(No Model.) 4 Sheets—Sheet 1.

Q. N. EVANS & W. SCHWANHAUSSER.

ELEVATOR CONTROLLING DEVICE.

No. 378,045. Patented Feb. 14, 1888.

Fig. 1

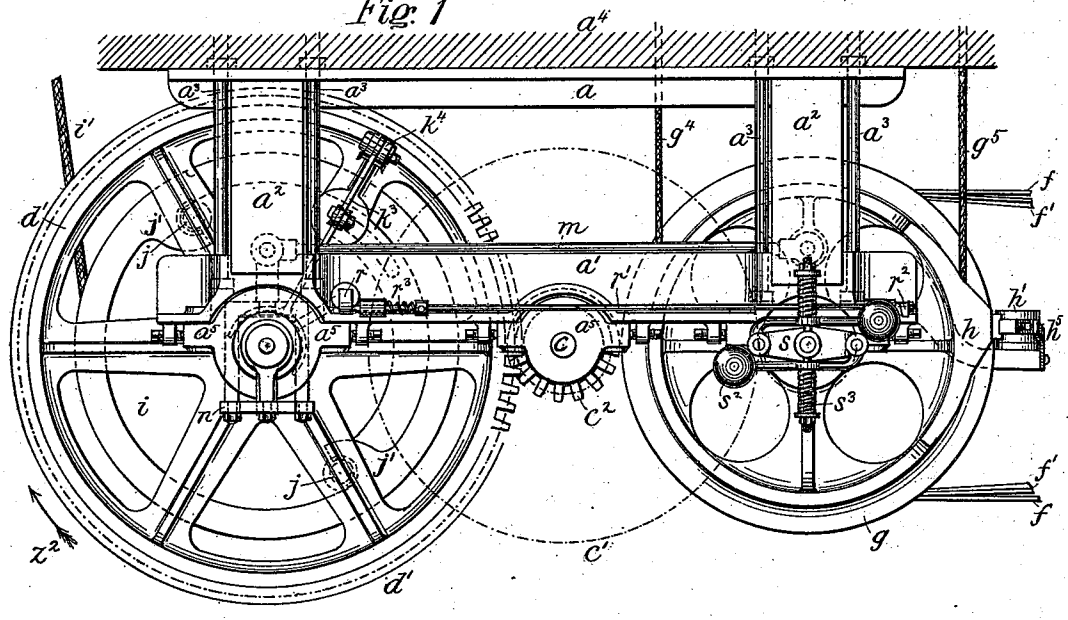
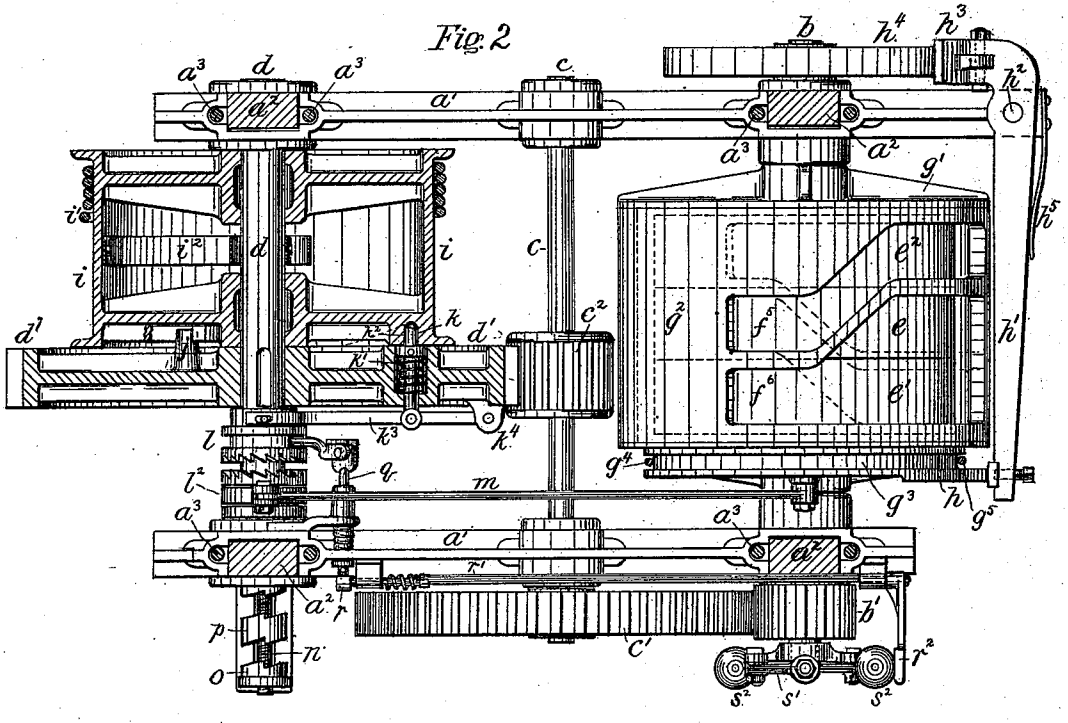


Fig. 2



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(No Model.) 4 Sheets—Sheet 2.

