(No Model.) 4 Sheets—Sheet 1.

C. E. TORRANCE.

ELEVATOR.

No. 441,718. Patented Dec. 2, 1890.

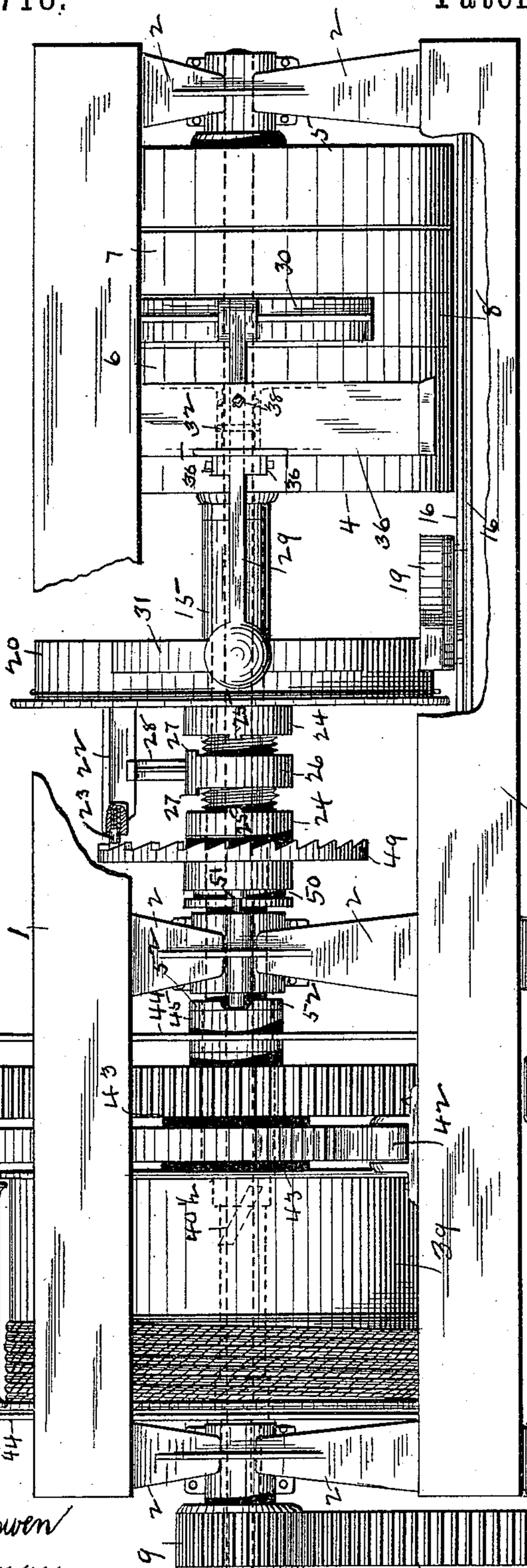

Fig. 1.

Witnesses
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J. E. Chapman

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C. E. Torrance
By his Attorneys
James Chapman

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

4 Sheets—Sheet 2.

C. E. TORRANCE.

ELEVATOR.

No. 441,718. Patented Dec. 2, 1890.

