(No Model.) 2 Sheets—Sheet 1.

W. M. THOMAS.

REDUCTION GEAR.

No. 480,679. Patented Aug. 9, 1892.

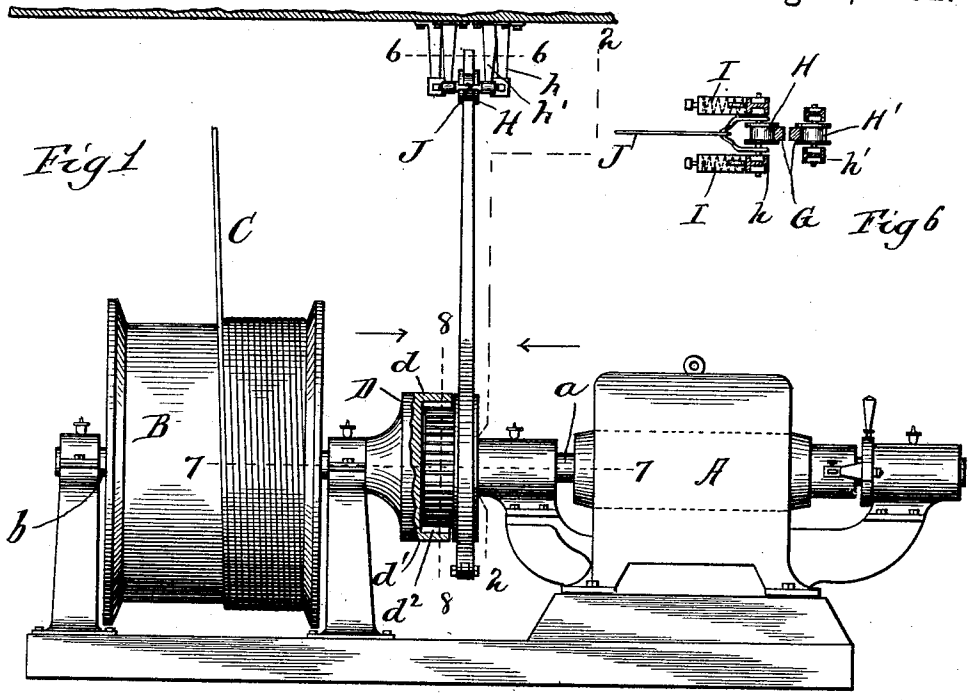
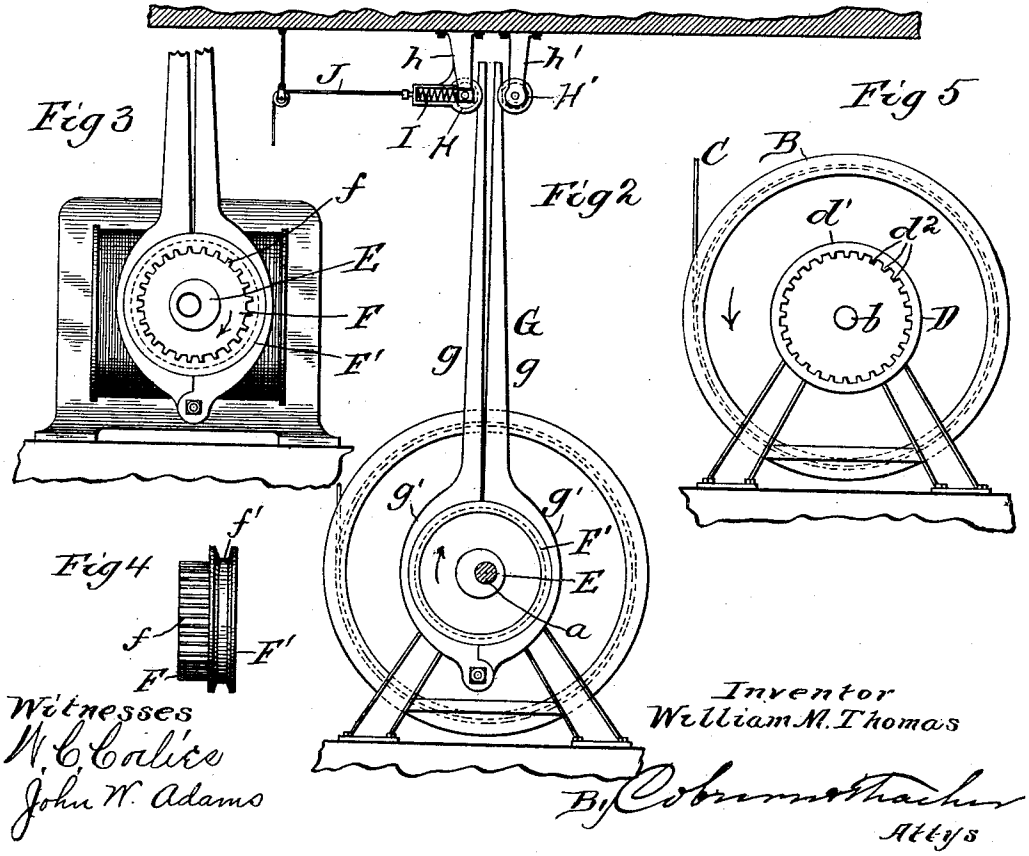


