(No Model.) 3 Sheets—Sheet 1.

G. DRYDEN.

Governor and Safety Appliance to Elevators.

No. 233,841. **Patented Nov. 2, 1880.**

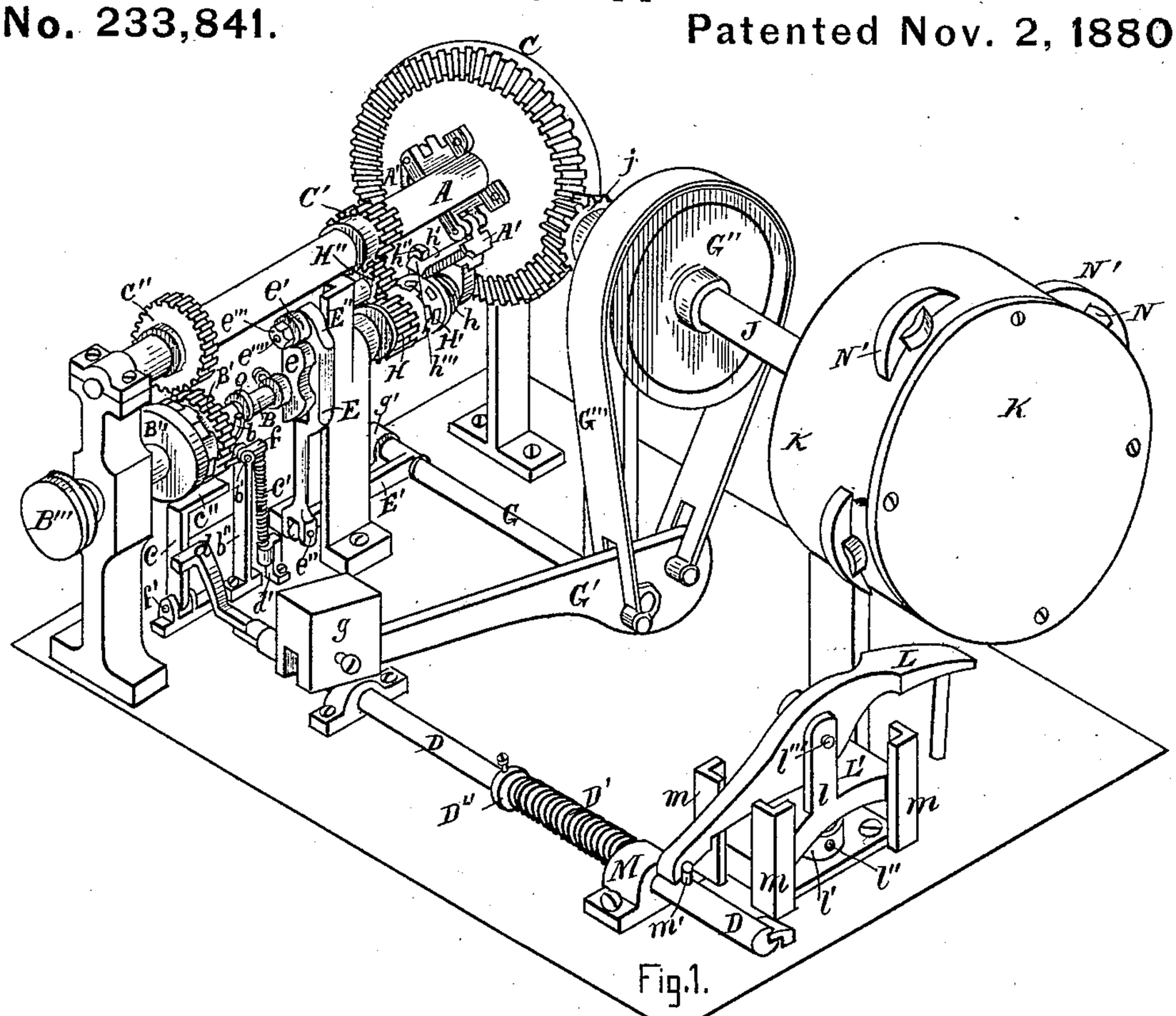

Fig. 1.

