(No Model.)

# G. F. CLEMONS.

## DIFFERENTIAL MECHANISM FOR HOISTING MACHINES.

No. 449,900. Patented Apr. 7, 1891.

Fig. 2.

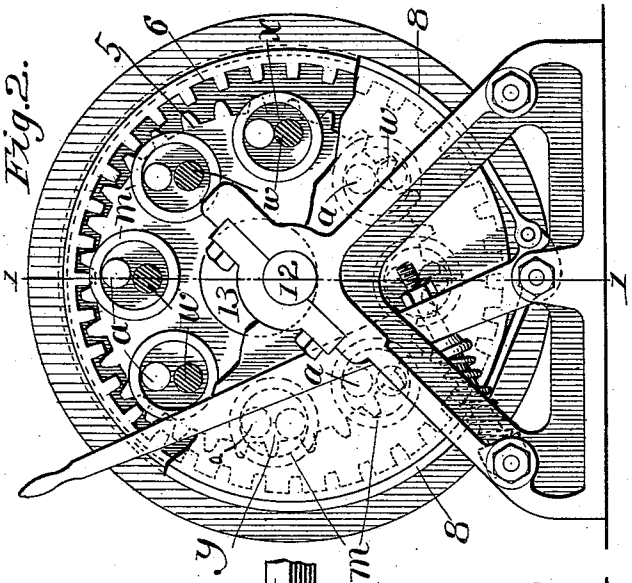



Fig. 1.

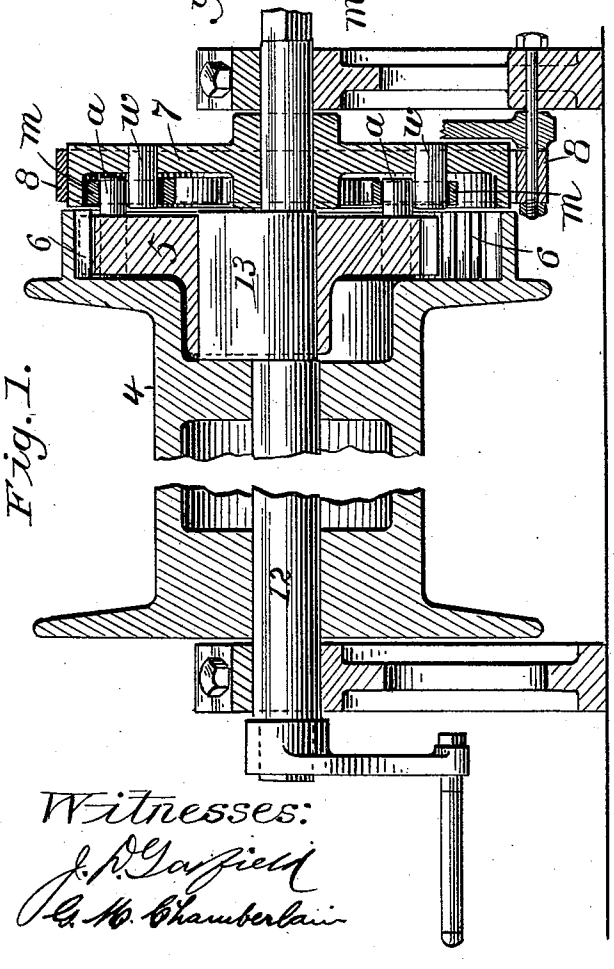



Fig. 4.