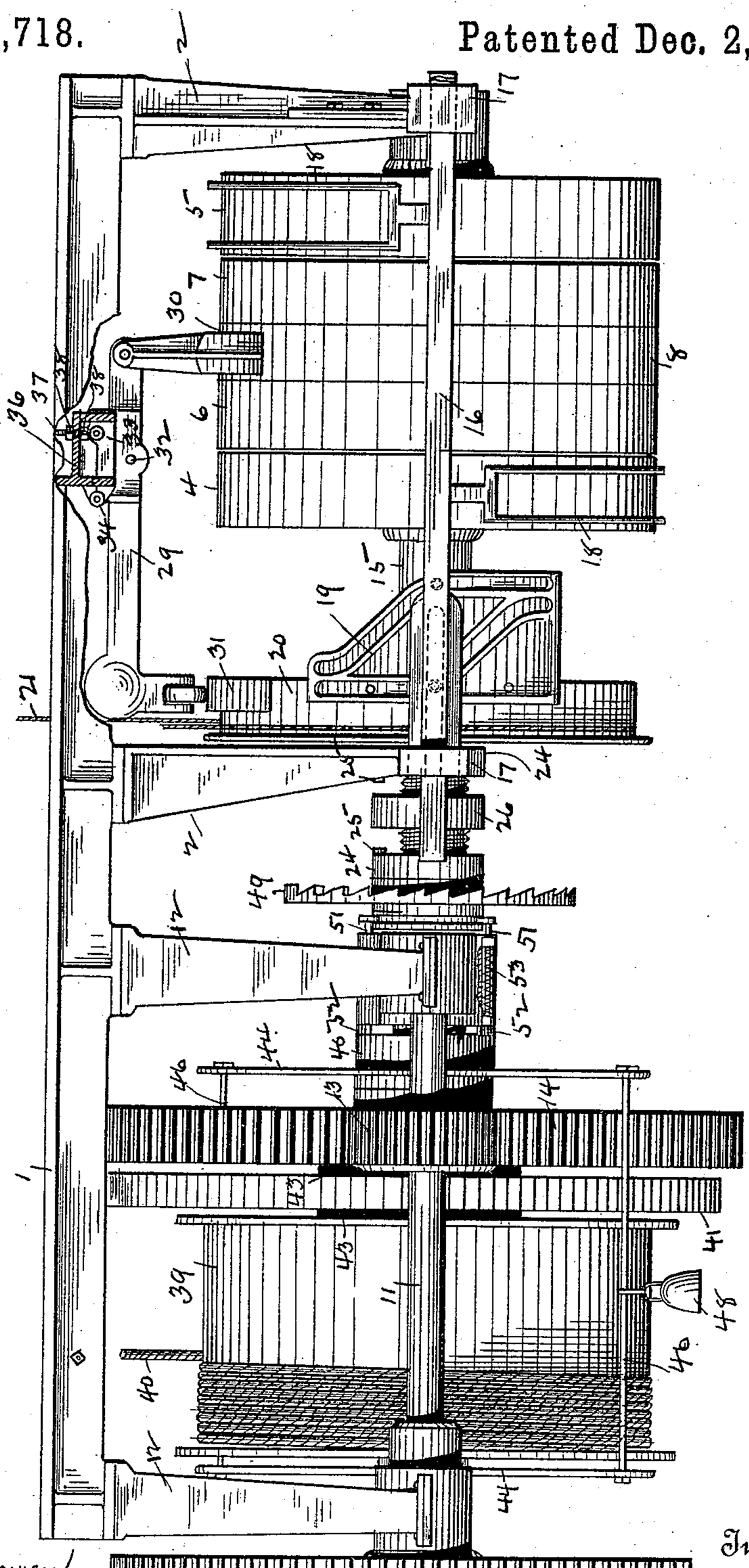

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

C. E. TORRANCE.

ELEVATOR.

No. 441,718. Patented Dec. 2, 1890.

Fig. 3.