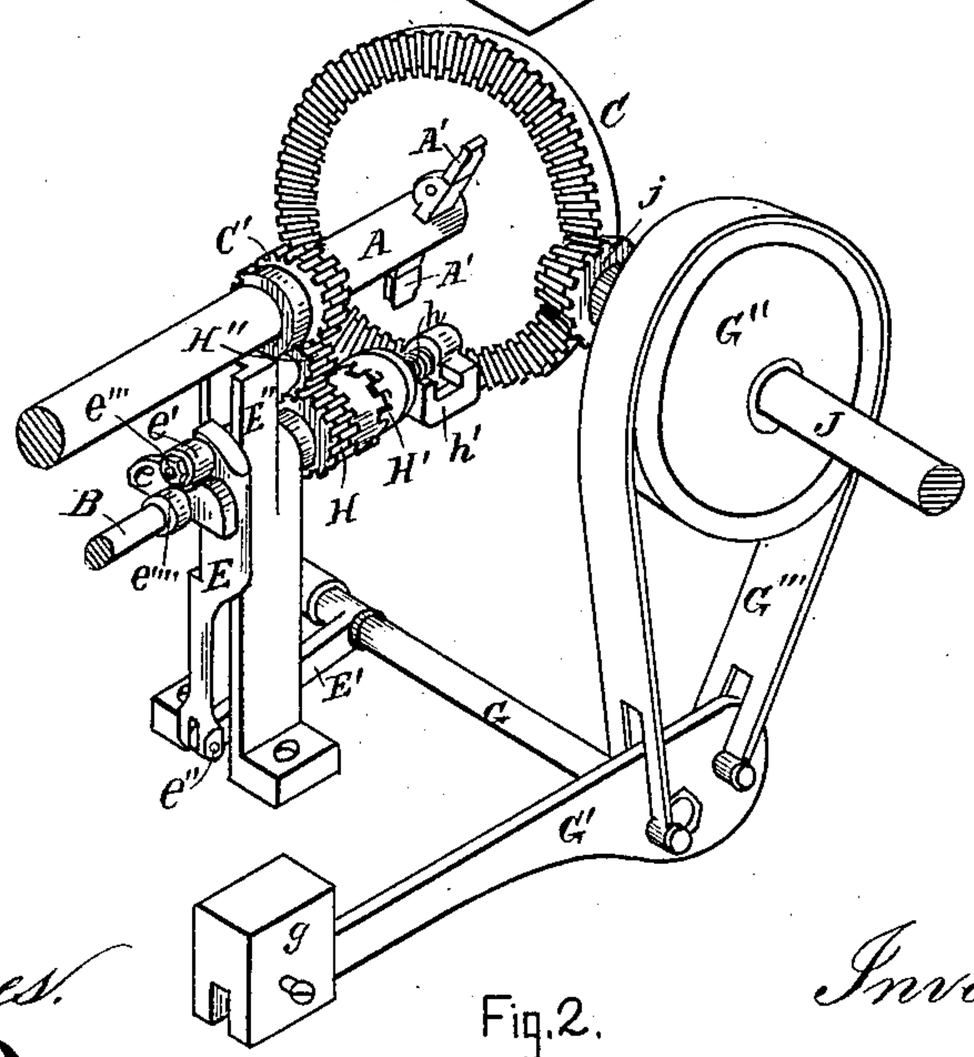

Fig. 2.

Witnesses.

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(No Model.) 3 Sheets—Sheet 2.