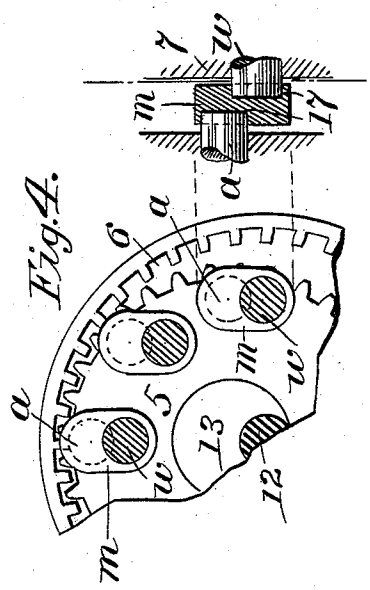
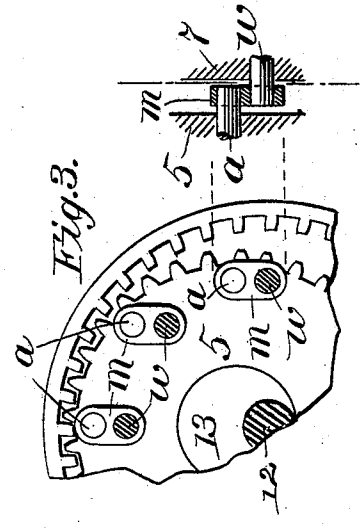



Fig. 3.




Witnesses:
J. P. Garfield
G. M. Chamberlain

Inventor
Geo. F. Clemons
by Chapin & Co
Atty's.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

GEORGE F. CLEMONS, OF SPRINGFIELD, MASSACHUSETTS.

## DIFFERENTIAL MECHANISM FOR HOISTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 449,900, dated April 7, 1891.

Application filed August 29, 1890. Serial No. 363,393. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE F. CLEMONS, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Differential Mechanism for Hoisting and other Machines, of which the following is a specification.

This invention relates to improvements in differential mechanism, particularly applicable for use in hoisting-machines, although adaptable for use in other situations and mechanisms, and is of the class of differential mechanisms embodied in Letters Patent of the United States granted to me June 11, 1889, No. 404,958, the object being to improve the construction of the mechanism of the class indicated, whereby a more uniform distribution of the power in transmission is secured, tending to secure an easier running and operation of the contrivance and with less wear than heretofore.

The invention consists in the construction and combination of parts, all substantially as will hereinafter more fully appear and be set forth in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of the improved hoisting device suitably mounted for operation. Fig. 2 is a front end elevation of same with some parts broken away to more clearly illustrate internal parts forming, essentially, elements of the present invention. Figs. 3 and 4 are face views to illustrate slight modifications in the construction, certain elements embodied in said modified constructions being also shown as projections in planes at right angles to said views, Figs. 3 and 4.

The hoisting mechanism of this invention comprises for its basis or foundation substantially the same or similar elements to those embraced in the mechanism covered by my aforementioned Letters Patent, and the parts which are common to said formerly-patented mechanism and to the present one will be now briefly described and explained, and so it will be stated that the said mechanism embraces shaft 12, mounted in suitable journals having thereon an eccentric 13, and a spur-gear 5, concentrically surrounding said eccentric, having a series of pins or studs *a* in concentric circular arrangement on the face thereof, which project in lines parallel with the axis of said shaft. There is a part 7, usually in the form of a disk-axially mounted on said shaft 12 alongside said spur-gear, having a series of pins or studs *w* thereon corresponding in arrangement to the series on the said gear, and with certain of which disk-pins certain of the said spur-gear pins have a working engagement at certain times, as through the turning of the shaft and eccentric the spur-gear is given a motion of revolution around the axis of said shaft, and also on said shaft 12 is axially mounted a part 6, essentially comprising an internal gear which is of greater diameter than and surrounds said spur-gear 5, and on which is usually formed a hoisting-drum 4.

