T. W. HEERMANS.
POWER DRIVEN ELEVATOR ENGINE.
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5 SHEETS—SHEET 1.

Inventor

Thaddeus Heermans

by Bobo Brown
his Attorneys

Witnesses:

F. Alfude

W. Hall
To all whom it may concern:

Be it known that I, THADDEUS W. HEERMANS, a citizen of the United States, of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Power-Driven Elevator-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in elevator or hoisting engines, and to improvements in braking apparatus designed for use in such engines and for other purposes; and the invention consists in the matters herein-after set forth and more particularly pointed out in the appended claims.

20 In the drawings:—Figure 1 is a diagrammatic view illustrating the application of my improvements to a typical form of elevator equipment. Fig. 2 is a side view of the elevator engine. Fig. 3 is an end view thereof.

25 Fig. 4 is a longitudinal section taken through the mechanism for arresting the movement of and for locking the elevator in an arrested position. Fig. 5 is an end view of the sleeve or hub of the grooved pinion driven by the armature or power driven shaft. Fig. 6 is a cross-section, taken on line 6—6 of Fig. 4. Fig. 7 is a side elevation of a nut constituting part of the elevator arresting and locking mechanism. Fig. 8 is an end view thereof. Fig. 9 is a face view of one of the locking rings constituting part of the arresting and locking mechanism. Figs. 10 and 11 are friction plates constituting part of said mechanism. Fig. 12 is a cross-section, taken on line 12—12 of Fig. 4.

As shown in the drawings, and referring more particularly to Fig. 1, A designates the elevator car or cage, A' the counterweight therefor, B a sheave about which is trained the cable C for driving the car, and D a pinion for driving said sheave. In the present instance said cable C is fixed at the points c c', and one side of the cable is trained about a sheave C (designed to be located at the top of the elevator shaft) and downwardly about a sheave C' to which the counterweight A' is attached, and thence upwardly to its point of attachment c'. The other side of the cable C is trained about a sheave C' and thence downwardly to its point of attachment c. The sheave C' is attached to one end of a cable C', which latter is attached at its other end to the car and said cable C' is trained between the said car and sheave C' over guide sheaves c' c'.

Referring now to the construction of the elevator engine proper, which is shown in the other figures of the drawings, the same is made as follows:

E designates the power mechanism for driving the engine, comprising, in this instance, a motor having the usual controller E'.

F designates the armature shaft which constitutes the driving shaft for the pinion D, and G designates the armature shaft brake which is, in practice, operated by any suitable mechanism from the car to arrest the rotation of the armature.

The connection between the motor shaft F and the pinion D for rotating the latter and therethrough for driving the car is so constructed and arranged that, in addition to its function of driving the car in either direction, it operates also a brake, actuated by the momentum or weight of the load, to arrest the movement of the car and further to lock the load from movement when arrested; said operation being generally similar to the operation of the mechanism shown in my aforesaid United States Letters Patent No. 815,015. This construction is made as follows: The said pinion D is formed on the end of a hollow sleeve or extension D' that surrounds and has bearing on the outer end of the shaft F. H designates a nut which surrounds the shaft and is internally screw-threaded to engage exterior screw-threads on the shaft. The said nut H (shown in detail in Figs. 4, 7 and 8) has interlocking connection at one end with the adjacent inner end of the pinion sleeve D', said sleeve for this purpose being provided with angularly separated projections d and intervening recesses d', (Fig. 5) and the nut being provided with similar projections h (Fig. 8) which enter said recesses d' and separated by recesses h' which receive said projections d. Located at either end of the nut H are two locking rings L p the former of which is provided with a hub i that surrounds and has bearing on the inner end of the pinion sleeve D and the latter of which is provided with a like hub i that surrounds and has bearing on the shaft F (Fig. 4). The said locking rings have limited rotative movement on the sleeve and shaft, respectively, and are also capable of being shifted endwise...
on their respective bearings. The outer end of the hub of the ring I abuts against or co-acts with an inwardly facing shoulder d forming on the sleeve D and the outer end of the hub i of the ring I likewise co-acts with a shoulder formed on a suitable flange F fixed to or formed on the shaft F. Said flange abuts at its other side against a bushing F' which constitutes a bearing for the shaft F and is limited from endwise movement with respect to the shaft and the casing surrounding the same in the manner shown in Fig. 4. Hardened metal bearing rings d' d" may be interposed between the hubs of the locking rings I and I' and the respective shoulders referred to. The pinion and its sleeve are locked from endwise movement on the shaft by means of a nut F' which has screw-threaded engagement with the outer reduced end of the shaft and enters a suitably formed recess in the pinion. The said nut is locked in the shaft. This may be accomplished by means of a tapered plug F" designated to enter an axial socket in the end of the shaft, and slitting the socketed end of the shaft, as shown in Figs. 4 and 12. The said plug, when turned between, expands the slitted portion of the shaft outwardly against the nut which prevents the latter from turning.