G. DRYDEN.

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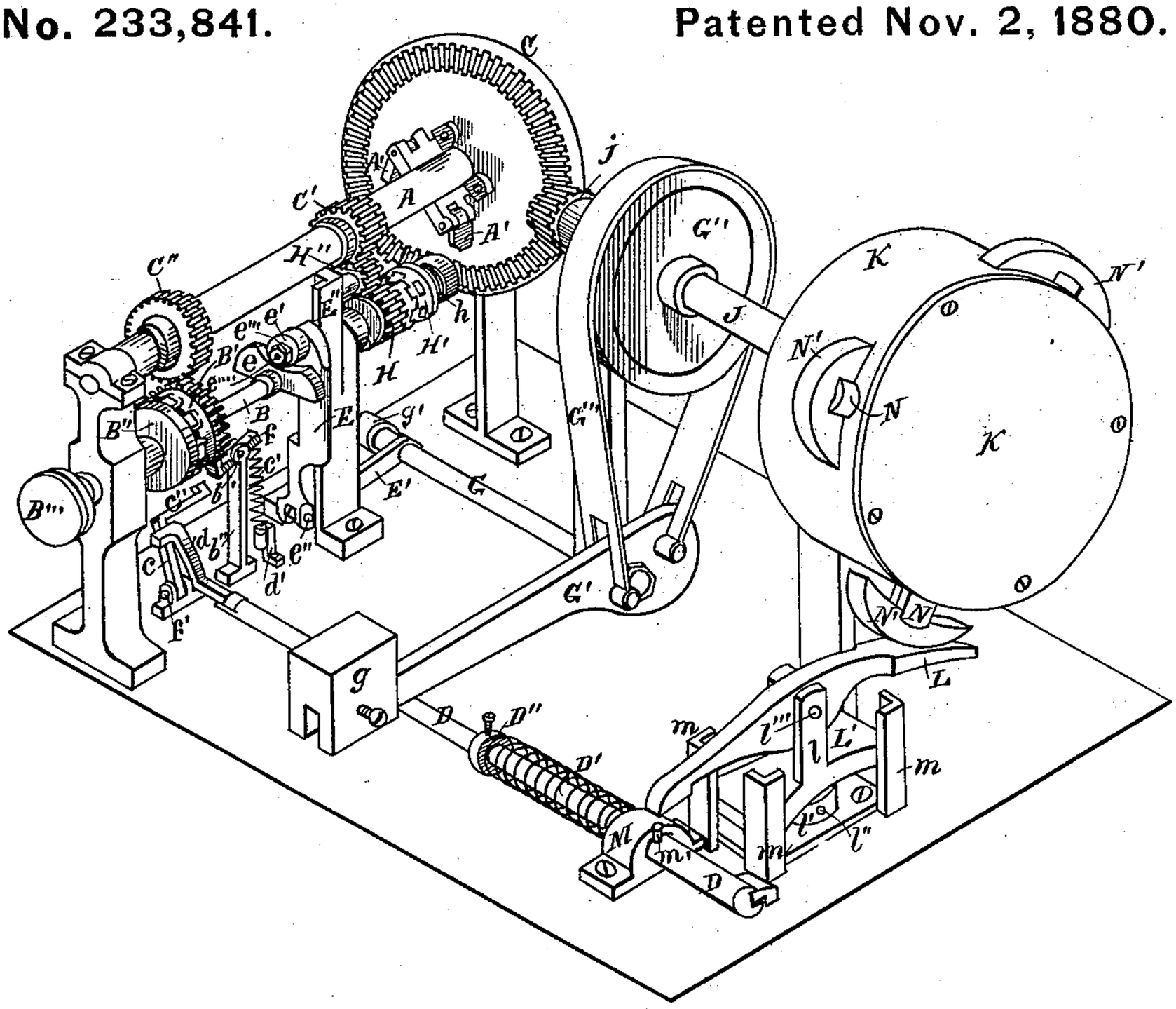

Fig. 3.

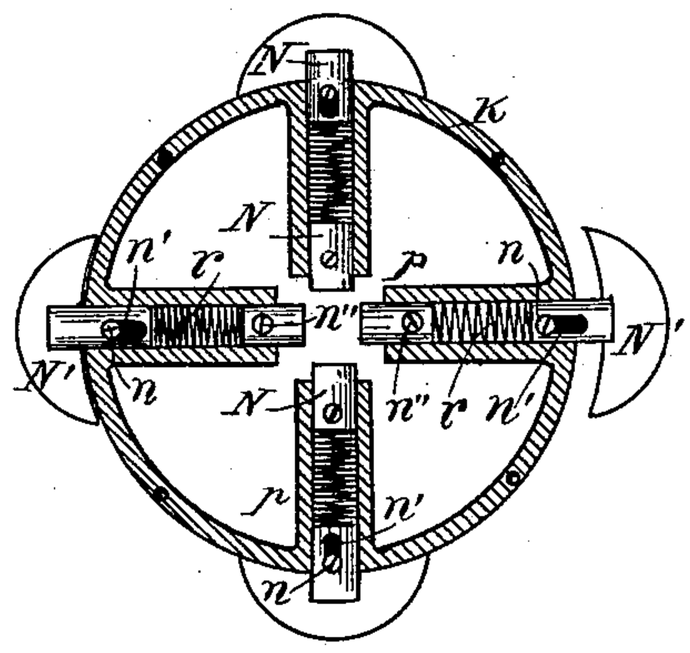

Fig. 4.

Witnesses.
Chas. Allen Taber.
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(No Model.) 3 Sheets—Sheet 3.