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Fig. 7

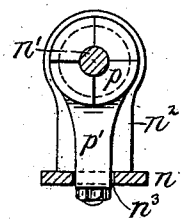


Fig. 9

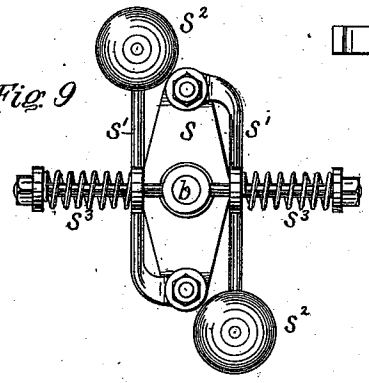


Fig. 8

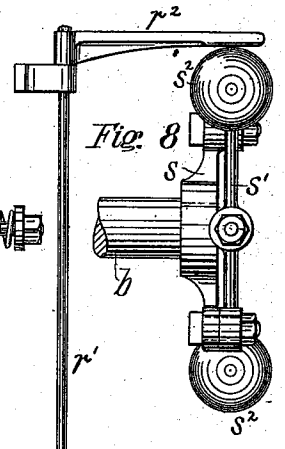


Fig. 6

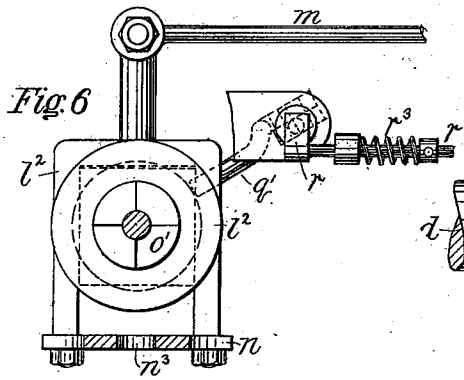


Fig. 5

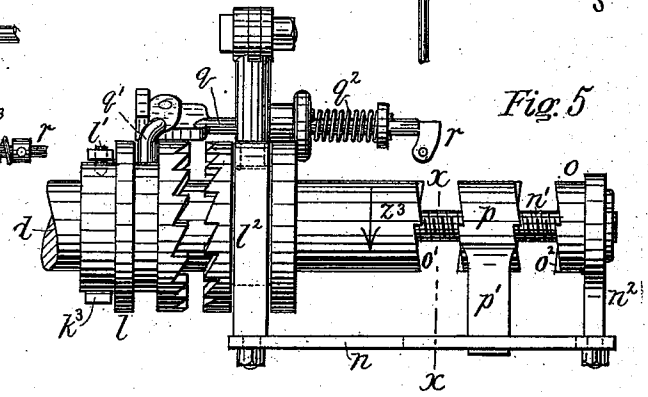


Fig. 4

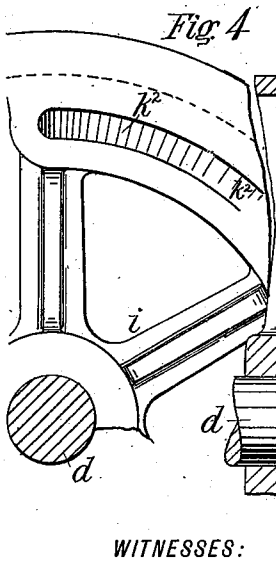
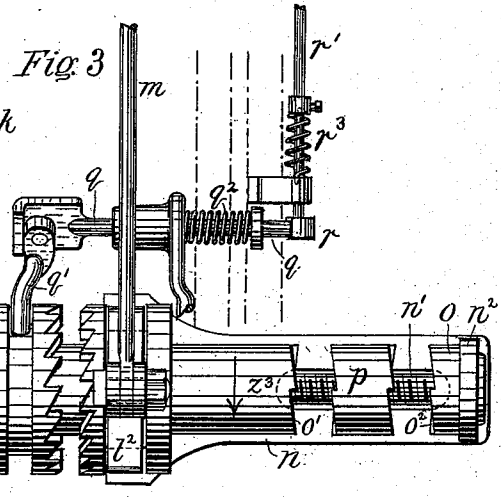


Fig. 3



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(No Model.) 4 Sheets—Sheet 3.

