No. 648,410. Patented May 1, 1900.

J. M. HOWARD.

ELEVATOR.

(Application filed Oct. 9, 1899.)

(No Model.) 4 Sheets—Sheet 1.

FIG. 1.

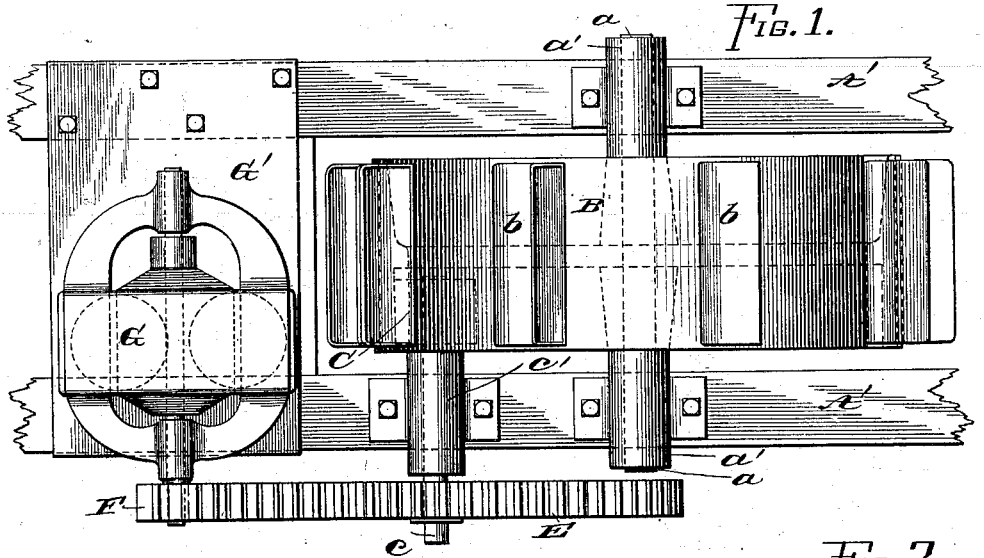
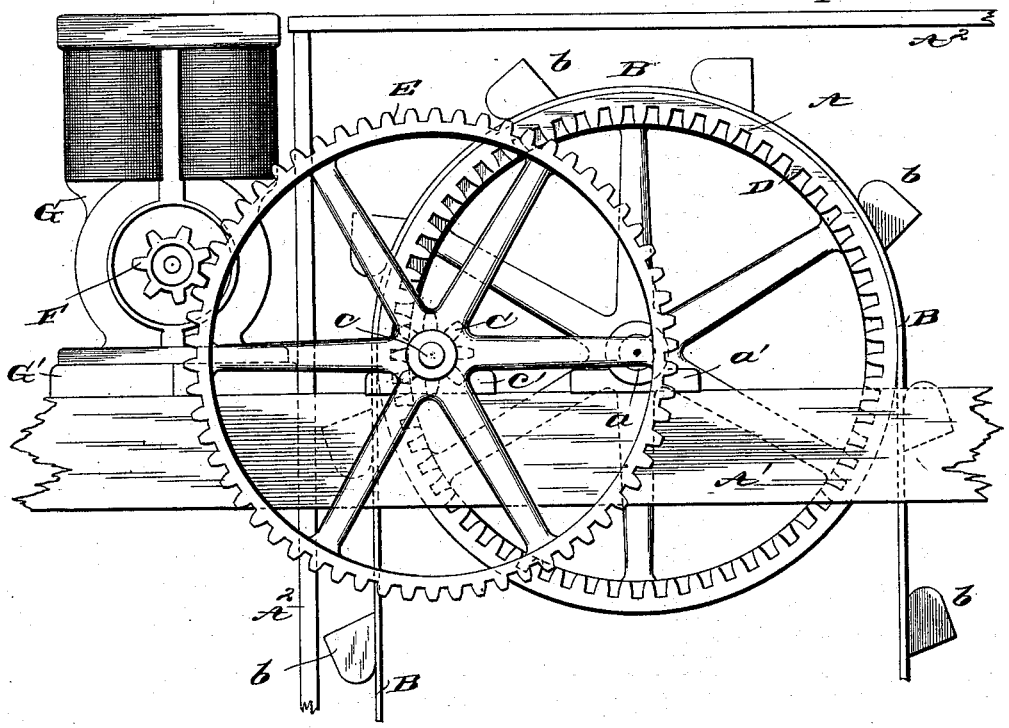


FIG. 2.