The said sleeve has a limited movement endwise of its bearing and the shaft F whereby it may be adjusted, through the medium of the nut F', to vary the extent of travel of the nut II. J J' designate casings mounted on the ends of said locking rings, each comprising an annular web j, a hub j' which has bearing engagement with the hub of the associated locking ring and a flange j" which surrounds the associated locking ring. Said casings are supported in the frame of the engine in any suitable manner, as will be hereinafter described, which holds the same from rotation. The said locking rings I and I' are provided with peripheral projections or teeth i' i" which extend outwardly therefrom. Said teeth are each formed on one side to provide a concave recess i' and on its other side with an inclined cam or wedge-face i", as more clearly shown in Figs. 5 and 9. The ends of said teeth fit closely within the annular flanges j' of the surrounding casing. In the chambers formed between the inner cylindric faces of said casings and the concave faces of said teeth are mounted a plurality of loosely confined cylindric rollers K K. The said cylindric rollers are held in place by means of retaining rings M M fastened by screws or otherwise to the inner faces of the locking rings and overlapping the roller chambers, as most clearly shown in Fig. 4. This arrangement permits the rings I I', when locked to the shaft F, to rotate freely in the direction towards which face the concave faces of the teeth, but said rings are prevented from rotating in the opposite direction, inasmuch as the latter movement of the rings pinch the rollers between the wedge faces i' of the teeth and inner cylindric faces of the flanges j'. Said wedge faces of the teeth of the locking rings are so disposed that one ring I is thus locked from rotation in one direction while the other ring is locked from rotation in the opposite direction.

The locking rings are provided on their inner faces with recesses i', as shown most clearly in Figs. 4 and 9. Interposed between the bottoms of said recesses and the adjacent ends of the nut, and contained within said recesses, are a plurality of friction rings L L', shown in place in Fig. 4, and in detail in Figs. 10 and 11. The said rings L L' of each group are arranged in alternate order, and the rings of one set are fixed to and rotate with the locking rings I I', while the rings of the other set are fixed to and rotate with the nut. As herein shown, the friction rings L rotate with the locking rings. For this purpose they are provided with peripheral projections l adapted to enter recesses i' in the inner cylindric walls of the flanges of the locking rings, while the friction rings L' are provided on their inner margins with similar projections l' adapted to fit within sockets k' (Fig. 8) formed in the projecting lugs that interlock with the sleeve D'.