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Fig. 10

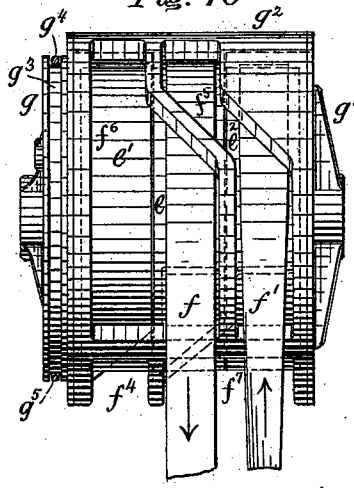

Fig. 11

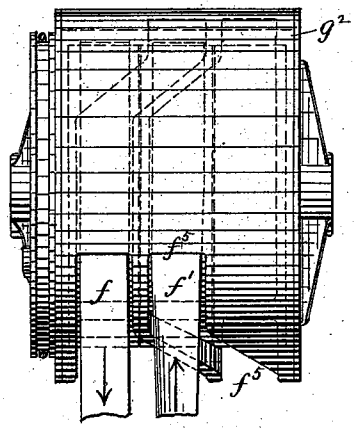

Fig. 12

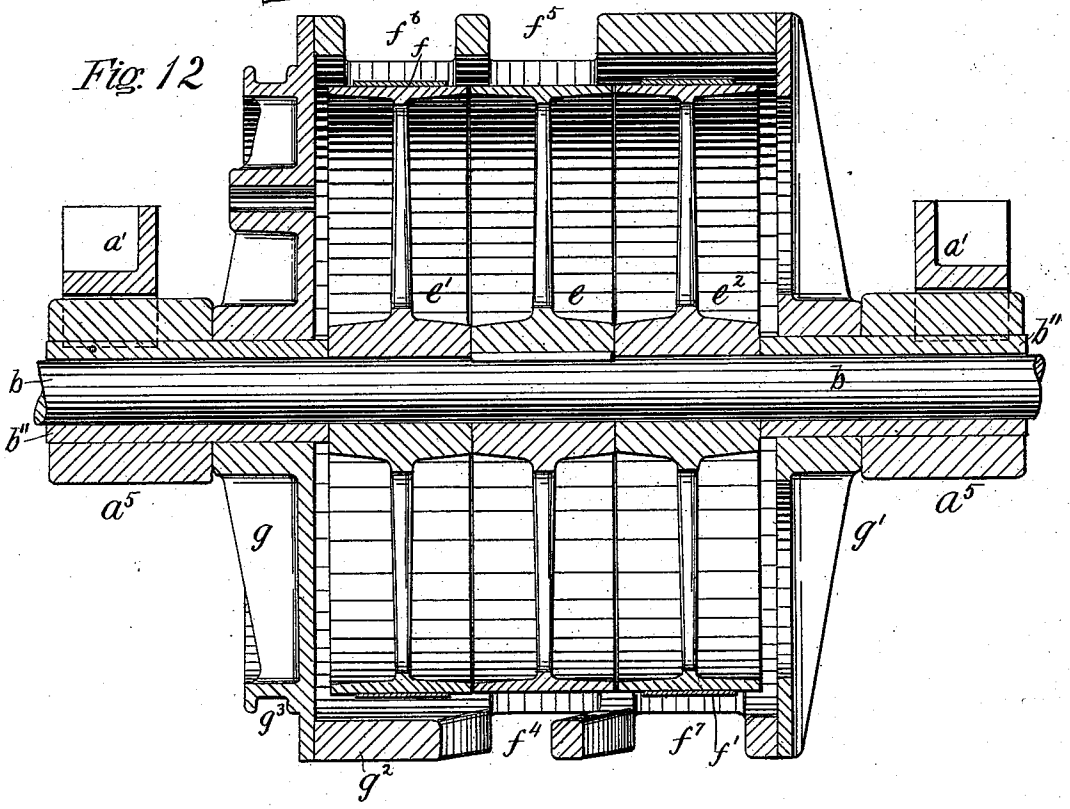

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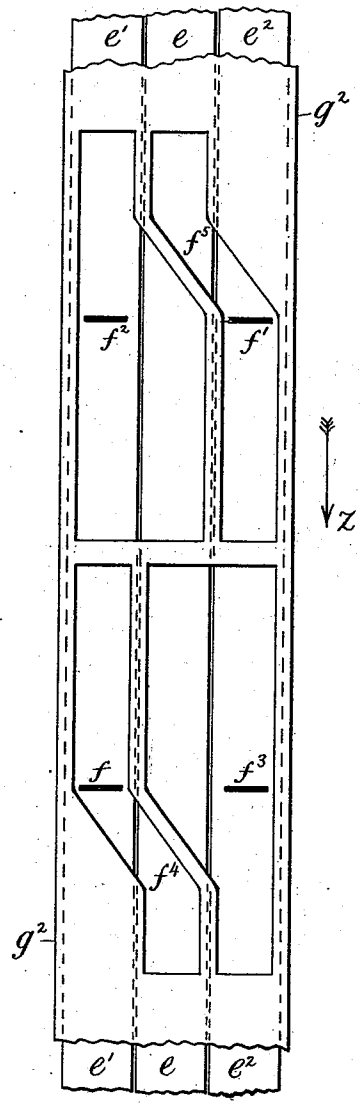
Fig. 13



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UNITED STATES PATENT OFFICE.

QUIMBY N. EVANS AND WILLIAM SCHWANHAUSSER, OF BROOKLYN, NEW YORK.

ELEVATOR-CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 378,045, dated February 14, 1888.

Application filed September 19, 1887. Serial No. 250,053. (No model.)

To all whom it may concern:

Be it known that we, QUIMBY N. EVANS and WILLIAM SCHWANHAUSSER, both citizens of the United States, and residents of Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Elevators, of which the following is a specification.

This invention relates to that class of elevators in which motion is transmitted from the source of power to the elevator by means of driving-belts; and it has for its object to increase their efficiency by providing them with improved controlling devices whereby their operation is made more secure.

Our improvements in elevators consist of, first, a slack-cable stop constructed and operated to automatically move the operating-belt off the fast pulley and apply the brake to the driving-shaft when anything arises to cause the cable-drum to move faster than the cable being paid off therefrom; second, a new form of automatic stop-motion arranged to automatically stop the elevator mechanism when the elevator-car reaches its prescribed limits of travel; third, a speed-controlling device of improved construction, which instantly causes the driving-belt to be shifted and the brake applied when the speed of the elevator-car becomes excessive; fourth, an improved belt-controlling device consisting of inclined slotted guides arranged concentric with the pulleys, holding the reversely-acting belts on their respective loose pulleys and adapted to be partly rotated, so as to positively throw either of the belts onto the fast pulley without disturbing the other one. This rotary-belt-shifter forms a part of and acts with the slack-cable stop, the automatic stop-motion, and the speed-controlling device.