WITNESSES:
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J. B. Weir

INVENTOR:
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Attys

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FIG. 3.

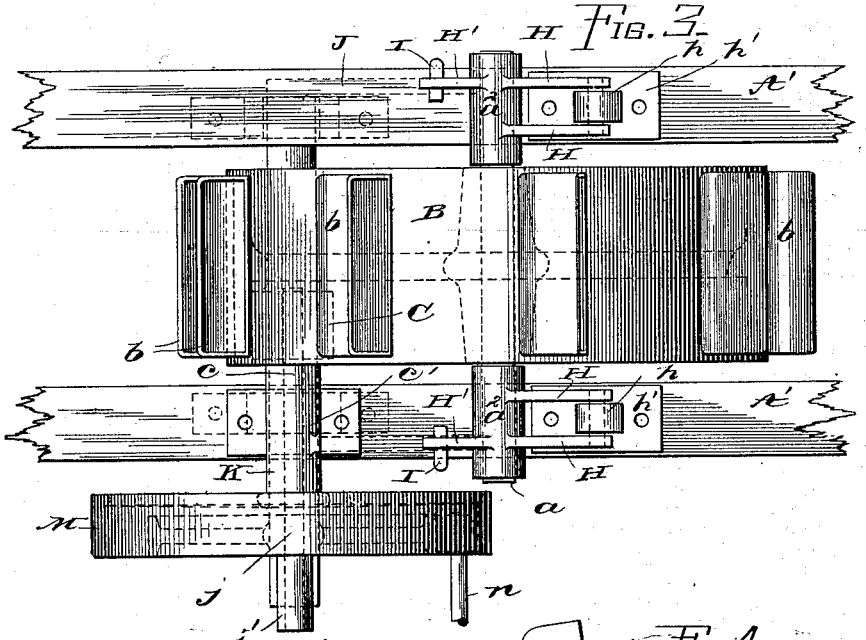

FIG. 4.

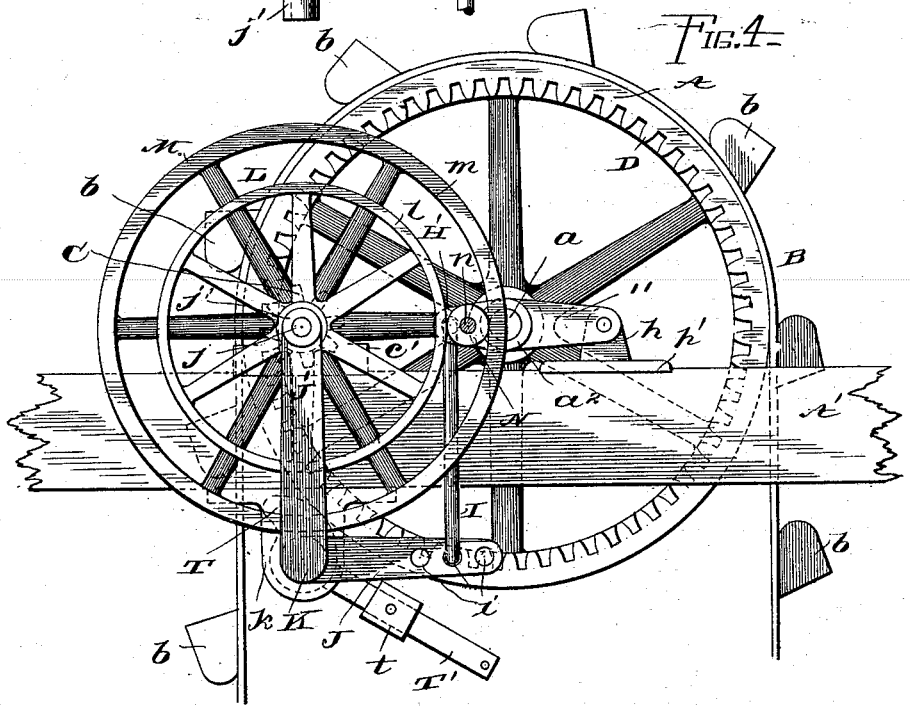

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FIG. 5.