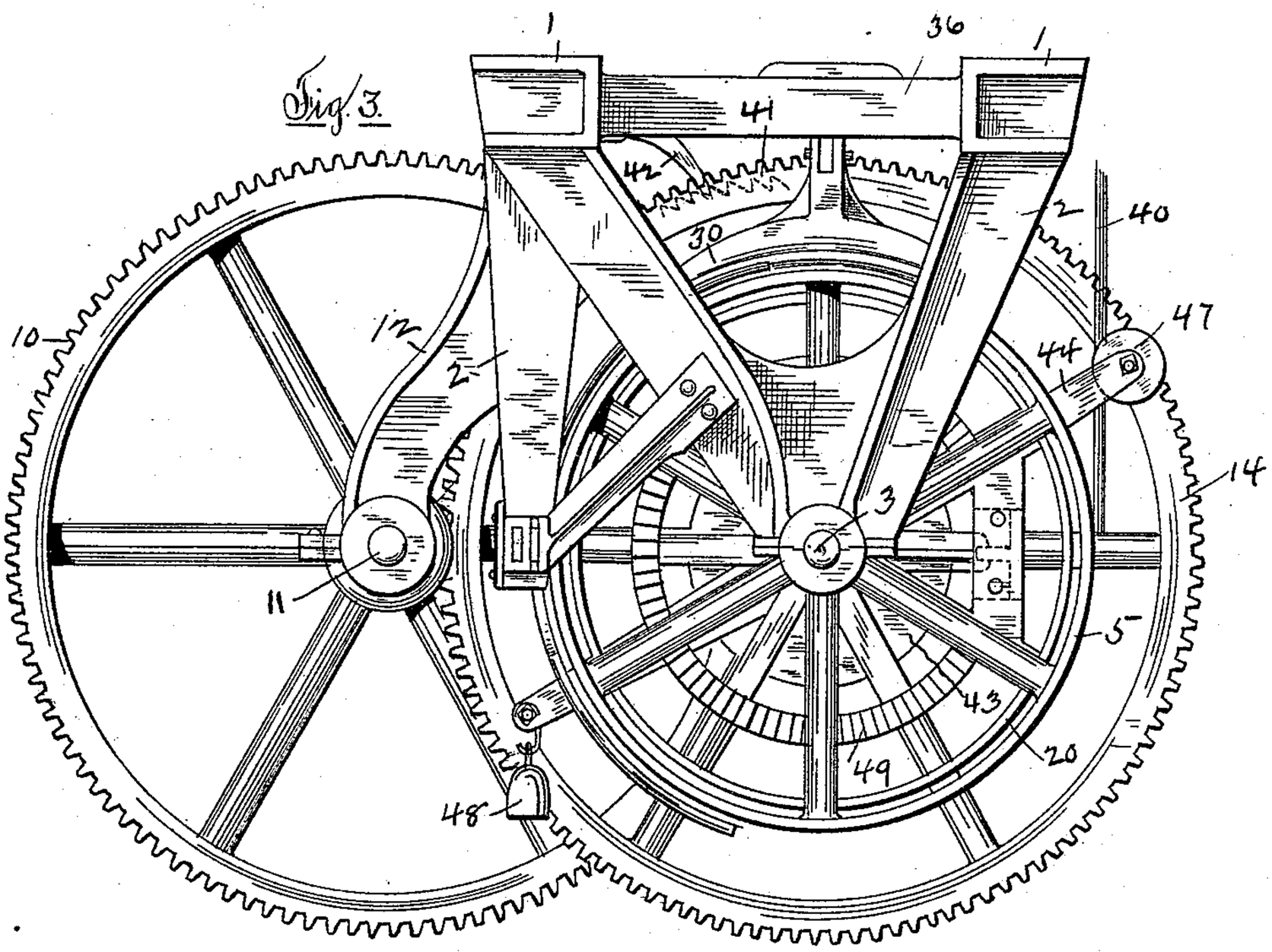


Fig. 4.

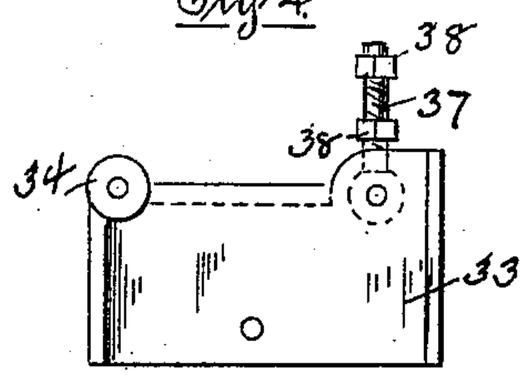


Fig. 5.

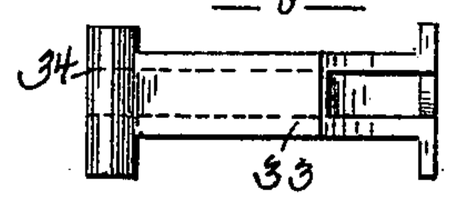


Fig. 6.