Fig 6



Witnesses
W. C. Colice
John W. Adams

Inventor
William M. Thomas
By Cobern & Thacher
Attys

(No Model.) 2 Sheets—Sheet 2.

W. M. THOMAS.

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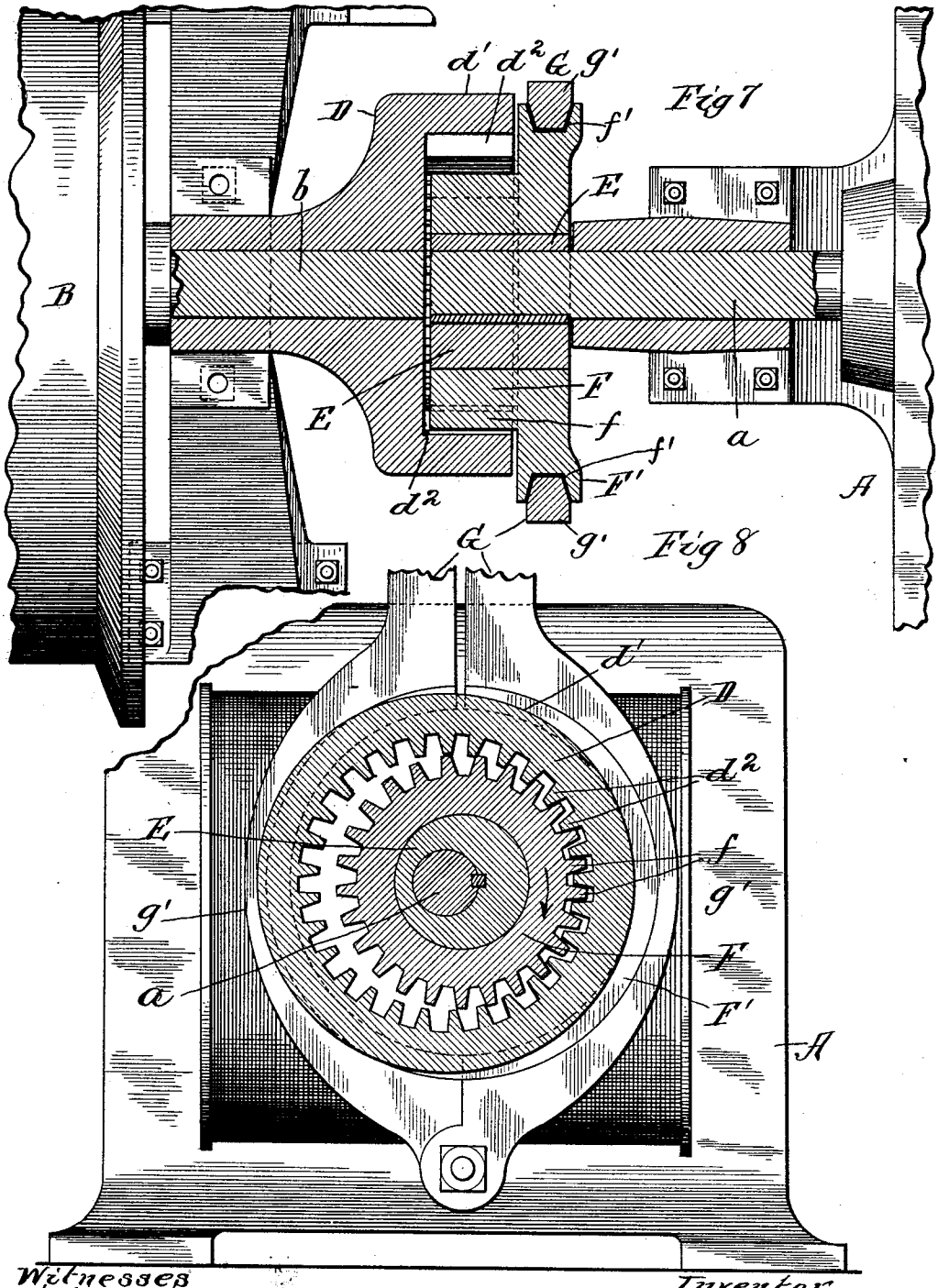