G. DRYDEN.

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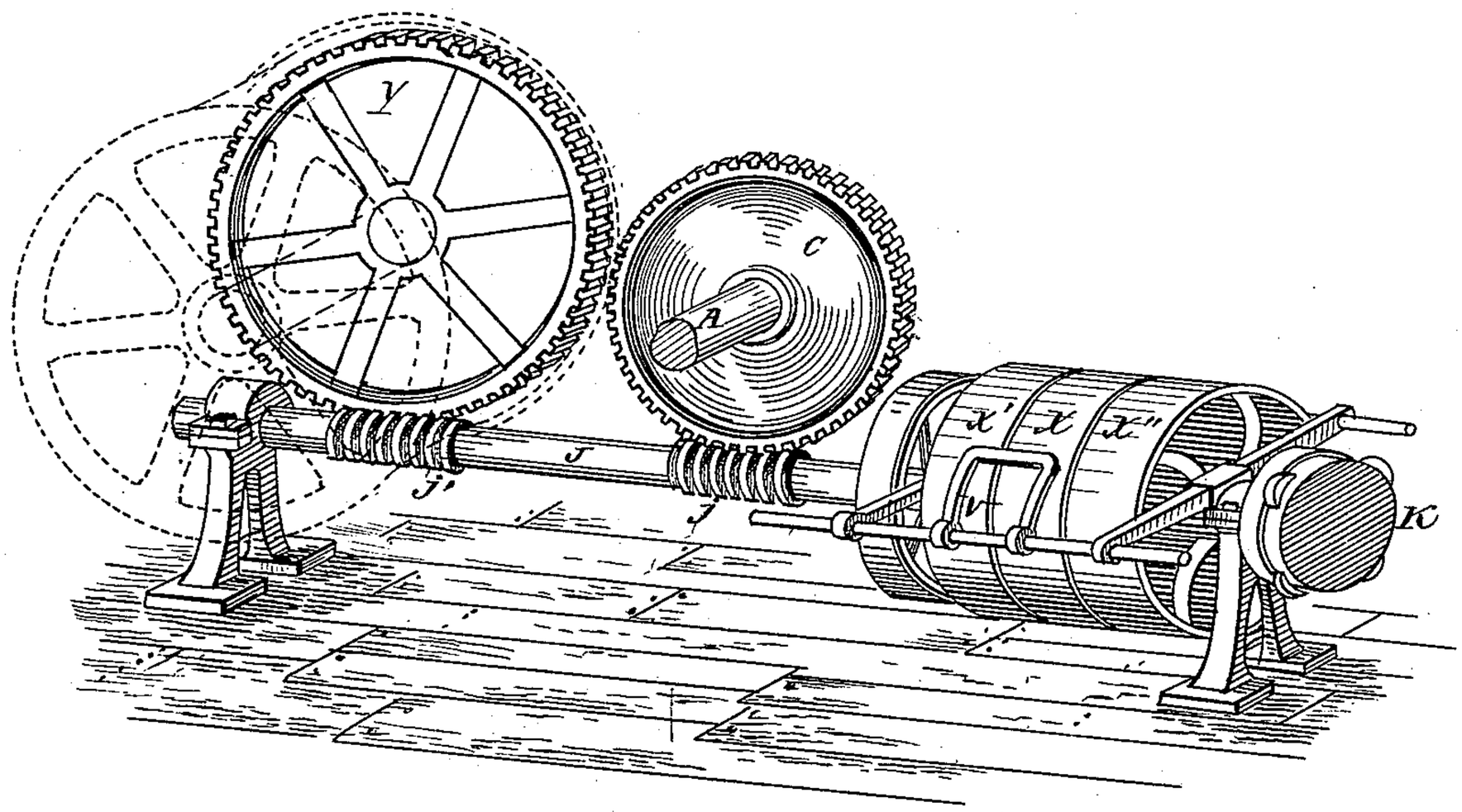

Fig.5.

Witnesses.

Chas. Allen Taber.

Francis C. Brightwell

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UNITED STATES PATENT OFFICE.

GEORGE DRYDEN, OF BOSTON, MASSACHUSETTS.

GOVERNOR AND SAFETY APPLIANCE TO ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 233,841, dated November 2, 1880.

Application filed June 21, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEORGE DRYDEN, of the city of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Governors and Safety Appliances to Elevators, which I will proceed to describe as follows, reference being made to the accompanying drawings, which form a part of this specification, like letters indicating like parts in the different figures thereof.

Figure 1 of the drawings shows my invention all set, and as it appears when the elevator is in motion. Fig. 2 shows the part of the safety appliance that operates to prevent the elevator from falling (when said elevator is on its upward trip) shut, and the brake on. Fig. 3 shows the part of the safety appliance just referred to set or open, as in Fig. 1, except that in this case the cam-shaft B is turned as when the elevator is on its downward course, bringing the angle-arm *h'* underneath said cam-shaft, instead of above it, as in Fig. 1; but this figure shows the condition of the machine when the elevator has started to fall while on its downward course and has been prevented from impending accident. There is also shown in this figure and in Fig. 1 the adjustable standard, to be hereinafter more fully described. Fig. 4 shows a sectional view of the casing K and longitudinal sections of the tubes *p*, placed therein, thereby exhibiting the spiral governing-springs and elongated slots, to be hereinafter fully described. Fig. 5 is purely illustrative and for the purpose of showing fully the application of this invention to elevating machinery. The only new part shown in this figure is the casing K, containing the tubes and spiral springs mentioned above.

The worm-shaft J and gear C are seen in Figs. 1, 2, and 3. The fast belt-pulley *x*, the loose belt-pulleys *x'* and *x''*, with belt-guide *v*, the left and right worms *j* and *j'*, respectively, the worm-shaft J, the drum Y, over which the cable which holds the elevator winds, and the gear C are all old and in use now in connection with elevating machinery.