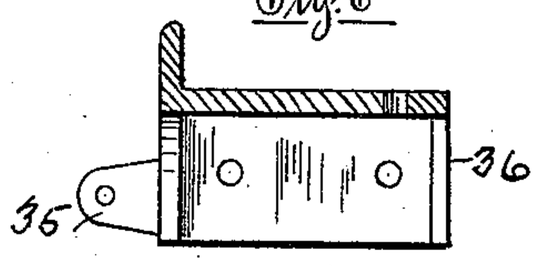
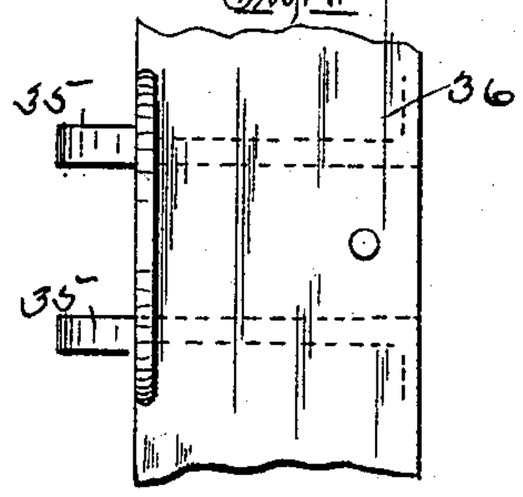


Fig. 7.



Witnesses
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(No Model.)

4 Sheets—Sheet 4.

C. E. TORRANCE.

ELEVATOR.

No. 441,718. Patented Dec. 2, 1890.

Fig. 7½

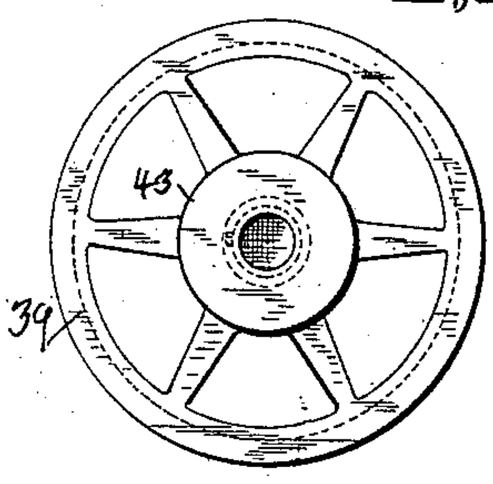


Fig. 8.

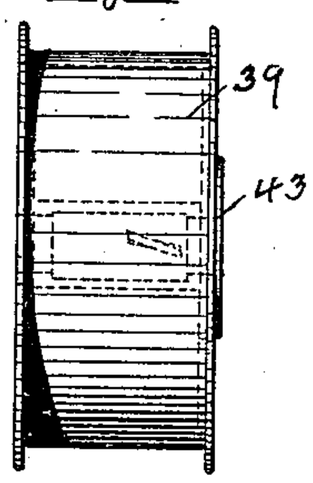


Fig. 9.

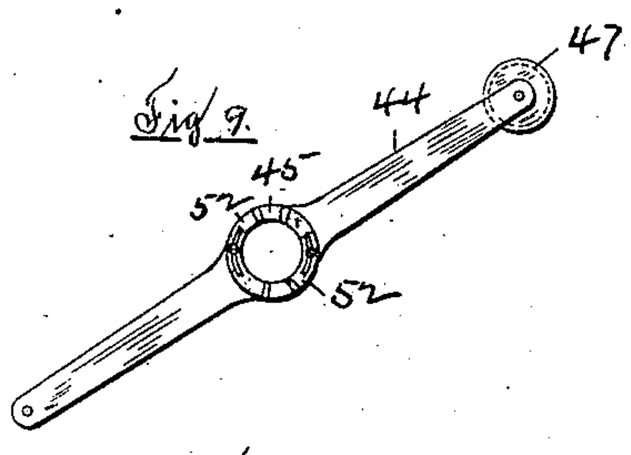


Fig. 10

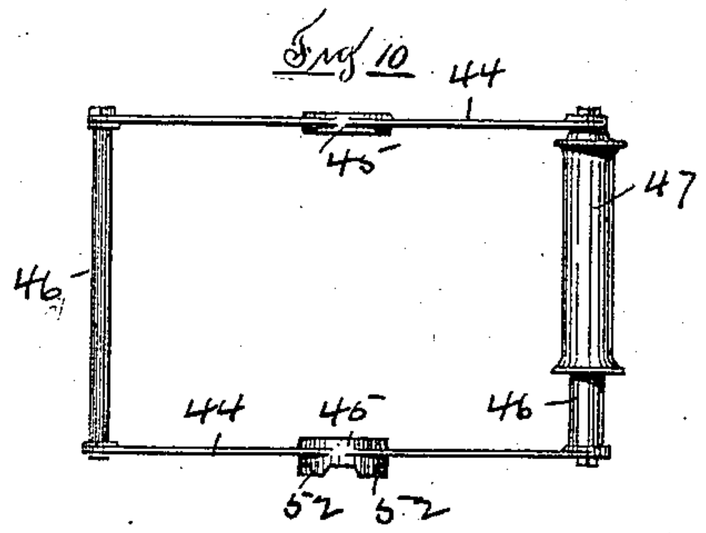


Fig. 11.