The invention also embraces other minor novel features of construction, which will be described in the following explanation of the salient features, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of our improvement in belt-power elevators. Fig. 2 is a plan view showing some of the parts in section. Fig. 3 is an enlarged plan view of the automatic stop-movement and slack-cable stop. Fig. 4 is an end view of part of the cable-drum. Fig. 5 is a side elevation of the automatic stop-movement. Figs. 6 and 7 are sectional views of the same cut on the line x x, Fig. 5, looking in opposite directions. Figs. 8 and 9 are respectively plan and end views of the governor. Figs. 10 and 11 are views of the rotary belt-shifter, showing it in two of its positions. Fig. 12 is an enlarged longitudinal vertical section of the belt-shifter, showing it in position to hold the belts on their loose pulleys; and Fig. 13 is a diagram giving the development of the belt-shifter.

The frame is composed of the top plate, a, which is placed against the ceiling, the lower side pieces, a' a', of cast-iron, the four struts of wood, a^2 a^2, arranged between the plate a and the side pieces, a' a', and the tie-bolts a^3 a^3, which bind the plate a, pieces a' a', and wooden struts a^2 a^2 rigidly together. These bolts a^3 a^3 may be prolonged so as to pass through the timber or beam a^4 of the ceiling, thereby providing means for securing the machine in position.

By making the compound frame, as shown, of iron and wood, a certain amount of flexibility is imparted thereto, and it is stronger and offers greater resistance to sudden shocks than frames made wholly of iron. Between screw-lugs in the under sides of the side pieces, a' a', are held bearings a^5 a^5, in which are fitted to rotate three parallel shafts, b, c, and d. These shafts are connected by the pinion b', secured on the driving-shaft b, meshing into the wheel c' on the end of the intermediate shaft, c, (shown by a dotted circle in Fig. 1,) and the pinion c^2, also on the shaft c, meshing into the gear-wheel d', keyed on the main or drum shaft d.