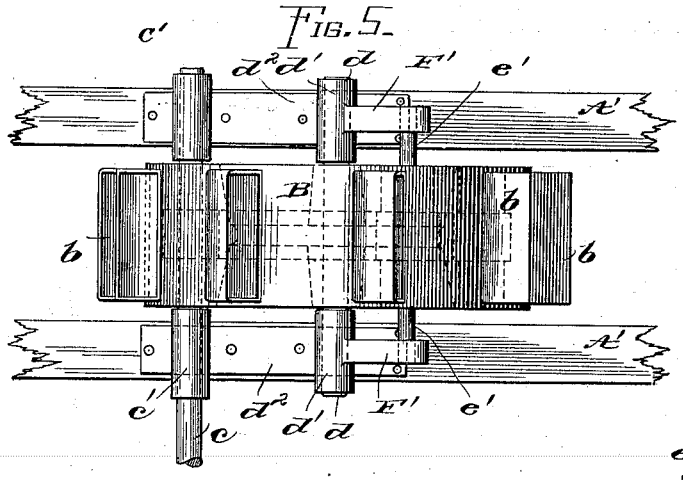


FIG. 7.

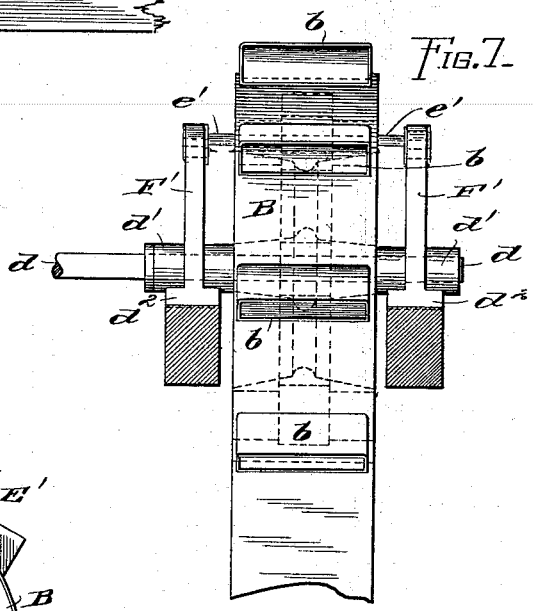
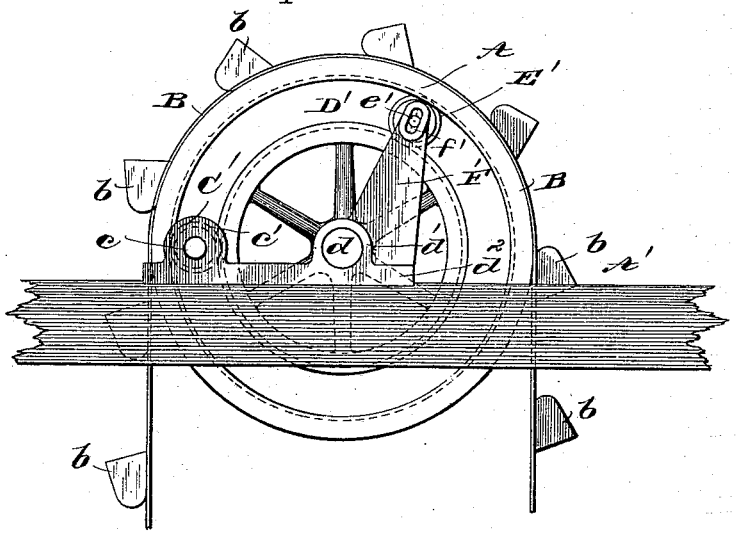


FIG. 6.



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4 Sheets—Sheet 4.

Fig. 13.

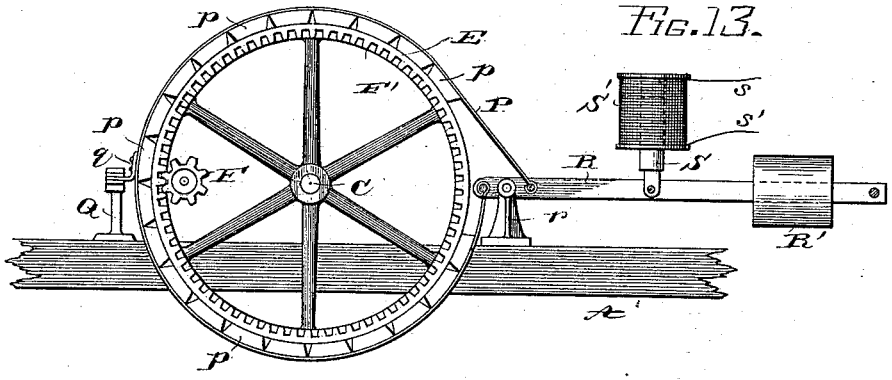


Fig. 12.