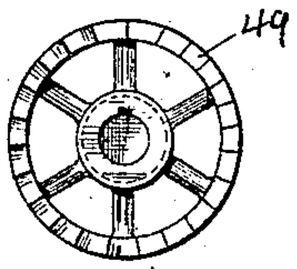


Fig. 12

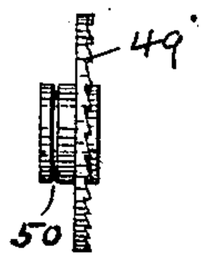


Fig. 13.

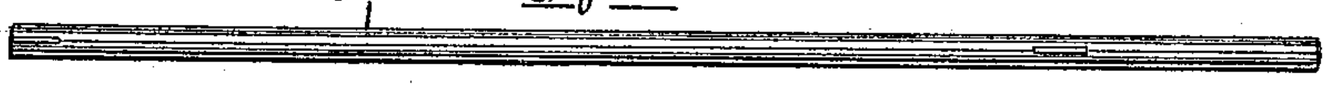


Fig. 14

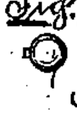


Fig. 15

Fig. 16.

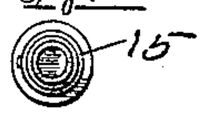


Fig. 17.

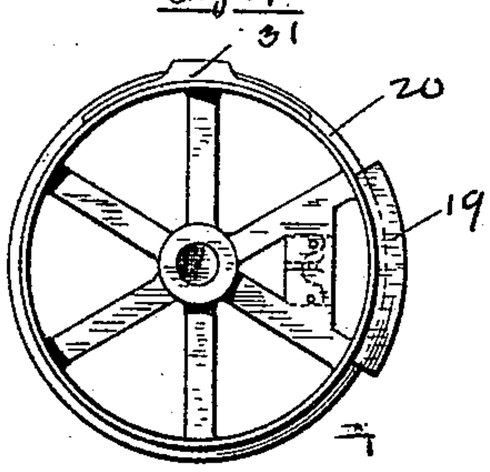
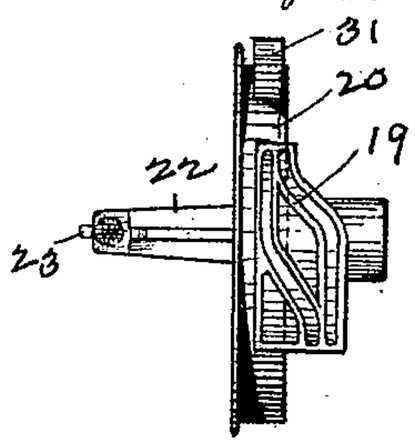


Fig. 18



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UNITED STATES PATENT OFFICE.

CHARLES E. TORRANCE, OF HOLYOKE, MASSACHUSETTS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 441,718, dated December 2, 1890.

Application filed February 21, 1890. Serial No. 341,273. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. TORRANCE, of Holyoke, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Elevators, of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates to the hoisting and lowering mechanism of both passenger and freight elevators, and particularly to what is known as "spur-gear" mechanism as distinguished from "worm-gear" hoisting apparatus.

The objects of the invention are to provide a simple and compact arrangement of the several parts composing the mechanism, to provide means for automatically stopping the descent of the car upon the breakage of the teeth of any of the operating-gears or other mishap to the operating machinery, to provide means for automatically shifting the belts and stopping the movement of the winding-drum should the car in its descent encounter any obstacle to its further downward movement, and to improve the construction of the various parts in detail.

To these ends the invention consists in the elevator-operating mechanism constructed and operating as hereinafter fully described, and particularly pointed out in the claims.

