted in the drive-wheel, a lever having its bearing and fulcrum in said sleeve, and a friction-band arranged on the friction-wheel, and attached at one end to the sleeve and at the other end connected to the lever, substantially as and for the purposes set forth.

2. In a hoisting-machine, a drive-wheel on the drum-shaft, in combination with the hoisting-drum mounted on said shaft, a friction-wheel fastened to the drum, two spindles or tubes inserted in the drive-wheel on opposite sides of the shaft, tightening-levers mounted in each of the said spindles, and a friction-band composed of two parts, one end of each attached directly to the respective spindles and the other end of each to the respective levers, substantially as and for the purposes set forth.

3. In a hoisting-machine, the hoisting-drum loose on its shaft, in combination with a friction-wheel attached to the drum, a drive-wheel fastened to the drum-shaft, thimbles or tubes passing through the drive-wheel and arranged on opposite sides of the shaft, lever-shafts mounted in the spindles, tightening-levers attached to the inner ends of said shafts, semicircular friction-bands having their fixed ends hinged to the projecting ends of the respective thimbles, and their movable or clamping ends attached to the tightening-levers on one side of the wheel, and actuating-levers attached to the lever-shafts on the opposite sides of the wheel, substantially as and for the purposes set forth.

4. In a hoisting-machine, a drive-wheel fixed to the drum-shaft, a drum mounted loosely on said shaft, a friction-wheel fastened to the drum, a friction-band attached to and carried around with the drive-wheel, mechanism, substantially as described, for tightening and releasing the friction-band on the friction-wheel,

and a supplementary gear-train for actuating the friction mechanism, substantially as and for the purposes set forth.

5. In a hoisting-machine, a drive-wheel fastened to the drum-shaft, a drum mounted loosely on said shaft, a friction-wheel and band whereby the drive-wheel and drum may be connected and disconnected, and a supplementary train of gears for operating the said friction devices, substantially as and for the purposes set forth.

6. In a hoisting-machine, a drive-wheel, in combination with a loose drum, a friction-wheel attached to the drum, a friction-band attached to and carried by the drive-wheel, lever-shafts mounted in the drive-wheel for operating the friction-band, actuating-levers attached to the lever-shafts and provided with segmental racks, a central gear-wheel loose on the drum-shaft and arranged to engage with the segmental racks, and a supplementary train of differential gears driven by the drum-shaft, and arranged to oscillate the central gear on said shaft by the change of their adjustment, substantially as and for the purposes set forth.

7. In a hoisting-machine, the drive-wheel fastened to the drum-shaft, in combination with a drum mounted loosely on the shaft, a friction mechanism for connecting and disconnecting the drum and drive-wheel, a central wheel mounted loosely on the drum-shaft and arranged to operate the friction mechanism by its oscillation on said shaft, the wheel *h*, attached to said central wheel, the wheel *l* on the drum-shaft, the gear-train K, *k*, L, *m*, and N, arranged substantially as specified, a worm-wheel, M, fastened to the wheel *m*, and a worm, O, for adjusting said worm-wheel, substantially as and for the purposes set forth.

8. In a hoisting-machine, a loose drum in combination with a drive-wheel, a friction-wheel attached to the drum, a friction-band connected to and carried by the drive-wheel, the lever-shafts mounted in the wheel and arranged to operate the friction-band, levers attached to said shafts outside of the drive-wheel, and provided with segmental racks on opposite sides of the drum-shaft, the central gear-wheel, H, arranged to engage with the segmental racks, the wheel *h*, attached to the central gear-wheel, the wheel *l*, fastened to the drum-shaft, the wheels K, *k*, L, M, *m*, and N, constructed and arranged substantially as specified, and the worm O, arranged to adjust the wheel M, substantially as and for the purposes set forth.

9. The drum-shaft, in combination with the central wheel, for operating the friction mechanism, the supplementary train of differential gears for actuating the central gear, and a casing inclosing the miter-wheels of said gear-train, and constructed to form bearings for said wheels and hold them in place, substantially as and for the purposes set forth.

10. A hoisting-drum mounted loosely on its shaft, in combination with a friction-wheel attached to the drum, a drive-wheel attached to the drum-shaft, a friction-band attached to and carried by the drive-wheel, mechanism, substantially as described, for setting and releasing the friction-band, a central wheel loose on the drum-shaft for operating said mechanism by its oscillation, a supplementary train of differential gears driven by the drum-shaft for oscillating the central wheel, and a friction-brake device arranged by the side of the driving-wheel, and both at one end of the drum adjacent to the drive-wheel, all substantially as and for the purposes set forth.

MAXIMILIAN JACKER.

Witnesses:
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R. E. MACE.