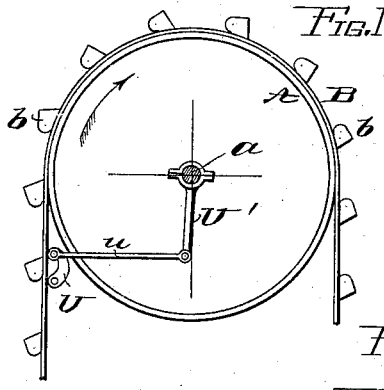


Fig. 8.

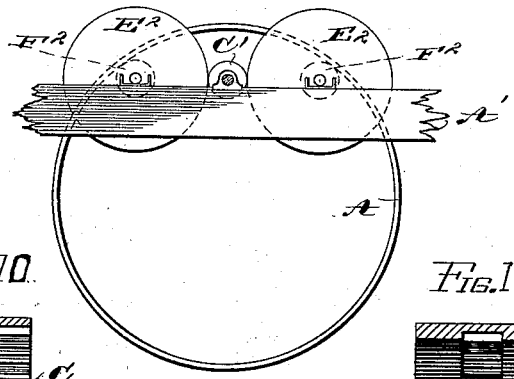


Fig. 10.

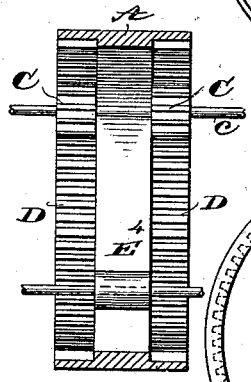


Fig. 11.

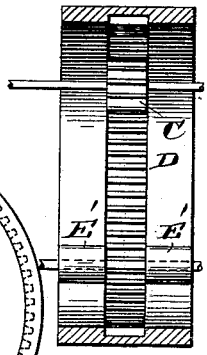
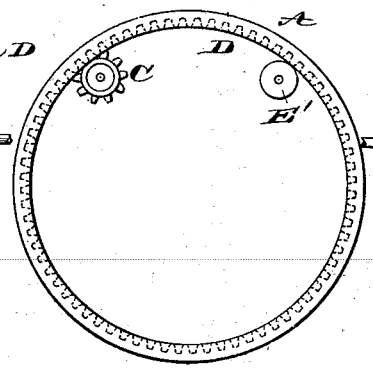


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN M. HOWARD, OF CHICAGO, ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 648,410, dated May 1, 1900.

Application filed October 9, 1899. Serial No. 733,049. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. HOWARD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

My invention relates more especially to that class or style of elevators in which buckets, flights, or other attachments on endless belts, ropes, or chains furnish the means for elevating the article or material to be hoisted and which are primarily designed for the hoisting of cereals, coal, and other similar freight; but the invention is adapted for use and can be used with other classes or styles of elevators.

The objects of the invention are the saving of power and giving an increased force or lift by applying the power almost direct to the surface of the endless carrier, on the inside thereof, so as to have almost a direct lift on such carrier in the direction of movement; the distribution of the load equally on two bearings, thereby giving an increased saving in the applied power which would otherwise be lost in the strain on numerous bearings; the driving of the head-wheel without disturbance to the original set and permanent true lines of such wheel with the elevator-leg, thereby maintaining the belt in true lines of run or travel; the saving of space by locating the driving mechanism for the endless carrier wholly within the inclosing hood of the elevator-head, protecting the driving mechanism against the admission of grit or other substances that would interfere with the easy operation of the parts; the reducing of speed directly through the head-wheel by applying the driving power to the periphery of said wheel, employing a small driving-pinion for that purpose; the removing of nearly all torsion on the shaft of the head-wheel and decreasing the loss of power from friction on the bearings of the shaft and otherwise, and the saving of labor and expenses by so mounting the head-wheel that the wheel itself needs no adjusting and having all the adjustments desired made in the driver for such wheel and this without any interference with the true line of the wheel with the elevator leg or casing.

Other objects will also appear from the description.

The invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompany drawings various modifications are illustrated for carrying out the objects and purposes of my invention; but in all cases the principal feature of the invention is embodied, which consists in providing a drum or rim over which the endless carrier runs and by which such carrier is driven and applying the power internally and direct to the inner surface or face of such drum or rim and in approximately a direct line with the lift or travel of the carrier.