The general operation of the mechanism thus far described is as follows: Assuming the shaft F to be rotating to the right, or in a clock-wise direction to drive the pinion D, the first effect of the rotation of said shaft, turning within the nut II, is to shift said nut against the friction rings associated with the locking ring I and thereby lock said nut to the shaft through a shearing action on the screw-threads thereof. By reason of the endwise interlocking connection of the nut with the sleeve D' of the pinion D, the said pinion will be rotated in the same direction as the shaft and drive the sheave B in the same direction. So long as the elevator is in motion and the shaft operates to drive the load, the nut H is locked to the shaft and constitutes a part of the driving connection. Upon arresting rotation of the shaft by the armature brake, as when the car is to be brought to a stop, the load is arrested through the mechanism described in the following manner. In the event that the load tends to reverse or drive the pinion D and its sleeve in the direction opposite to which it is being driven by the motor, as when the car is heavily loaded, such reversing of the rotation of the pinion acts to hold the friction rings, associated with the locking ring I, engaged or pressed together so that the locking ring I tends to rotate in such reverse direction with said sleeve D'. Inasmuch as the teeth of the locking ring I and the associated rollers K are active to lock said ring from such reverse rotation, the parts at this
time serve as a lock to prevent reversal of movement of the elevator. In case, however, the load; by reason of the overweight of the counterweight relatively to that of the car, tends to continue the rotation of the pinion D and sleeve D’ in the original direction in which they have been driven, such action, after the armature shaft is arrested, operates to shift the nut H towards the set of friction rings associated with the locking ring F and to lock by friction said rings to the locking ring F, thereby tending to rotate the locking ring F in the same direction as the sleeve is tending to rotate. The rollers K and the wedge surfaces of the teeth of the latter ring are active in this direction, however, as to prevent movement of the locking ring, whereby the parts are locked to prevent the elevator from over-runnin the landing at which it is desired to arrest the car. The same operation of the mechanism occurs when the shaft is rotating in an opposite direction from that described, to wit, towards the left hand, with the exception that the parts function to lock the pinion D to the shaft to constitute part of the driving mechanism or to lock the load from movement, in a manner the reverse of that set forth. When one set of friction rings are operated to lock the nut to the shaft in a manner to constitute the nut as a part of the driving mechanism or to avoid reversal of the parts, the opposite set of said friction rings are loose and vice versa. The said mechanism operates, not only to stop the car at a given landing when the motor is arrested, but its retarding influence is felt whenever there is a tendency of the load of the car or counter-weight to drive the motor in either direction.

It will be observed, therefore, that the motor-brake is relieved from the work of arresting the load of the car or counter-weight, or holding said parts after they have been arrested. The action of the motor-brake modifies the load arresting and locking mechanism and therefore cooperates with said locking mechanism to control the car. That is to say, the promptness with which the said mechanism is brought into action to arrest the car under usual running conditions depends upon the greater or less activity with which the motor-brake is operated to control the motor and its shaft. The car is, therefore, under the control of the conductor at all times, without the necessity on the part of the conductor calculating the relation of the load on the car to the effect of the action of the brake mechanism, it only being required that he shall determine once for all the proper period of setting the armature brake to arrest the motor.

It may be observed that the relative movements of the parts to shift the nut from one side to the other or to lock the locking rings from reverse rotation is small, and that the parts are brought into operation to arrest the car, or to avoid tendency of the overload on either side to drive the motor, smoothly and without abrupt action or shock on the relatively movable parts. Preferably one set of the friction rings, the friction rings L as herein shown, is perforated in order that the lubricant, in which said parts operate, may be freely distributed among the various rings.

The construction of the mechanism herein shown is such that when the nut H is shifted toward the left, the abutment on the shaft against which said nut acts is the flange or collar F’, and when the nut is shifted towards the other direction the abutment against which said collar acts is the nut F at the end of the shaft F. The interlocking lugs or extensions on the nut and sleeve, respectively, are so proportioned that said projections will be clear from the bottoms of the recesses containing the same when the associated friction rings are forced or jammed together, thereby preventing the wearing of said rings bringing the interlocking parts of the shaft and sleeve into contact relation.