Our new belt-shifter comprises slotted inclined guides constructed to rotate concentrically with three pulleys carried by the shaft b, the center one of which, e, is keyed firmly to the shaft b, and the side pulleys, e' and e^2, are fitted to rotate freely on the shaft. This device is shown detached from the machine in Figs. 10, 11, and 12, f and f' representing, respectively, a straight and crossed belt; but a clearer understanding of the operation of the same will be had by referring first to the diagram development, Fig. 13, in which e e' e^2 represent in the flat the peripheries of the

pulleys; the lines f and f' the parts of the straight and crossed belts, respectively, that move toward the pulleys, and the lines f^2 and f^3 the parts of the two belts moving away from the pulleys, and also their relative positions on the pulleys. Under the condition of parts here shown the two belts are represented on their respective loose pulleys, the parts f and f' being within the guide-slots f^4 f^5, which are straight where they extend over the loose pulleys e' e^2 and in line with the peripheries of these pulleys, and are inclined from these straight parts to the parts extending over the fast pulley e. Now, when it is desired to run the elevator ahead, or so as to raise the elevator-car, the guides are moved in the direction indicated by the arrow z, thus throwing the belt f' onto the fast pulley e by the inclined part of the guide f^5, and holding the belt f on its loose pulley by the straight part of the guide f^4 remaining over said belt. By reversing the movement of the guides the belt f' is again thrown over its loose pulley, when the guides assume a central position, and by continuing this movement of the guides the belt f is, by the inclined part of the guide f^4, moved onto the fixed pulley e and the belt f' held on its loose pulley by the straight part of the guide f^5. Thus it is seen that the two belts have a minimum amount of side motion in moving on and off the fast pulley, and that the width of all of the pulleys exceeds but little the width of the belts. The manner adopted by us in applying these inclined guides to a rotary belt-shifter is shown in Figs. 2, 10, 11, and 12, in which g g' are two heads fitted to run loosely on the sleeve-bearings b'' b'' of the shaft b between the loose pulleys e' and e^2 and the bearings a^5, and g^2 a cylindrical shell secured to the heads g and g' and inclosing the pulleys e e' e^2, through which shell are formed the slot-guides f^4 and f^5, corresponding to the similarly-marked slots in the diagram view, Fig. 13, and this shell g is also provided with openings f^6 and f^7, through which the receding parts of the belts f and f' pass without obstruction, in whatever position the shell g^2 may be placed. This shell g^2 affords a protective covering for the pulleys and belts; but it is not essential to the proper working of the rotating guide-slots that the shell should extend around the pulleys, as it is evident that all the requirements of the device will be fulfilled if the shell be cut away, excepting so much of it as is necessary to form the slots f^4 f^5. The head g is provided with a groove, g^3, in which are secured the two parts g^4 and g^5 of the shifting-rope, which pass through or are in close proximity to the elevator-car, thereby providing means for starting, stopping, or reversing the elevator. This rotary belt-shifter is also actuated by automatic governing devices, to be hereinafter described.

The belts f f' are omitted from Fig. 2 to more clearly show the construction of the belt-shifter.

A cam, h, projecting from the side of the head g, Figs. 1 and 2, acts on the end of the long arm of the lever h' when the belt-guides occupy a central position and the two belts f and f' are on their loose pulleys. This lever is pivoted at h^2 to one of the side pieces, a', of the frame, the short arm being provided with a shoe, h^3, arranged to bear on the brake-wheel h^4, secured to the end of the shaft b. The spring h^5 holds the lever against the cam h.

The drum i, upon which the cable i' is wound, is fitted loosely on the shaft d, but is connected thereto by the spring i^2, arranged to act on the drum i to keep the cable i' taut thereon when, from any cause, the cable tends to become slack during the operation of the elevator. The cable-drum is carried around with the wheel d' by means of the two studs j j, projecting from the side of the wheel and catching against the lugs j' j', formed internally on the flange of the drum, said studs and lugs being normally held in contact by the weight of the car carried by the cable i'.

The slack-cable stop comprises the pin k, fitted with the spring k' in a recessed hole formed through the wheel d'. The end of this pin is caused by its spring to project into the inclined recess k^2, formed in the end flange of drum i. (Clearly shown in the enlarged views, Figs. 3 and 4.) The outer end of this pin k is pivoted to the lever k^3, having its fulcrum at one end in the ears k^4 on the side of the wheel d', and having its other end bifurcated and arranged to surround the hub of the clutch-sleeve l, which is carried around with the wheel d' by a pin, l', projecting from it through the end of the lever k^3; or it may be rotated by means of a key or feather in the shaft d. The yoke l^2, fitted to rock on the shaft d and provided with clutch-teeth forming the counterpart of the clutch l, is, by means of the link m, connected to the side of the rotary belt-shifter.