Now, assuming that the disk having the pins *w* is held fixed, as it may be, through the strap 8, (the application of which has been described in said former patent,) and the shaft is rotated, carrying the eccentric around with it and also carrying the spur-gear, which surrounds the eccentric, around the inner toothed part constituting the internal gear, of course, were it not for the abutment by certain of the pins *a* in relation to certain of the disk-pins *w* obstructing the free movement of said spur-gear, said spur-gear would have a free revolution around upon the teeth of said internal gear and without effect upon the latter, for through the engagement of the spur-gear teeth with those of the internal the spur-gear as it revolved would be rotated on the eccentric; but through the obstruction of certain spur-gear pins *a* by certain of the fixed disk-pins *w*, whereby as the spur-gear is revolved or carried bodily around on the eccentric its rotation is obstructed, and whereby in its revolution and engagement with the teeth of the internal gear it is not permitted to yield or rotate on the eccentric, and the motion of revolution of the spur-gear being positive, of course the internal gear must give and said internal gear will be partially rotated, and with it the spool or winding drum 4, which is formed thereon or attached thereto, and under the rotation of the eccentric there will be a pair of pins, one on the disk and one on the spur-gear, in working engagement, the position of such pins being at right angles to a line drawn through the axis of the

shaft and the center of the eccentric—as, for instance, in Fig. 2, the particular pair of pins at *x*, which are at right angles to *l l*, are the working pins under the relations of the parts shown, and as the eccentric and spur-gear are turned other pairs of pins *a w* successively become the working ones.

It will require a number of revolutions of the eccentric and revolutions of the spur-gear to insure one rotation of the internal gear equal to the number of times the difference between the teeth of the spur and internal gears are contained in the number of the internal gear-teeth. This may be explained as dependent on the demonstrable fact that when a spur-gear having a given number of teeth is given an eccentric motion—that is, a revolution about the axis of its carrying-shaft—and is held against rotation, and is, roving around on the teeth of an internal gear having a greater number of teeth, and which internal gear may rotate concentric with the axis of the eccentric carrying-shaft, such spur-gear, in order to make its bodily circuit or revolution without rotation around on the internal gear, must necessarily force or pry the internal gear around about the axis of the latter in an extent corresponding to the difference between the number of teeth comprised in the spur-gear and the number comprised in the internal gear, and so, for instance, when there are thirty-six teeth in the internal gear and thirty teeth on the spur-gear it will require six rotations of the eccentric to cause one of the said internal gear; or, should the spool and internal gear be held against rotation and the disk part carrying the pins *w* be permitted to turn, on turning the eccentric 13 five times the said disk will be rotated once. This latter effect is due to the fact that the internal gear becomes the resistant, the spur-gear in its roving around on the internal necessarily being forced or pried around in each of its revolutions or circuits for such portion of a rotation thereof around on the eccentric as corresponds to the difference between the number of teeth in the spur-gear and that in the internal, and therefore, the difference in the present instance being six, the spur-gear of thirty teeth is necessarily given one-fifth of a rotation in each of its circuits or revolutions, and the pin-carrying disk will of course be correspondingly rotated, and while, where one or the other of the parts 6 or 7 is held fixed, the part not held is free to rotate under the rotation of the eccentric and movement of the spur-gear, as described, any power applied on the part 6 or 7, which is not held, will not secure the rotation of such part, owing to the mesh of the spur and internal gear teeth and the nest of pins *a a* and *w w* forming, as it were, a clutch between the disk and spur gear; but of course on turning the eccentric in a reverse direction from that necessary for winding up the drum the drum may be turned in an unwinding direction, and again, after the drum has been slowly wound up by the numerous rotations of the eccentric, and the strap, or whatever equivalent confining device for the disk is employed, is released from its confinement on said disk, the disk and the internal gear and drum and all intermediate parts therebetween may be rapidly and freely rotated, all moving as one around and upon the shaft 12.