Figure 1 is a top or plan view showing the cross timbers or supports of an elevator-head with my invention or improvement mounted thereon; Fig. 2, a side elevation of the arrangement and parts shown in Fig. 1; Fig. 3, a top or plan view likewise showing the timbers or supports of an elevator-head and showing an arrangement for imparting power to the drum or rim by means of a gear-pinion driven by friction and regulating the power to correspond to the load; Fig. 4, a side elevation of the arrangement and parts shown in Fig. 3; Fig. 5, a top or plan view showing the timbers or supports of an elevator-head and showing a drum or rim with a friction driving-pinion for imparting power to the drum or rim; Fig. 6, a side elevation of the arrangement and parts shown in Fig. 5; Fig. 7, an end elevation of the arrangement and parts shown in Fig. 5; Fig. 8, a side elevation showing an arrangement of friction-wheels, bearing-wheels, and pinion for driving the drum or rim; Fig. 9, a side elevation showing a gear-pinion for driving the drum or rim and a supporting roller or idler for maintaining the drum or rim in position. Fig. 10 is a central sectional elevation showing two gear-pinions, one on each side and a central roller or idler on the plan of Fig. 9; Fig. 11, a central section showing two rollers or idlers, one on each side, and a central gear-pinion on the plan of Fig. 9; Fig. 12, a side elevation showing an arrangement for applying a brake-shoe or clutch-dog and stopping backward rotation of the head-wheel, and Fig. 13 a side elevation showing a brake band or belt applied to

the periphery of the driver-wheel and operated electrically.

In illustrating and describing my invention I have only deemed it necessary to illustrate so much of an elevator as is necessary to clearly point out the invention and will only describe such parts as are necessary for the purpose of having the invention understood, and for this reason only two of the upper supporting-timbers of an elevator-head are all that is deemed necessary to show and describe in connection with my improvement.

In constructing my invention or improvements as illustrated in Figs. 1 and 2 I provide a drum or rim A, having its shaft *a* mounted in suitable boxes or supports *a'*, common only to the shaft of the drum or rim and bolted or otherwise secured to supports or timbers A', which may be the timbers at the top or head of an ordinary grain-elevator. The top or head has the usual casing A^2 surrounding the head-wheel and the endless carrier, as usual. The endless carrier B may be of the ordinary form of endless-belt carrier or otherwise, provided with buckets or flights *b* and running over the periphery or outer face of the drum or rim A to be driven by the revolving of the drum or rim, as usual. A pinion C on a shaft *c*, mounted in a suitable journal box or support *c'*, is arranged to mesh with an internal gear D on the drum or rim, by which arrangement the power for driving the drum or rim is applied in close proximity to the travel of the endless carrier, so as to act in almost a direct line on such carrier. The shaft *c* has secured thereto a gear or driver E, with which meshes a pinion F on the shaft of a dynamo G, supported on a base or plate G', bolted to the timbers or cross-pieces A'. The dynamo is preferably of that type which is "sparkless;" but other forms of motor or driver than an electric motor can be used.

The motor, if an electric one, is to be connected with an electric circuit in any usual and well-known manner, and when the motor is in operation the pinion on its shaft meshing with the gear or driver E drives the same, which in turn rotates the shaft *c* and gear-pinion C, driving the drum or rim A through the internal gear D, and the rotation of the drum or rim imparts movement to the endless carrier, operating such carrier to raise the material carried in the buckets or flights and dump such material, whether grain or some other article, in the usual and well-known manner.

The invention is specially applicable for use in grain-elevators, where the old practice has been to mount the head-wheel either singly or in series on a driving-shaft at the top of the elevator-leg and rotate such shaft at the end thereof by a large gear-wheel and a driving-gear. This practice of mounting the head-wheel on a shaft and applying power to the end thereof is objectionable in that it causes more or less strain on the shaft from the relation of the power and load, and consequently more or less torsion, throwing the shaft out of line and twisting the journal boxes or supports, creating a great amount of friction, which requires additional power to overcome.