My invention consists in an improvement upon the device described and claimed in Letters Patent numbered 220,709, granted to me and dated October 21, 1879, for an improvement in governors and safety appliances to elevators.

This improvement embraces—

First, pawls placed upon the gear-shaft of elevating machinery in such a manner that when any part of the connection between the source of power and the worm-shaft shall break when the elevator is on its upward trip, causing the reversing of the elevating machinery and the consequent falling of the car, one of said pawls will strike an arm placed upon the cam-shaft, throwing said arm from its position, and thus relieving a spring which is placed upon the cam-shaft, by which means a clutch-gear is set, the cam-shaft is turned partly around, dropping a weight and setting the same brake that is set when the person running the elevator-car stops the car by pulling his cord.

Secondly, in an improved construction and combination of devices by which another clutch-gear is set, the cam-shaft turned partly around, the same weight dropped and the same brake set as when the car falls while on its upward trip, though this part of my device is for preventing the elevator from falling while on its downward course, the accident being caused, however, by substantially the same circumstances as above described. This part of my device is operated, however, by the expansion of spiral springs placed upon the worm-shaft and spreading by means of increased centrifugal force caused by the increased speed of the worm-shaft attendant upon the falling of the elevator, the principle of which is the same as described in my former patent above referred to; but I have made an improvement in the construction and arrangement of said spiral springs as regards the rods in which they are inserted, each of said rods having an elongated slot therein, with a pin passing through said slot, giving the spiral spring plenty of room for play, but yet preventing a shoe from flying out of place in case of the breaking of one of said springs, as will be hereinafter fully set forth.

Thirdly, the plate over which the shoes pass in the course of their revolutions upon the worm-shaft is placed upon an adjustable instead of upon the fixed standard described and

shown in my former patent above referred to, so that the governor may be readjusted when necessary without stopping the machinery. This device accomplishes the same result accomplished by the invention described and shown in my former patent—viz., protection of life and property from the falling of elevators caused by the breaking of the connection between the source of power and the elevating machinery.

I will proceed to describe the construction in detail of my improved device, its application to elevating machinery, and its practical operation, as follows:

J represents the worm-shaft, upon which are the belt-pulleys x, x', and x''. (Shown in Fig. 5.) The two loose pulleys x' and x'' are for the purpose of shifting the up and down belts respectively from the fast pulley x when the elevator is to be stopped, in the ordinary and well-known manner. By said up and down belts passed over said pulleys the worm-shaft is connected with the source of power.

The left worm, j, meshes into the gear C, which gear being made fast to the end of the gear-shaft A, said gear-shaft of course revolves when the elevating machinery is in motion. The left worm, j, is shown in Figs. 1, 2, and 3, and appears also in Fig. 5; but in the latter figure the gear-shaft A is seen broken off and the cam-shaft B does not appear.

The pawls A′ are made fast to the face of the gear C, the standards or frames thereof being arranged over and upon the gear-shaft A in the manner shown in Figs. 1, 2, and 3 of the drawings.

Upon the cam or reversing shaft B is the angle-arm h', one end of which is made fast to said cam-shaft and with the trip h''' at the opposite end. Encircling the cam-shaft B is the spiral spring h, and upon the clutch H′ is the catch h''. Said clutch H′ is placed over and upon the cam-shaft B, said cam-shaft having an elongated slot cut therein longitudinally, while a key is fastened in the inside of the clutch H′ in such a manner as to run in said elongated slot. By this arrangement it will be readily seen that said clutch will move with the cam-shaft when said shaft revolves, but will also move upon the cam-shaft longitudinally of said shaft. The clutch-gear H is loose upon the cam-shaft, and by means of the connecting-gear H″ said gear H is moved by and from the gear C′, which gear is made fast to and revolves with the gear-shaft A.

When the appliance is set to allow the elevating machinery to run, the clutch H′ is forced back longitudinally on the cam-shaft B, thus contracting the spring h, and said clutch is held, after being thus forced back, by the locking of the trip h''' with the catch h'', as shown in Fig. 1.

One end of the rocker-shaft G is held at the point g', and at the opposite end of said rocker-shaft is the lever G′, with the weight g attached to the end thereof, and upon this lever are fastened the two ends of the band-brake G‴, which brake passes over the periphery of the pulley G″, said pulley being made fast to the worm-shaft J. Attached to said rocker-shaft is the rocker-arm E′, the opposite end of said arm being held to the vertical beam E by the pivot e''. Connected with the upper end of said vertical beam is the friction-wheel e', said friction-wheel being placed upon a small shaft, e'''', which shaft passes through said wheel and in turn through the upper end of said vertical beam E. The inner end of this shaft moves up and down in the guide-standard E″ with the turning of the cam-shaft B and consequent turning of the cam e.