Witnesses
W. C. Curtis
John W. Adams

Inventor
William M Thomas
By Johnson Kaufman
Atty's

UNITED STATES PATENT OFFICE.

WILLIAM M. THOMAS, OF DETROIT, MICHIGAN, ASSIGNOR TO LOUIS WARFIELD, OF SAME PLACE.

REDUCTION-GEAR.

SPECIFICATION forming part of Letters Patent No. 480,679, dated August 9, 1892.

Application filed March 31, 1892. Serial No. 427,144. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. THOMAS, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Reduction-Gears, which are fully set forth in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a side elevation of an electric motor and hoisting-drum with my invention applied thereto; Fig. 2, a cross-section taken on the line 2 2 of Fig. 1, looking in the direction of the arrow; Fig. 3, an inner end elevation of the motor and its shaft disconnected from the drum; Fig. 4, an edge elevation of the pinion mounted on the end eccentric of the motor-shaft; Fig. 5, an inner end elevation of the drum and its shaft disconnected from the motor; Fig. 6, a detail plan section taken on the line 6 6 of Fig. 1; Fig. 7, a detail plan section taken on the line 7 7 of Fig. 1; and Fig. 8, a cross-section taken on the line 8 8 of Fig. 1, looking in the direction of the arrow. Figs. 1 to 6, inclusive, are on one and the same scale, but Figs. 7 and 8 are on another scale, considerably enlarged from the former.

My invention relates to devices for converting speed to power, or, in other words, changing a high-speed movement with comparatively small power to a slow movement, but with a corresponding increase in power.

An invention of this nature is especially useful with electric motors, in which, as is well known, the ordinary effect is to develop high speed, but with the usual loss of power attendant upon rapid movement. The invention is not, however, confined in its application to electric motors, but may be used in connection with any motor whatever where the conversion from speed to power is desired, and is intended also to be used in connection with power mechanism of any kind whatever to which it can be applied.

For the purpose of illustrating the application and operation of my invention I have in the accompanying drawings shown it applied to an electric motor and an elevator or hoisting-drum intended to be driven by the said motor.

I will now describe in detail the construction and operation of my invention thus applied in one practical way, and this description will be followed by claims, in which the particular improvements that I believe to be new and wish to secure by Letters Patent will be more definitely pointed out.