The sheave B is driven from the pinion D through the action of exterior ribs d’ and interenging grooves on the exterior of the pinion which engages complementsal ribs b and interenging grooves on the interior surface of the sheave. The said ribs and grooves are of wedge-shape and provide a friction surface of large extent and of a character to positively hold said parts in driving relation. By this construction, power is communicated from the motor to drive the elevator noiselessly and without reducing gears such as has heretofore been used. It will be observed that the employment of the sheave B, constructed as described, permits the cable to be driven at the peripheral speed of the pinion D (which is a comparatively low speed) while at the same time provides large friction surface on the sheave B for engagement with the bight of the cable trained about said sheave, it being manifest that the peripheral speed of the sheave B is the same as that of the pinion D and that it is practical to thus communicate the power directly to the cable without interenging speed reducing gearing.

The said sheave is held against the pinion by the tension of the cables, and it is centered by means of idlers X X which are mounted on shafts n n affixed to the frame members N’ N’ that support the operative parts of the mechanism, some of which are not shown, nor constitute a part of this invention (Figs. 3 and 4).

The main operative parts of the mechanism described is inclosed within a casing O made of separable upper and lower parts joined or connected by bolts o (Fig. 2) extending through lugs on the meeting margins of said parts. The said casing is extended at each side to form bearing sleeves O’ O’.
arrangement avoids lost motion due to wear of the parts inasmuch as the sheave B is always held firmly against the pinion by the tension of the cables connecting the car and counterweight with said sheaves. I claim as my invention:

1. The combination with a motor or driving shaft and a pinion mounted on one end of said shaft and capable of relative rotation thereon and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with said shaft and operatively connected with said pinion, and means cooperating with said nut and actuated upon by the momentum or load of the driven part acting through said pinion in either direction to arrest the said driven part and lock it in an arrested position.

2. The combination with a motor or driving shaft, and a pinion mounted on one end of said shaft and capable of relative rotation thereon and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with said shaft and operatively connected with said pinion, and means cooperating with said nut and actuated upon by the momentum or load of the driven part acting through said pinion in either direction to arrest the said driven part and lock it in an arrested position.

3. The combination with a motor or driving shaft and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of means operatively connected with the end of said sleeve and actuated upon by the momentum or load of the driven part acting through the pinion in either direction to arrest said driven part.

4. The combination with a motor or driving shaft and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having a screw-threaded engagement with the shaft and having interlocking engagement with the end of said sleeve and braking and locking mechanism cooperating with said nut and controlled by the momentum or load of the driven part acting through said pinion in either direction.

5. The combination with a motor or driving shaft and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with the shaft and having interlocking engagement with the end of said sleeve, and braking and locking mechanism cooperating with said nut and controlled by the momentum or load of the driven part acting through said pinion in either direction.

6. The combination with a motor or driving shaft, and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of means operatively connected with the end of said sleeve and actuated upon by the momentum or load of the driven part acting through said pinion in either direction.
sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with the shaft and having interlocking engagement with the end of said sleeve, and braking and locking mechanism cooperating with said nut and controlled by the momentum or load of the driven part acting through said pinion in either direction, embracing a set of friction devices, locking rings, one on each side of the nut between which and the nut the friction devices are interposed, abutments on the shaft against which said locking rings act, and means operating to hold each locking ring from rotation in one direction, permitting one locking ring to rotate freely in one direction and the other in the other direction.

7. The combination with a motor or driving shaft, and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with said shaft and interlocked with said sleeve, locking rings surrounding the shaft, means for locking said rings from rotation in one direction while permitting free rotation thereof in the other direction, one ring rotating in a direction opposite from the other, and a group of friction rings between each locking ring and the nut, the rings of each group being fixed alternately to and rotating with the nut and associated locking ring, respectively.

8. The combination with a motor or driving shaft and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with said shaft and interlocked with said sleeve, locking rings surrounding the shaft, means for locking said rings from rotation in one direction while permitting free rotation thereof in the other direction, one ring rotating in a direction opposite from the other, and a group of friction rings between each locking ring and the nut, the rings of each group being fixed alternately to and rotating with the nut and associated locking ring, respectively, the alternate rings being perforated.