Now, assuming that the elevator-car is to be lowered and the parts of the machine are in their normal stationary condition, as shown in Figs. 1 and 2, the part g^5 of the shifting-rope is pulled up to cause the rotating belt-shifter to move into the position shown at Fig. 10, and thereby ship the straight belt f onto the fast pulley e. The wheel d' and drum i then rotate, as indicated by the arrow z^2, Fig. 1. If during such rotation anything happens to arrest the downward movement of the car, or to tend to cause the cable to slacken on the drum i, the wheel d' moves away from or quicker than the drum, which is held back by the spring i^2 acting to keep the cable taut on the drum i, and such variation in the speed or movement of the wheel d' and drum i causes the end of the pin k to ride up the inclined guide k^2, and through the medium of the lever k^3 moves the sleeve-clutch l toward the yoke l^2. The teeth of the sleeve l, by engaging the teeth of the yoke l^2, rock the yoke into a central position, and through the medium of the link m and the rotary belt-shifter cause the belt f to

move from the fast pulley *e* onto the loose pulley *e'*, and at the same time apply the brake to the brake-wheel h^4, thereby quickly stopping the machine before the cable *i'* becomes slackened by unwinding from the drum *i*, thus preventing the cable from slipping off its guide-pulleys. The rotary belt-shifter $f^4 f^5$, the connecting-link *m*, and the yoke l^2 are also utilized in the automatic stop device for shutting off the elevator when the elevator-car reaches the two extreme limits of its movement, and in the governing device for stopping the elevator when its speed exceeds a predetermined limit. To utilize these parts in the automatic stop device a plate, *n*, is secured to the under side of the yoke l^2, and extends outwardly under the bearing of the shaft *d* and the screw *n'*, projecting from the end of the shaft. This plate *n* is held parallel to the screw *n'* by the arm n^2, which fits on the end of the collar *o*, rigidly secured to the end of the screw *n'*. Left-handed clutch-teeth *o'* are formed on the end of the shaft *d*, and the collar *o* is provided with right-handed clutch-teeth o^2. Between the clutch-teeth *o* and o^2 on the screw *n'* is the nut *p*, having teeth formed on its sides the counterpart of the clutch-teeth *o'* and o^2, and it is provided with a tail-piece, *p'*, the end of which fits and slides in the slot n^3, formed in the plate *n*.

The number of free threads in the screw *n'* equals the number of revolutions the drum *i* makes to the full movement of the elevator. In the drawings the nut *p* is shown occupying about a central position between the clutch-teeth *o* and o^2, the cable *i'* then being about half unwound from the drum *i;* and assuming that the elevator-car is now ascending, the arrow z^3 on Fig. 5 indicates the direction of rotation of the drum-shaft *d*. The rotary belt-shifter is then in the position shown in Fig. 11, with the crossed belt *f'* upon the fast pulley *e*, the yoke l^2 being held out of its central position by the rod *m*. As the shaft *d* now rotates, the nut *p*, acted upon by the screw *n'*, is caused to move toward the clutch-teeth *o'*, which it reaches, and by which it is engaged when the elevator-car attains the limit of its upward movement. The shaft *d* thus causes the nut *p* to move with it, which in its turn, by the action of its tail-piece *p'* upon the plate *n*, moves the yoke l^2 and the rotary belt-shifter into central position, causing the belt *f'* to pass from the fast pulley *e* onto the loose pulley e^2 and the brake to press on the brake-wheel h^4. When the belt-shifter is actuated by the part g^5 of the shifting-rope to throw the belt *f* on the fast pulley *e*, as shown in Fig. 10, the yoke l^2 is moved so as to occupy a position opposite to its previous position, and the drum-shaft rotates in the opposite direction to that indicated by the arrow z^3, thereby causing the nut *p* to travel toward the collar *o*, which it reaches, and is engaged by the clutch-teeth o^2 when the car approaches its lower limit. The nut *p* now moves with the shaft *d*, and actuates the belt-shifter as before, but in opposite manner, to throw the belt *f* from the fast pulley *e* to the loose pulley *e'*, at the same time applying the brake and effectually stopping the elevator. In the sectional view, Fig. 12, the belt-shifter is shown in position to hold the two belts *f* and *f'* upon their respective loose pulleys *e'* and e^2.

The means employed to actuate the yoke l^2 and belt-shifter when the downward movement of the elevator exceeds the normal speed consists of the short rod *q*, fitted to slide in a bearing in the side piece, *a'*, and provided at its inner end with the tongue *q'*, extending into a groove in the clutch-sleeve *l*, and hinged to the rod *q* in such a manner that when the rod is moved in an outward direction the clutch-sleeve is caused to move with it and engage with the teeth on the yoke l^2, while the clutch-sleeve can be moved toward the yoke by the lever k^3 of the slack-cable stop mechanism without imparting any motion to the rod *q*.