In the drawings, A represents an electric motor of any type. As the construction of the motor is no part of my present invention, special description is unnecessary here. A hoisting-drum B is arranged relatively to the motor to be driven thereby. This device in its main features may be of any construction and requires no further description. It is fixed on a shaft *b*, which is mounted horizontally in suitable supports, and a hoisting-cable C is wound thereon, by means of which an elevator car, platform, or anything else desired may be lifted. The driving-shaft *a* of the motor is also mounted horizontally in suitable supports and is arranged in line with the shaft of the drum, and the motor and drum are brought reasonably close to each other.

On the inner end of the shaft *b* of the hoisting-drum, or the end next to the motor, there is fixed an internal gear-wheel D, the shaft being extended beyond its inner journal-bearing, so that this wheel will stand outside of the latter, as seen in Fig. 1. As seen in the drawings, this wheel consists of a solid disk or body *d*, which is secured to the shaft, and a rim-flange *d'*, projecting straight out therefrom, so as to form a kind of cup, and the flange is provided with internal gear-teeth d^2. As already stated, the shafts of the motor and drum are arranged in line with each other. The former is also extended beyond its bearing toward the latter, so that it enters within the cup formed by the flange of the wheel D and is brought close up to the end of the drum-shaft, as seen in Fig. 7. On this inner end of the motor-shaft *a* there is an eccentric E, which may be in one piece with the shaft or separate therefrom and secured thereto, as seen in Fig. 8. A gear wheel or pinion F is mounted loosely on this eccentric, but concentrically therewith, as seen in Fig. 8. It will be obvious from this description that the eccentric and gear-wheel mounted thereon will stand within the internal gear-flange of

the wheel D. The teeth *f* of the wheel F are adapted to engage with the teeth d^2 of the internal gear; but the diameter of this wheel is considerably smaller than that of the internal gear, so that the wheel F may have a certain amount of lateral movement within the gear-flange. Now as the motor-shaft is rotated it is evident that the revolution of the eccentric on the inner end thereof will have the effect to move the wheel F from side to side within the gear-flange, and these parts are so constructed, relatively, that the eccentric is just large enough to keep the wheel F always in engagement with the internally-geared flange. As stated above, the wheel F is mounted loosely on the eccentric. Obviously then, if left in this condition, the rotation of the latter (mentioned above) will simply cause the wheel F to turn upon the eccentric by its engagement with the internal gear as it is carried around within the latter and held in engagement by the swell of the eccentric as the latter is rotated within the flange, as indicated in Fig. 8. This operation is a mere idle movement, for evidently the drum-shaft will not be moved thereby; but if the wheel F is held from rotation while the eccentric is still left free to revolve it is evident that the engagement of the wheel with the internal gear will now impart movement to the latter, and so will rotate the drum-shaft. It is also obvious that this rotation of the wheel D and the drum-shaft to which it is attached will be considerably slower than that of the motor-shaft, for the wheel F, being held from rotation, one revolution of the eccentric on which it is mounted will impart only a part revolution to the wheel D, and so several revolutions of the motor-shaft and the eccentric which it carries will be required to give a single revolution to the wheel D and the drum-shaft to which it is attached. It will be seen at once that this depends upon the relative size of the internal gear and inclosed wheel F, and is a matter of mathematical calculation.