The drum or rim A constitutes in effect a head-wheel over which and by which the endless carrier or belt is driven, and the gear-pinion C, with the internal gear D, applies the power directly to the drum or rim instead of to the shaft of such drum or rim, and by thus applying the power no twisting or torsion on the head-wheel or drum or of its shaft can possibly be had and the shaft and wheel will run true and even at all times. In addition the lift or power is applied almost directly to the inside surface of the endless carrier, as the point of applying and the point of receiving the power are separated only by the thickness of the wall of the drum or rim, so that in effect the lift is in the direct line of the travel of the carrier and not at one side of such line, as with the old arrangement of driving endless carriers from a central shaft. This direct-line driving makes a great saving in power and also applies the power precisely at the point where it will be the most effective and do the most work. By having the power transmitted to the drum or rim direct a small driving gear-pinion may be employed and a high-speed motor used for imparting the power, which is a great advantage, as it permits the motor to be located adjacent to the head-wheel, making a saving of space in the elevator-head, as well as locating the motor in the best possible position for use.

It is desirable in some cases to have the application of the power correspond to the load and have the load regulate and govern the power, and an arrangement to this end is illustrated in Figs. 3 and 4, in which the drum or rim, the endless carrier, the driving gear-pinion, and the internal gear are the same as already described for the construction of Figs. 1 and 2 except that the shaft *a* is not mounted in stationary journal boxes or supports. The shaft *a* is mounted in a box or sleeve a^2, having extending out from one side thereof arms H, pivoted on a standard or post *h* on a plate *h'*, bolted to the timbers A'. An arm H' extends out from the opposite side of the box or sleeve a^2 and has connected therewith a rod I, the lower end of which enters one of a series of holes *i* in an arm J, which arm projects out from a shaft K, mounted in suitable boxes or supports *k* on the under side of the timbers A'. A suspending support, consisting of the arms H, arm H', rod I, and arm J, is provided for each side of the drum or rim, and the holes *i* furnish an adjustment between the arms for pressure-applying purposes.

Extending up from the shaft K and standing at right angles to the arm J is an arm J', the upper end of which has a bearing *j'*, in which is mounted a stud or trunnion *j*, carrying a wheel L, between which wheel and a

wheel M is located a friction-gear N on a driving-shaft *n*. The friction-gear contacts with the outer face *l* of the wheel L and with the inner face *m* of the wheel M, and the amount of power or force exerted for driving the wheel M will depend upon the pressure of the wheel L on the driving-pinion N, which pressure is regulated by the load and the adjustment of the rod I forward or back in the holes *i*.

The wheel M is mounted on the shaft *c* of the driving gear-pinion C, so that the rotation of the wheel M drives the gear-pinion and imparts rotation to the drum or rim, as already described for the previous construction of Figs. 1 and 2, to drive the belt or endless carrier and cause it to travel as required for use.

The amount of friction on the driving-pinion N is regulated and controlled by the load and the leverage through the rod I. The drum or rim mounted in the arms H with a light load will bear down but little, and consequently the depression of the arms will be slight, and such depression will through the connecting-rod and the L-lever, formed by the arms J and J′, carry the wheel L forward, so as to impinge with but little force on the periphery of the driving-pinion, exerting a corresponding slight force on the driver M to be transmitted to the driving gear-pinion C for the load. An increase of load produces a corresponding increase of weight and a consequent depressing of the arms H, which through the rod I and the L-lever forces the friction-wheel L with greater pressure against the friction-pinion, giving such pinion increased power on the driver M to be transmitted to the gear-pinion C and the drum or rim. It will thus be seen that with this arrangement the load and power automatically conform to each other, a light load resulting in a light power and a heavy load resulting in an increased power. At the same time the full benefit and advantage of a direct line of lift on the endless carrier is had through the internal gear and driving gear-pinion, the same as with the construction of Figs. 1 and 2.

Various applications of power are adaptable for use with the leading feature of my invention, which is applying the power directly to the inner surface or face of the carrier drum or rim, so as to have approximately a straight-line draw or pull on the load in the direction of the forward travel of the carrier and against the resistance of the load on the loaded side of the drum or rim. An arrangement employing a friction-wheel and a friction-gear is illustrated in Figs. 5, 6, and 7. The drum or rim A in this form of construction has its inner face smooth and is not provided with spokes or arms and has no center or hub. Within the drum or rim is located a carrying or friction wheel D′, with a space between its exterior face and the interior face of the drum or rim, in which is located a friction-gear C′, mounted on a shaft *c* in a suitable box or support *c′*. The carrying or friction wheel D′ has its shaft *d* mounted in a suitable box or support *d′* on a plate d^2, which plate also carries the box *c′*, so that the two shafts are stationary or fixed in relation to each other. A supporting roller or idler E′ has its shaft or journal *e′* mounted in a slot *f′* of an arm F′, so that the periphery of the roller or idler runs in contact with the inner face of the drum or rim, and, as shown, the drum or rim has a central groove, and the roller or idler has a central flange entering the groove with a face on each side of the flange to bear against the face of the drum or rim.