Referring to the drawings, in which like numerals designate like parts in the several figures, Figure 1 is a plan view of the mechanism devised by me, the girders, by means of which the same is suspended from a suitable support, being partly broken away to show the parts beneath them. Fig. 2 is a side elevation thereof. Fig. 3 is an end elevation, looking toward the left, in Figs. 1 and 2. Figs. 4 and 5 are respectively a side and plan view of the adjustable brake-lever stand. Figs. 6 and 7 are respectively a cross-section and partial plan view of the tie-bar which supports said stand. Figs. 7½ and 8 are respectively an end and side view of the cable-winding drum. Figs. 9 and 10 are respectively a side and plan view of the slack-stop arms or frame. Figs. 11 and 12 are respectively an end and side view of the slack-stop ratchet-disk. Figs. 13 and 14 are respectively a side and end view of the main shaft. Figs. 15 and 16 are similar views of the secondary shaft. Figs. 17 and 18 are respectively an end and side view of the shipper-pulley and the cams carried thereby.

The mechanism about to be described can be located at the top or bottom of the building in which the elevator is situated and adjacent to the elevator-shaft, as is customary, and in either case will preferably be supported from the ceiling or other overhead support by means of two girders 1, having depending therefrom a series of hangers 2, which are provided at their lower ends with bearings, in which is journaled the main shaft 3. Said main shaft carries at or near one end two loose pulleys 4 5, and between said loose pulleys two fixed pulleys 6 7, by means of which motion is transmitted to said shaft in opposite directions from a suitable source of power by means of open and crossed belts in well-known manner. A brake-pulley 8 is also fixed upon said shaft, preferably between the two fixed pulleys 6 7, as shown, by means of which a brake is applied to the shaft simultaneously with the shipping movement of said belts from the fast to the loose pulleys, as will be presently described. At its opposite end the main shaft carries a spur-gear 9, which gear meshes with a gear-wheel 10, carried by a short shaft 11, which is journaled in hangers 12, depending from the girders 1, and extends parallel with said main shaft. Said shaft 11 also carries a spur-gear 13, which meshes with a gear-wheel 14, carried by the winding-drum shaft 15. For the purpose of economizing in the space occupied by the mechanism, we prefer to make the last-mentioned shaft in the form of a sleeve surrounding the main shaft, the same being shown detached in Fig. 15, it being journaled in the hangers in such manner as to revolve independently of the main shaft. By the described intermediate connections between the main shaft and said shaft 15 it will be obvious that the latter will be revolved at a greatly accelerated speed from the former.

The belts are shifted from the loose to the fast pulleys, and vice versa, by means of two bars 16, which are supported in such manner as to have a free sliding movement in bear-

ings 17, and which carry the loops 18 for the belts. Each of said bars carries a stud provided with an anti-friction roll, the inner bar being forked to embrace the stud on the outer bar, as represented by broken lines in Fig. 2, thereby enabling the bars to move independently of each other, and said studs are received within the grooves of a cam 19, secured to the periphery of the shifting-pulley 20, which latter is mounted upon the shaft 15 in such manner as to have a partial revolution thereon as the shipper-cord 21 is pulled in one or the other direction. As thus arranged, the face of cam 19 is parallel with the peripheries of the fast and loose pulleys, and the grooves therein, which are composed of a straight and an inclined section, are reversely arranged, so that the inclined portion of one groove lies opposite to the straight portion of the other, so that when said cam lies midway between its two extremes of movement, as shown in Fig. 2, the belts will be held upon the two loose pulleys, and movement of said cam in either direction will shift one of the belts to its fast pulley, while the other belt will still be held upon its loose pulley. Movement of said cam in the opposite direction will first return the last-shifted belt to its loose pulley and, if continued, will shift the opposite belt to its fast pulley and reverse the motion of the main shaft. Each of the belts is thus positively controlled by the shifting device at all times.