An outward motion is imparted to the rod *q* by means of the spring q^2, which is placed between a collar secured thereto and the end of the bearing in which it slides; but it is normally held back in the position shown in the drawings by the tappet *r*, secured to the end of the shaft *r'*, held in bearings on the side piece, *a'*, of the frame. On the other end of this shaft *r'* is secured the arm r^2, so set as to occupy a position in line with the driving-shaft *b* when the tappet *r* rests against the end of the rod *q*, and this position is maintained by means of the torsional spring r^3, held between a collar on the shaft *r'* and one of its bearings.

On the end of the driving-shaft *b* is secured the plate *s*, to which are pivoted the arms *s' s'*, provided at their ends with the centrifugal balls s^2 s^2. Springs s^3 s^3 are placed on rods which pass through the arms *s' s'*, and are so adjusted, by means of nuts at their free ends, that when the normal speed of the shaft *b* is exceeded the balls s^2 s^2 fly out and strike the arm r^2, the relative position of which to the centrifugal governor is such that it is outside the circle of rotation when the machine is running at the normal working speed. As soon as this centrifugal governor expands by reason of an excess of speed and the arm r^2 is struck down by one of the balls, the tappet *r* at the other end of the shaft *r'* leaves the end of the rod *q*, thus allowing the spring q^2 to act and slide the rod *q* outwardly over the tappet *r*, and, by means of the tongue *q'*, carry the sleeve-clutch *l* against the clutch-teeth of the yoke l^2, which is thereby moved, as before described, and shifts the belt *f* onto its loose pulley *e'* and causes the brake-shoe h^3 to bear against the brake-wheel h^4. Before the elevator-car can be again started it is necessary to push the rod *q* back and set the arm r^2 again into active position, thus compelling the attendant, when the apparatus has been stopped by an excess of speed, to attend to the machine and

set it in active condition, and at such times he will be induced to critically examine all parts thereof and satisfy himself that the apparatus is in proper working condition, and also that the belts are intact, as this speed-governor would act as an automatic stop-motion should either of the belts break or become too slack to work.

Having now described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In an elevator comprising a driving-shaft, pulleys, a belt-shifter, a main shaft, and connecting-gears, in combination therewith a cable-drum on the main shaft, having an inclined groove in its end and driven positively in one direction by studs projecting from the gear secured to the main shaft, a sliding pin in the gear resting in the inclined groove on the end of the drum, and connecting devices joining the sliding pin to the belt-shifter, whereby the belt-shifter is actuated when the drum moves slower than the main shaft in unwinding the cable.

2. In an elevator comprising a driving-shaft, pulleys, a belt-shifter, a main shaft, and connecting-gears, in combination therewith a gear wheel secured to the main shaft, a drum fitted loosely thereon having an inclined groove on its end, a spring connecting the drum and shaft, driving-studs on the wheel acting against lugs on the drum, a sleeve on the shaft provided with clutch-teeth, a spring-pin fitted in the wheel and extending into the inclined groove on the end of the drum, a lever connecting the spring-pin to the sleeve-clutch, a rocking yoke-piece provided with clutch-teeth, and a link connecting the yoke to the belt-shifter, substantially as and for the purpose set forth.

3. In an elevator comprising a driving-shaft, pulleys, a belt-shifter, a main shaft, and connecting gears, in combination therewith a centrifugal governor on the end of the driving-shaft, an arm carried by a shaft and located in the path of the expanding parts of the governor when the speed of the same exceeds a prescribed limit, and mechanism connecting the shaft of the arm to the belt-shifter, whereby the belt-shifter is actuated to stop the elevator when the governor strikes the arm.

4. In an elevator comprising a driving-shaft, pulleys, a belt-shifter, a main shaft, and connecting-gears, in combination therewith a sleeve-clutch on the main shaft, a yoke in line therewith provided with clutch-teeth and connected to the belt-shifter, a sliding spring-acting rod provided with a tongue arranged to move the sleeve-clutch, a shaft fitted in bearings at right angles to the driving and main shafts, provided with a tappet at one end which bears against the end of the sliding rod, and a spring to hold this shaft from rotating, an arm secured to the other end of this shaft and held parallel to the driving-shaft, and a centrifugal governor secured to the end of the driving-shaft.