The roller or idler engages and supports the drum or rim, and the drum or rim is rotated through the friction-gear C′, such gear and the roller or idler, with the central carrying or friction wheel, furnishing a support for the drum or rim, by which it is free to be revolved and drive or travel the endless carrier or belt. The roller or idler not only supports the drum or rim, but it also assists in driving the same, as it will be rotated by the drum or rim and the carrying-wheel, and such rotation drives the drum or rim. It will be seen that with this arrangement if the pinion slips on the drum or rim no stoppage or back movement can occur, as the carrying-wheel acts to drive the supporting roller or idler, which in turn drives the drum or rim. This is an advantage, as it insures the driving of the drum or rim at all times, even if the pinion slips, and more than one supporting roller or idler can be provided if desired or necessary.

A modification in driving by friction, using a drum or rim and driving from the inside direct thereon without spokes and a hub or center, is shown in Fig. 8, in which a friction-pinion C′, having its shaft *c* driven in any suitable manner, drives the friction-wheels E^2. The shaft of each friction-wheel has thereon a roller F^2, which contacts with the inner face of the drum or rim. The endless carrier or belt travels over the outer face of the drum or rim, and the load pressing down on the rollers or supporting-wheels F^2 has a tendency to crowd such rollers inward, and as the rollers are on the shafts of the friction-wheels and such shafts are mounted in movable bearings it will be seen that the pressure of the drum or rim on the supporting rollers or wheels is according to the load, and consequently the friction between the driving-pinion and the friction-wheels is increased or decreased according to the weight of the load, thereby furnishing the power proportionate to the load.

Another modification in driving the drum or rim, having no spokes and hub or center, is shown in Figs. 9, 10, and 11, in which a driving gear-pinion C, meshing with an internal gear D, and a supporting roller or idler E′, are provided. As shown in Fig. 10, a single central supporting roller or idler is provided, and two driving gear-pinions, one on each side of the supporting-roller, are used,

and, as shown in Fig. 11, a single driving-pinion at the center of the drum or rim and a supporting roller or idler on each side of the central gear are used.

A backward rotation of the drum or rim would or might produce injurious effects, and to prevent such rotation means should be employed to engage the drum or rim and prevent any backward travel thereon.

A brake and a controlling mechanism and an arrangement for this purpose are shown in Fig. 13. The gear or driver E has an internal gear instead of an external, and the driving gear-pinion F of the motor meshes therewith, as in the construction of Figs. 1 and 2. A brake-band P, having blocks of wood or other suitable material, encircles the periphery of the driver E and is supported on one side, as shown, by a post or upright Q with a flexible connection *q*. The ends of the band are attached to a lever R on the opposite sides of the standard or support *r* of such lever, and the lever carries a weight R′, which can be adjusted forward or back, as required for the amount of pressure to be exerted by the brake-band. An armature S is connected to the lever R and coacts with a magnet S′, connected by wires *s* and *s′* with an electric circuit, so that with the breakage of such circuit, either by stopping the electric motor when used for the power or otherwise, the magnet becomes deënergized, allowing the armature to drop and the lever to be carried down by the weight and apply the brake-band, and with the starting of the motor or by making the circuit in some other manner the magnet is energized and the armature moved up, raising the lever with its weight and releasing the brake-band.

As shown in Fig. 4, a clutch-dog or brake-shoe T is mounted loosely on the shaft K and has an arm or lever T′, on which is a weight *t*, which is adjustable so as to change the pressure of the dog or shoe against the face of the drum or rim. The forward rotation of the drum or rim is not interfered with by the dog or shoe; but with the backward rotation the face of the drum or rim contacts the face of the dog or shoe and by such contact forces it against the drum or rim, being assisted therein by the weight, and effectually stops the backward rotation.

As shown in Fig. 12, a clutch-dog or brake-shoe U is connected by a rod *u* with an arm U′, swinging from the shaft of the drum or rim, which dog or shoe is so constructed and has such relation with the drum or rim as not to interfere with the forward rotation of such drum; but with any backward rotation the arm U′ is carried toward a central position and through the rod *u* forces the dog or shoe in contact with the drum or rim, so as to effectually stop any backward rotation. Either arrangement of clutch-dog or brake-shoe or the arrangement of the brake-band will be found effectual for preventing backward rotation of the drum or rim.