Having thus described the composition of the mechanism so far as it is substantially similar to the one shown in my said patent of June 11, 1889, whereby the adaptability to said mechanism of the features of improvement forming the present invention may be more readily understood, I will now proceed to describe the said features of improvement, it again being noted that under the said patented mechanism there is a working engagement between but one pair of pins found in a line at right angles to the eccentric line and at a side thereof in accordance with the direction of rotation of the eccentric. Therefore, in order that I may secure a working engagement between pairs of pins *a w* which are under any position of the eccentric at opposite sides of the eccentric line—that is, the line through the eccentric and shaft centers—I provide connections *m* between each pair of said pins, which act as links, so that as the pin of one pair of pins *a w* at one side of the eccentric line is exerting a crowding or forcing action upon the adjacent pin of such pair a pin of one pair at the opposite side of the eccentric line is through said link medium exerting a drawing or hauling action upon the adjacent pin of said last-named pair. To accord with different circumstances and in varying situations in the construction of the differential mechanism the said link mediums are modified. For instance, first, where the pins carried both on the spur-gear and on the part 7 are of a diameter equal to or very slightly less than the distance between the centers of shaft and eccentric and lie bodily alongside of each other the linking devices may be for all the pairs of pins *a w* a ring, as shown in Figs. 1 and 2, which surrounds the respective pairs of pins, and therefore as one pin of the particular pair indicated at *x* is exerting a crowding action upon the other and adjacent pin the pin of the pair particularly indicated by *y* at the diametrically-opposite side of the eccentric line through said ring-formed linking-connection exerts a drawing action upon the other and adjacent pin, and, secondly, where the pins of the two series are not by their extremes projected alongside of each other, but terminate, as seen in Fig. 4, at either side of a plane between and parallel with the eccentric and the part 7, a link having separate or independent pin-receiving sockets 17 let thereinto at its opposite sides is provided, and this construction and arrangement is particularly advantageous and necessary where the pins on the eccentric and on the part 7 are, as is often de-

sirable for the purposes of strength, formed of a comparatively large diameter—that is, one greater than the distance between the shaft and eccentric centers—while, on the other hand, even where the pins of the two series are projected alongside of each other, but are of a small diameter as compared with the distance between eccentric and shaft centers, as shown in Fig. 3, a two-eyed or double-socketed link may be advantageously employed, as shown in said Fig. 3.

In the construction of the mechanism of course the part embracing the internal gear may be the strap-held part, and the drum may be formed on the part 7, which latter may then be free to rotate.

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

1. In a mechanism of the character described, in combination, a shaft having an eccentric thereon, a spur-gear mounted on said eccentric and provided with circularly-arranged series of pins, a part, as the disk, axially mounted relative to said shaft and having a similar series of pins for engagement with those of said spur-gear, a part suitably mounted and adapted to have a rotary motion axially relative to said shaft and provided with an internal gear with which said spur-gear has an engagement, and mediums for constituting linking connections between the respective pairs formed by adjacent pins of both of said series, for the purpose set forth.

2. In a mechanism of the character described, in combination, a shaft having an eccentric thereon, a spur-gear mounted on said eccentric and provided with circularly-arranged series of pins, a part, as the disk, axially mounted relative to said shaft and having a similar series of pins for engagement with those of said spur-gear, a part suitably mounted and adapted to have a rotary motion axially relative to said shaft and provided with an internal gear with which said spur-gear has an engagement, and mediums for constituting linking connections between respective pairs of pins formed by adjacent pairs of both of said series, and a means for restraining one of the above-stated axially-mounted parts against rotation, for the purpose set forth.

3. A differential hoisting-machine consisting of a shaft having an eccentric thereon, a spur-gear mounted on said eccentric, having a circularly-arranged series of pins or studs, a disk 7, axially mounted relative to said shaft and provided with a circularly-arranged series of pins or studs which pair with those of said first-named series, mediums, substantially as described, for constituting link connections between the several pairs of pins, a means for restraining said disk against rotation, an internal gear larger than and surrounding said eccentrically-carried spur-gear axially mounted relative to said shaft and with which said spur-gear has a mesh, and a winding drum or spool affixed to said internal gear, subtantially as described, and for the purpose set forth.

GEORGE F. CLEMONS.

Witnesses:
WM. S. BELLOWS,
G. M. CHAMBERLAIN.