The friction-wheel e' is held upon the shaft e'''' by means of the nut e'''. The end of said shaft e'''' is shown in Fig. 1. The cam e is held upon the cam-shaft B in the manner shown in Figs. 1, 2, and 3 of the drawings—that is, said cam e is keyed onto the cam-shaft B.

Having described the construction of that part of my safety appliance which operates to stop a falling elevator when said elevator is on its upward course and the application of the same to elevating machinery, I will now proceed to describe its operation.

When an elevator on its upward course commences to fall on account of the breaking of the connection between the source of power and the worm-shaft, the drum Y, over which passes the cable that holds the elevator, of course reverses and turns in the opposite direction, the drum being connected with the worm-shaft J by means of the worm j', which worm meshes into the gearing of the drum, as seen in Fig. 5, and the worm j meshing into the gear C, as also shown in the same figure, it is obvious, from an examination of the drawings, that when the drum Y is reversed the entire system of elevating machinery is reversed and the elevator begins to fall.

When the elevator is going up the gear-shaft A is turning toward the casing K, and the pawls A′ drop upon and pass over the angle-arm h' as the gear-shaft revolves; but when the elevator begins to fall and the drum reverses its revolution the worm-shaft J, and with it the gear C and gear-shaft A, of course reverse. The pawl that first comes around strikes the angle-arm h' on the side thereof, as the pawl of course cannot pass over said angle-arm after the gear-shaft A has reversed its revolution. Said pawl A′ strikes the angle-iron h', forces it forward, removing the trip h''' from the catch h''. The spiral spring h is relieved and pushes the clutch H′ against the moving clutch-gear H. Then, as is obvious, said clutch-gear turns the clutch H′, and thus turns the cam-shaft B, turning the cam e from under the friction-wheel e'. Said friction-wheel falls, carries with it the vertical beam E, and in turn the end of the rocker-arm E′. Where said rocker-arm is joined to said vertical beam the rocker-shaft G is turned, lowering the lever G′ and weight g, setting the band-brake G‴ upon

the periphery of the pulley G″, and said pulley being made fast to the worm-shaft J, said worm-shaft is stopped and the entire elevating machinery is locked and held fast.

The cord by which the elevating machinery is controlled by the person running the elevator passes over the pulley B‴, the periphery of said pulley being grooved to hold the cord, so that this device does automatically what the attendant of the elevator does when he pulls the cord and turns the cam-shaft—namely, sets the brake, as before described, and stops the machinery. Fig. 2 shows fully the condition and position of this part of my device after the operation just described is completed.

More than two pawls can be placed upon the gear-shaft, if desired, and in that event, as is obvious, the machinery would be stopped even quicker in case of accident, the revolution of the gear-shaft being stopped more promptly.

The construction, application, and operation of the part of my invention employed to prevent the falling of the elevator by the breaking of the connection between the source of power and the worm-shaft when the elevator is on its downward course, I will describe as follows: The gear C″ is made fast to the gear-shaft A, and carries the clutch-gear B′, which clutch-gear is placed over and upon the cam-shaft B, revolving, however, independently of said cam-shaft. The clutch B″ is made fast to the cam-shaft. Placed upon the standard *d′* is the vertical spiral spring *c′*, upon the upper end of which is the lever *f*, and placed upon the end of said lever is the shoe *b*. The lever *f* is held in the end of the standard *b″* by means of the pivot *b′*, said pivot forming the fulcrum of said lever *f*. The rocker-arm *c* moves upon the pivot *f′*, and when the appliance is set to admit of the running of the elevator the spring *c′* is pressed down, as shown in Fig. 1, the opposite end of the lever *f* is raised thereby, and the angle-arm *c″* of the rocker-arm *c* is placed under the end of the lever *f*, as is also shown in Fig. 1. Back of the clutch-gear B′, and cast in the same piece with it, is a collar, *o*, which collar furnishes a bearing for the shoe *b*, which is necessary in drawing the clutch-gear B′ back and holding said clutch-gear in place when the appliance is set to allow the elevating machinery to move.

D represents a shaft with the angle-arm *d* at one end thereof, said shaft being encircled by the spiral spring D′, as shown in Figs. 1 and 3. Upon this shaft D is the trip *m′*.

Fig. 4 of the drawings shows a sectional view of the tubes *p* and the springs *r*, which springs are held within the divided rods N, being inserted therein. Thus far the portion of my invention shown in Fig. 4 is like that described in my former patent hereinbefore referred to; but the improvement in this invention consists in the arrangement of the elongated slots *n′* and the pins *n* with screw-heads, and a thread at the opposite end thereof, with a corresponding thread in the tube *p*, to hold said pins firmly therein. The set-screws *n″* are used to hold the rods N firmly within the tubes *p*. The shoes N′ are the same as are described and shown in my former patent.