9. The combination with a motor or driving shaft, and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with the shaft and having interlocking engagement with the end of said sleeve, braking and locking means cooperating with said nut and controlled by the momentum or load of the driven part acting through said pinion in either direction, and adjusting means for varying the travel of said nut on the shaft for the purpose set forth.

10. The combination with a motor or driving shaft and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with the shaft and having interlocking engagement with the end of said sleeve, braking and locking means cooperating with said nut and controlled by the momentum or load of the driven part acting through said pinion in either direction, embracing a set of friction devices, locking rings one on each side of the nut between which and the nut the friction devices are interposed, abutments on the shaft against which said locking rings act, and means operating to hold each locking ring from rotation in one direction permitting one locking ring to rotate freely in one direction and the other in the other direction, one of said abutments being adjustable on the shaft to increase the distance between said abutments.

11. The combination with a motor or driving shaft and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut on the shaft for locking the pinion and its sleeve from endwise movement thereon, a nut having screw-threaded engagement with said shaft and interlocked with the end of the sleeve, locking rings surrounding the shaft and sleeve, respectively, means for locking each of said rings from rotation in one direction, friction devices interposed between said rings and the ends of said nut and opposing inwardly facing abutments, one on the shaft and one on the sleeve, against said locks.

12. The combination with a motor or driving shaft, and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut on the shaft for locking the pinion and its sleeve from endwise movement thereon, said nut having screw-threaded engagement with said shaft and interlocked with the end of the sleeve, locking rings surrounding the shaft and sleeve, respectively, means for locking each of said rings from rotation in one direction, friction devices interposed between said rings and the ends of said nut, said sleeve locking nut opposing a shoulder on the shaft which together constitute abutments against which said locking rings act, and means for adjusting said sleeve locking nut on the shaft and locking it in an adjusted position.

13. The combination with a motor or driving shaft, and a pinion having an elongated sleeve mounted on the shaft and designed for operative connection with a part to be driven, of a nut having screw-threaded engagement with the shaft and having interlocking engagement with the end of said sleeve, and braking and locking means cooperating with
said nut and controlled by the momentum or load of the driven part acting through said pinion in either direction, combined with a brake for arresting the driven shaft.

14. The combination with a driving shaft and a pinion driven by said shaft and capable of relative rotation thereto, of friction means operatively connected with said pinion and shaft and arranged to be acted upon by the momentum or reversal of the load acting through said pinion in either direction to arrest said load, and a ring-like sheave operatively connected with said load and having an internal driving surface frictionally engaged with said pinion, for the purpose set forth.

15. The combination with a driving shaft and a gear mounted on said shaft and capable of relative rotation thereto and designed to be operatively connected with a load to be driven, of a nut having screw-threaded engagement with the shaft and operatively connected with the gear, and means cooperating with the nut and acted upon by the momentum or reversal of the load, acting through said gear, to arrest the load in either direction.

16. The combination with a driving shaft and a gear having an elongated sleeve mounted on the shaft and designed for operative connection with the load to be driven, of means operatively connected with the end of said sleeve and acted upon by the momentum or reversal of the load in either direction, acting through said pinion, to arrest the load.

17. The combination with a driving shaft and a pinion mounted on the shaft having an elongated sleeve and designed for operative connection with a load to be driven, of a nut having screw-threaded engagement with said shaft and interlocked with said sleeve, locking rings surrounding the shaft, means for locking said rings from rotation in one direction while permitting free rotation thereof in the other direction, one ring rotating in a direction opposite from the other, and braking elements between each locking ring and the nut, the braking elements of each group being fixed in part to and rotating with the nut and associated ring, respectively.

In testimony, that I claim the foregoing as my invention I affix my signature in presence of two witnesses, this 10th day of July A. D. 1809.

THADDEUS W. HEERMANS.

Witnesses:

George R. Wilkins,
A. M. Burr.