It will be seen that some device is necessary whereby the wheel F may be stopped and held in a fixed position whenever it is desired to transmit motion from the motor to the drum. Any device suitable for this purpose may be employed; but obviously it must be one which will permit the lateral movemect of the wheel occasioned by the revolution of the eccentric. The device for this purpose shown in the drawings is a kind of friction-brake G, which is applied to the wheel F, or rather to a hub or disk F′ on the outside of the gear-teeth and either in one piece with the wheel or rigidly attached thereto. This hub or disk is provided with a circumferential groove *f′*, preferably V-shaped. The brake G is composed of two parts or arms *g*, with semicircular curves *g′* at one end, adapted to fit the groove of the hub F′ and together about inclose it. The arms are hinged together at their bent ends, so that they may be applied to embrace the hub, as seen in Fig. 2. These arms are of considerable length, extending away from the wheel in any direction desired. In the drawings they are shown extending directly upward, for in this position they are least in the way. The arms must be clamped together, so as to sharply bite the hub F′ and securely hold it from any rotation. At the same time they must be free to move somewhat longitudinally to accommodate the lateral motion of the wheel already described. To effect these results the outer or upper ends of the brake-arms are passed between two rollers H and H′, mounted in hangers *h h′* depending from the ceiling above. These rollers are set at such a distance apart as to securely clamp the brake-arms upon the wheel; but at the same time it is evident that the arms may move lengthwise between them, thus providing for the lateral movement of the wheel. The journal-bearings of one of the rollers H are adjustable, and strong springs I are set behind them, which hold the arms clamped with sufficient power on the wheel, but at the same time will yield to any extraordinary force. This provides, also, for releasing the clamp, for by attaching a cord J to the journal or journal-bearings of this roller the latter may be drawn away from its fellow and so permit the brake-arms to separate and release the wheel F. In this way the driving connection between the motor and the drum may be broken whenever desired, and the movement of the latter cease without stopping the motor; and the stopping and starting of the motor as it is usually applied is objectionable and attended with considerable loss. With these devices the hoisting apparatus may be started and stopped at will without any change in the motor. It will be seen from this description that I have produced a reduction-gear by means of which high speed is changed to low speed, with, of course, a corresponding increase in power and without the intervention of a number of multiplying-gears, which is the usual method employed.

The mechanism is simple, cheap, very effective, and easily managed. It is especially adapted for application to electric motors, for reasons already stated; but I do not wish to be understood as restricting the invention to such application, for I contemplate its application to all kinds of machinery where it may be utilized. Furthermore, I do not wish to be understood as limiting the invention to all of the particular devices and details of construction herein set forth and shown. For instance, the brake I have here shown and described is only given as an illustration of a suitable device for the purpose, and, in fact, the whole mechanism here shown and described is rather for the purpose of general illustration than of any specific form which my invention must necessarily assume.

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

1. The driving-shaft of a motor, in combination with a driven shaft in line therewith, an internal gear mounted on the latter, an eccentric fixed on the end of the motor-shaft, a gear-wheel mounted loosely on said eccentric and of less diameter than the said internal gear within which it is arranged, and a stop device adapted at will to stop the said gear-wheel from rotary movement about the eccentric while at the same time permitting lateral movement thereof, substantially as described.

2. In a reduction-gear device, a driving-shaft *a*, in combination with a driven shaft *b*, arranged in line therewith, an internal gear-wheel D, mounted on the driven shaft, an eccentric E on the driving-shaft and arranged within the circumference of said internal gear, a spur-gear F, mounted loosely on said eccentric and of less diameter than the internal gear, and a brake G, adapted to be applied to the wheel F to hold it from rotation, but free to move with said wheel in its lateral movement caused by the rotation of the eccentric, substantially as described.

3. A motor-driving shaft *a*, in combination with a driven shaft *b*, arranged in line therewith, the internal gear D, mounted on the latter, the eccentric E, fixed on the end of the former shaft, the spur-gear F, mounted loosely on the eccentric, arranged within the internal gear and provided with a hub F′, the brake-arms *g*, hinged together at one end and adapted to clasp the hub F′, and guide-rollers H H′, arranged to hold the outer or free ends of said arms in proper position to clamp the wheel F, while at the same time they are free to move lengthwise between said rollers, substantially as described.

4. The guide-rollers H H′, the former mounted in adjustable bearings, in combination with springs I, arranged behind said bearings, the gear-wheel F, mounted loosely on a rotating eccentric E, a brake G, consisting of hinged arms *g*, adapted to embrace and clamp the said gear-wheel, and with their free ends arranged to slide between said rollers, an internal gear D, surrounding the gear F and of greater diameter, and a cord or other device attached to the movable roller, whereby the brake may be released at will, substantially as described.

WILLIAM M. THOMAS.

Witnesses:
A. B. REMEY,
D. R. BOGUE.