In case of the breaking of one of the springs *r* the shoe N′ and piece of the divided rod N attached thereto cannot fly out, being held by the pin *n* in the slot *n′*. Then said slot, being elongated, gives ample play to the spring *r* to admit of the shoe N′ striking the plate L in case of unduly-increased speed of the worm-shaft, while in the device described and shown in my former patent, if one of the springs *r* were to break, one-half of the divided rod N and the shoe N′ would fly out and possibly do injury. Then in my former device the set-screws holding the divided rods in place must be loosened whenever the governor is to be readjusted to accommodate a variation of speed of the worm-shaft, and this necessitates the stopping of the machinery; but in this device the readjustment is accomplished by moving the adjustable standard up and down, according to the description hereinafter given, which can be done without stopping the machinery.

One of the shoes N′ in Fig. 4 is shown thrown out by the expansion of the spring *r*, as at the instant when the elevating machinery is stopped, and the other three springs are seen in their normal position while the machinery is running.

The improvement in the standard L′ consists in making said standard adjustable, while the standard described and shown in my former patent was fixed. The standard is adjusted by a screw in a manner similar to that adopted in the so-called "jacks" used in raising buildings. The outside of said screw device is shown by *l′* in Fig. 1, and *l″* shows one of the openings in which the end of a rod is placed to turn said screw. In this manner the adjustable standard L′ is moved up and down in the guides *m*, to bring the face of the plate L at the exact distance from the faces of the shoes N′ as they pass required by the rate of speed at which it is desired the worm-shaft should revolve.

The plate L is a lever, with the pivot *l‴* as the fulcrum, as is fully shown in Figs. 1 and 3.

Figs. 1 and 3 show four shoes, N′, and Fig. 4 shows the four springs and divided rods belonging thereto, while my former patent showed but two such shoes; but I do not claim this particular feature as any part of this invention, it being obvious that with double the number of shoes the elevator, in case it should fall, would be stopped in half the time required when but two shoes are used.

The casing K does not of necessity form a part of this device, but is of use to protect the tubes *p* from dust, and more especially to give a finished appearance to the end of the worm-shaft; but when said casing is used it enters into the combination employed for

stopping an elevator in case it falls when on its downward course—that is to say, it enters into said combination if the tubes *p* are arranged in the best manner, which is to insert said tubes into the rim of the casing K, as shown in Fig. 4, and make them fast therein. Now, this casing K is made fast to the end of the worm-shaft J, as shown in Figs. 1 and 3, the end of said worm-shaft being inserted into the side of said casing exactly at the center thereof, so that the casing revolves upon and by the worm-shaft J. Now, if the tubes *p* are inserted in the rim of the casing K and made fast therein, as described, the springs *r* in the tubes *p* will feel the revolutions of the worm-shaft transmitted through the medium of said casing, for in this construction the tubes *p* will not be attached directly to the worm-shaft. So in this method of construction the casing K is of practical use. The ends of the tubes *p* opposite to the shoes N′, however, may be attached to the end of the worm-shaft, and thus the springs *r* will be made to feel the revolutions of said worm-shaft directly, which is the form of construction in my former patent before referred to. In this construction the casing K is, of course, of no practical use; but I regard the first-described method of construction as the better.

From the description of the rods N, with the elongated slots *n′*, and of the adjustable standard L′, and from an examination of the drawings, it is obvious that the governor can be easily readjusted without stopping the machinery by turning with a rod the screw *l′*, and in this consists one of my most important improvements over the device described and shown in my former patent before referred to.

The operation of this the part of my invention by which an elevator is prevented from falling while on its downward trip I will describe as follows: The collar D″ is made fast upon the shaft D, the shoe M being held stationary by screws, as shown in Figs. 1 and 3, so that said shoe forms a bearing for the spring D′ when said spring is contracted. I contract the spring D′ by pressing upon the collar D″, which pressing moves the shaft D back at the same time until I am able to place the end of the lever-plate L against the trip *m′*, as shown in Fig. 1. Of course, at the same time the opposite end of said lever-plate is raised. I have now moved the shaft D so that the angle-arm *d* does not touch the rocker-arm *c*. I adjust the standard L′ so that as the worm-shaft revolves at the desired speed the shoes N′ will pass over the face of the plate L, passing just as near to said plate as possible without hitting. Now, then, if the connection between the source of power and the worm-shaft breaks while the elevator is on its downward trip, the weight of the falling elevator of course increases its speed as it descends, and in turn increases the speed of the revolutions of the drum over which the cable that holds the elevator is carried, and said drum being connected with the worm-shaft J, by means of the worm *j′*, the speed of the worm-shaft is of course increased thereby, and the increased centrifugal force produced by the increased speed of the worm-shaft expands the spiral springs *r*, and one of the shoes N′ strikes the lever-plate L, lifting the opposite end of said lever-plate from its position against the trip *m′*, thus relieving the spring D′, allowing the shaft D to move forward, so that the angle-arm *d* strikes the rocker-arm *c*, and the angle-arm *c″* is removed from under the lever *f*, allowing the end thereof to drop, and of course raising the opposite end of said lever.