5. In an elevator, the combination, with a driving-shaft, a central pulley secured thereto, two loose pulleys in close proximity to this fast pulley, and a straight and a crossed belt, of two connected inclined guides concentrically arranged relative to the pulleys, through which the leading sides of the belts pass, and adapted to be rocked on the axis of the driving-shaft and to be retained in three positions: first, to hold the belts on their respective loose pulleys; second, to move and hold the straight belt onto the fast pulley without disturbing the crossed belt, and, third, to move and hold the crossed belt onto the fast pulley without disturbing the straight belt.

6. In an elevator, a rotating belt-shifter consisting of a cylindrical shell provided with heads or end bearings and having openings partly straight and partly inclined to act as belt-guides, in combination with a shaft passing through the end bearings of the shell, three pulleys, one fast and the others loose on the shaft, located within the shell, and two belts passing through the openings in the shell and around the pulleys.

7. In an elevator, a rotating belt-shifter consisting of a cylindrical shell provided with heads or end bearings, and having openings partly straight and partly inclined, to act as belt-guides, in combination with a shaft passing through the end bearings of the shell, three pulleys, one fast and the others loose on the shaft, located within the shell, two belts passing through the openings in the shell and around the pulleys, a brake-wheel on one end of the shaft, a brake-lever having a shoe at one end in line with the brake-wheel, and a cam secured to the side of the belt-shifter and arranged to act on the other end of the brake-lever to apply the brake when the belt-shifter is in position to hold the belts on their respective loose pulleys.

8. In an elevator, in combination, the main shaft d, the drum i, the spring i^2, the gear-wheel d', provided with driving-studs $j\,j$, the spring bolt or pin k, the lever k^3, the sleeve-clutch l, the yoke l^2, the link m, the driving-shaft b, the pulleys $e\,e'\,e^2$, and the rotary belt-shifter $g\,g'\,g^2\,f^4\,f^5$, substantially as and for the purpose set forth.

9. In an elevator, in combination, the main shaft d, the screw n', the clutch-teeth $o'\,o^2$, the nut p, the guide n, the yoke l^2, the link m, the driving-shaft b, the pulleys $e\,e'\,e^2$, and the rotary belt-shifter $g\,g'\,g^2\,f^4\,f^5$, substantially as and for the purpose set forth.

10. In an elevator, in combination, the main shaft d, the sleeve-clutch l, the yoke l^2, the link m, the driving-shaft b, the pulleys $e\,e'\,e^2$, the rotary belt-shifter $g\,g'\,g^2\,f^4\,f^5$, the centrifugal governor on the end of the driving-shaft, the arm r^2, the shaft r', the tappet r, the spring r^3, the sliding rod q, the spring q^2, and the hinged tongue q', substantially as and for the purpose set forth.

11. In an elevator, in combination, the driving-shaft b, the fast pulley e, the loose pulleys

e' e^2, the heads g g', and the cylindrical shell g^2, provided with the inclined belt-guide openings f^4 and f^5 and the belt-clearance openings f^6 and f^7, substantially as and for the purpose set forth.

12. In an elevator, in combination, the driving-shaft b, the fast pulley e, the loose pulleys e' e^2, the heads g g', the cylindrical shell g^2, provided with the inclined belt-guide openings f^4 and f^5 and the belt-clearance openings f^6 and f^7, the cam h on the head g, the brake-lever h' h^3, and the brake-wheel h^4, secured to the shaft b, substantially as and for the purpose set forth.

13. In an elevator, in combination, a gear-wheel on the driving-shaft, a drum fitted loosely on the shaft and driven positively in one direction by studs on the gear-wheel, a clutch on the shaft, a shifting device connected to the moving part of the clutch and actuated by the drum when it moves relatively to the gear-wheel, a belt-shifter connected to the other part of the clutch, a rod provided with a hinged tongue extending in a groove in the sliding part of the clutch, a centrifugal governor on the end of the driving shaft, a tappet device controlling the rod having the hinged tongue, and a pivoted arm connected to the tappet device and located in close proximity to the governor, substantially as and for the purpose set forth.

14. In an elevator, in combination, a belt-shifter, a pivoted yoke provided with clutch-teeth, an automatic stop connected to the pivoted yoke and constructed to actuate the same when the elevator reaches either of its extreme limits, a clutch-sleeve adapted to engage with the pivoted yoke, a slack-cable stop connected to the sliding sleeve, by which the said sleeve is caused to actuate the pivoted yoke when the cable tends to become slack, and a speed-regulator arranged to operate the sliding sleeve and move it to engage with the pivoted yoke when the speed of the elevator exceeds its prescribed limit.

Signed at New York, county and State of New York, this 9th day of September, 1887.

QUIMBY N. EVANS.
WILLIAM SCHWANHAUSSER.

Witnesses:
H. D. WILLIAMS,
FLOYD CLARKSON.