What I regard as new, and desire to secure by Letters Patent, is—

1. In an elevator, the combination of an endless carrier, a revoluble drum or rim over which the carrier runs and by which it is moved, and means for applying power internally and directly to the inner surface or face of the drum or rim, for the transmission of the lift or pull on the endless carrier to be approximately in the straight line or plane of travel of the inner surface of the carrier and at the line of initial engagement of the drum or rim and the carrier on the loaded side, substantially as described.

2. In an elevator, the combination of an endless carrier, a revoluble drum or rim on the periphery of which the belt travels, and a driving-pinion applying power internally and directly to the inner surface or face of the drum or rim, for transmitting a direct lift or pull to the endless carrier approximately in the straight line or plane of travel of the inner surface at the line of initial engagement of the drum or rim and the carrier on the loaded side, substantially as described.

3. In an elevator, the combination of an endless carrier or belt provided with buckets, a revoluble drum on the periphery of which the carrier or belt travels, a driving-pinion for applying power internally and directly to the inner surface or face of the drum or rim on the loaded side, for transmitting a direct lift or pull to the endless carrier or belt approximately in the straight line or plane of the travel of the inner surface thereof at the line of initial engagement of the drum or rim and the carrier or belt, and a driver for the pinion independent of the drum or rim and its shaft, substantially as described.

4. In an elevator, the combination of an endless carrier or belt provided with buckets, a revoluble drum or rim on the periphery of which the carrier or belt travels, a driving-pinion for applying power internally and immediately on the inner surface or face of the drum or rim, transmitting a direct lift or pull to the endless carrier or belt approximately in the straight line or plane of travel of the inner surface thereof at the line of initial engagement of the drum or rim and the carrier or belt, and an electric or high-speed motor for driving the drum or rim and reducing the speed by direct connection of the pinion with the drum or rim dispensing with intermediate speed-reducing mechanism between the pinion and the main driver, substantially as described.

5. In an elevator, the combination of an endless carrier or belt, a revoluble drum or rim, a fixed shaft on which the drum or rim is mounted, and a power-transmitting pinion between the fixed shaft and the interior surface or face of the drum or rim and in engagement therewith on the loaded side for the resistance of the load to operate and regulate the power, substantially as described.

6. In an elevator, the combination of an end-

less carrier-belt, a drum or rim over which the belt runs and by which it is driven, and a driving-pinion applying power internally and direct to the inner surface or face of the drum or rim in a forward direction with the travel of the belt at the junction-point of the belt and the drum or rim on the loaded side and against the weight or resistance of the loaded side of the belt for increasing the effective force exerted, substantially as described.

7. In an elevator, the combination of an endless carrier-belt, a revoluble drum or rim over which the belt runs and by which it is traveled and a driving-pinion internally and directly engaging the inner surface or face of the drum or rim adjacent to the loaded side and in the line extending between the center of the drum or rim and the junction-point of engagement of the belt with the drum or rim for giving a direct-line pull or lift in a straight forward direction on the endless belt, substantially as described.

8. In an elevator, the combination of an endless carrier-belt, a revoluble drum or rim over which the belt runs and by which it is traveled, a shaft on which the drum or rim is mounted, a pinion located in line with the shaft and the junction-point of initial engagement of the carrier-belt with the drum or rim on its loaded side arranged to internally and directly engage the inner surface or face of the drum or rim and apply a direct-line lift or pull on the carrier-belt at the inner surface and against the weight or resistance of the load, substantially as described.

9. In an elevator, the combination of an endless carrier-belt, a drum or rim over which the belt runs and by which it is driven and means internally and directly engaging the inner surface or face of the drum or rim and proportionately to the carried load of the belt and transmitting power direct to the rim on the loaded side against the weight or resistance of the load accordingly as the load is heavy or light creating a varying direct pressure and frictional contact and drive for the drum or rim, substantially as described.

10. In an elevator, the combination of an endless carrier-belt, a revoluble drum or rim over which the belt runs and by which it is traveled and a power-transmitting means internally and directly operating on the inner surface or face of the drum or rim in a forward direction with the travel of the load of the belt and in the direction of the line of pull coinciding with the plane of the inner surface of the belt on the loaded side for giving the power the benefit of the weight or resistance of the load, substantially as described.

JOHN M. HOWARD.

Witnesses:
THOMAS A. BANNING,
BELLE W. BARRY.