It is obvious that this movement is accomplished suddenly, because of the spring *c′*, which is relieved when the lever *f* moves, as described. The clutch-gear B′ is forced against the clutch B″ by the shoe *b*, which shoe is attached to lever *f*, as before described; the cam-shaft B is turned thereby; the friction-wheel *e′* drops upon the turning of the cam *e*. The movements of the vertical beam E, the rocker-arm E′, the rocker-shaft G, and the lever G′ are the same as when the stop is effected by means of the pawls, when the elevator falls while going up, and the same band-brake G‴ is set. The positions of the different parts of the device at this point are fully shown in Fig. 3.

The gear C″, the clutch-gear B′, and the clutch B″ form a part of the well-known "automatic" used to stop the elevating machinery by turning the cam-shaft, and thus shifting the belt, when the elevator-car arrives at either the top or bottom of the building, or at either end of its course.

Upon examination of the drawings it is obvious that when the cam-shaft B is turned to admit of the downward trip of the elevator the angle-arm *h′* is turned under the cam-shaft B, so that the pawls A′ revolve without touching anything in their course.

I have intentionally repeated portions of the description which form a part of the patent hereinbefore cited, for the purpose of showing more fully than I could otherwise have shown the exact relation of this invention to elevating machinery, its application thereto, and for the purpose of showing fully wherein this invention is an improvement upon the device described and claimed in my former patent herein cited.

Having fully described my invention, its application to elevating machinery, and its operation, what I claim as new, and desire to secure by Letters Patent, is—

1. The mode of setting the brake and stopping the revolutions of the worm-shaft, when the connection between said worm-shaft and the source of power breaks while the elevator is on its upward trip, substantially as described and shown, and for the purpose set forth.

2. The combination of the spiral springs *r*, the tubes *p*, the shoes N′, and the divided rods N, with elongated slots *n′* and pin-screws *n*,

with a governor and safety appliance to elevators, constructed and arranged substantially in the manner and for the purpose described.

3. The combination of the adjustable standard L′, with lever-plate L, arranged as described, with the shoes N′, the spiral springs *r*, the tubes *p*, and the rods N, with elongated slots *n′* and pin-screws *n*, forming a governor, substantially in the manner and for the purpose described.

4. In combination, the gear-shaft A, the pawls A′, the angle-arm *h′*, with trip *h‴*, the spring *h*, the clutch H′, with catch *h″*, the clutch-gear H, the gear H″, the gear C′, the cam-shaft B, the cam *e*, the friction-wheel *e′*, the shaft *e‴′*, with nut *e‴*, the guide-standard E″, the vertical beam E, with pivot *e″*, the rocker-arm E′, the rocker-shaft G, the gear C, the worm-shaft J, with the left and right worms *j* and *j′*, respectively, and with the fast pulley G″, the lever G′, with weight *g*, and the band-brake G‴, all constructed and arranged substantially in the manner described and shown, and for the purpose specified.

5. In combination, the divided rods N, with elongated slots *n′*, pin-screws *n*, and set-screws *n″*, the spiral springs *r*, inserted in said divided rods, the tubes *p*, the shoes N′, the casing K, the adjustable standard L′, the lever-plate L, fulcrum *l‴*, standard *l*, screw *l′*, with openings *l″* and guides *m*, the shaft D, with collar D″ and bearing M, the spring D′, the angle-arm *d*, the rocker-arm *c*, with pivot *f′* and angle-arm *c″*, the lever *f*, with pivot *b′* and shoe *b*, the spring *c′*, the standard *d′*, the clutch B″, the clutch-gear B′, with collar *o*, the gear-shaft A, the gear C″, the cam-shaft B, the cam *e*, the friction-wheel *e′*, the shaft *e‴′*, the nut *e‴*, the guide-standard E″, the vertical beam E, the rocker-arm E′, the pivot *e″*, the rocker-shaft G, the lever G′, with weight *g*, the gear C, the worm-shaft J, with left and right worms *j* and *j′*, respectively, and with the fast pulley G″ and the band-brake G‴, all constructed and arranged substantially in the manner described and shown, and for the purpose specified.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORGE DRYDEN.

Witnesses:

CHAS. ALLEN TABER,

FRANCIS M. BOUTWELL.