It is desirable that means be provided for automatically imparting sufficient movement to the shipper-pulley to stop the movement of the car at the top and bottom of its shaft or well, and to secure this result we rigidly connect to said pulley an arm 22, which extends laterally therefrom parallel with the shaft 15, and which carries at its outer end a pin 23, said pin being movably mounted in a socket in said arm and being pressed outwardly by a coil-spring, as shown. A portion of shaft 15 adjacent to the shipper-pulley is threaded, and at the two extremities of said threaded portion are keyed collars 24, each of which is provided with a lug 25 upon its face next said threaded portion of the shaft. Upon the threaded portion of the shaft is mounted a traveling collar 26, which is interiorly threaded to correspond with the shaft, and which has a lug 27 projecting from each side thereof, and has a rigid arm 28 projecting radially therefrom, said arm being forked at its outer end to embrace the arm 22 on the shipper-pulley, as shown in Fig. 1. The collar 26, being prevented from revolving with shaft 15 by the engagement of its arm 28 with arm 22, is given a traveling movement lengthwise of said shaft by the threads on the latter and in opposite directions as the shaft is revolved in opposite directions. When said collar arrives at either end of its traverse, its lug 27 is engaged by the lug 25 on the collar 24 at that end, and a sufficient revolving movement with the shaft is imparted to said collar to cause its arm 28 to move the shipper-pulley to the position shown in Fig. 2, thereby shipping the operative belt to its loose pulley and stopping the car. By adjusting the collars 24 to vary the distance between them provision is made for thus causing the stoppage of the car at the top and bottom of shafts of varying heights without any further change in the mechanism.

In order to secure the prompt stoppage of the car, whenever the shipper-pulley is operated for that purpose I employ a brake-lever 29, which carries at one end the shoe 30, adapted to engage the periphery of brake-pulley 8, and at its opposite end is provided with an anti-friction roll, which is engaged by a peripheral cam 31 on the shipper-pulley 20, said cam being so located as to operate said lever simultaneously with the action of cam 19 in shifting either of the belts to its loose pulley. The end of the brake-lever which engages said cam is weighted, as shown, to normally hold the shoe 30 out of engagement with pulley 8. Said brake-lever is supported between its ends upon a pivot 32, and to compensate for wear of the shoe 30 and secure perfect action of the brake at all times I make said pivot vertically adjustable. As shown, I secure such adjustment by mounting said pivot in a stand 33, which is provided at one end with socket 34 to receive a bolt, whereby said stand is pivotally connected to two ears 35, projecting from a tie-bar 36, extending between the girders 1. An eyebolt 37 extends upwardly from the opposite end of said stand through a hole in the tie-bar, and is provided with the set-nuts 38, one of the latter being above and the other below the tie-bar, and by means of said nuts the stand 33 can be adjusted vertically upon its pivot to vary the vertical plane of the pivot 32 of the brake-lever. Other means for securing this desirable result will suggest themselves to persons skilled in the art.

The winding-drum 39 for the cable 40 is connected with shaft 15; but instead of making such connection a rigid one I provide means whereby said drum can have a limited movement independently of the shaft and provide a friction safety device, whereby, in case there should be a breakage of the teeth of any of the driving-gears or other similar mishap to the machinery, the descent of the car will be stopped almost instantly, and accidents thereby prevented. In the practice of this portion of my invention I connect the drum 39 to the shaft 15 by means of corresponding screw-threads, so that movement of either independently of the other will cause a progressive movement of the drum longitudinally upon the shaft. The desired amount of such movement, however, is very slight, and said threads can therefore extend entirely around the periphery of the shaft and the bore of the drum, or may consist of a portion of a thread or spirally-disposed feather $40\frac{1}{2}$, as shown in Figs. 1 and 15,

on the shaft, which enters a similarly-disposed groove in the bore of the drum, which groove is indicated by broken lines in Fig. 8. A ratchet-wheel 41 is loosely mounted upon the shaft 15 adjacent to said drum, said wheel having peripheral teeth, which are engaged by a pawl 42, pivotally secured to the frame in such manner as to permit said wheel to revolve freely in a direction corresponding to that of the drum when the latter is winding up the cable or raising the car, but which prevents movement of said wheel in the opposite direction. The drum, said ratchet-wheel, and gear-wheel 14 are provided with corresponding annular frictional surfaces 43 of considerable area upon their adjacent ends, (see Figs. 7½ and 8,) whereby a very rigid and secure frictional engagement between them can be secured. The screw-thread engagement between the shaft and drum is such that the weight of the car will normally hold the drum in engagement with said ratchet-wheel with such force as to cause said drum and wheel and gear-wheel 14 to revolve in unison when the former is winding up the cable, the pawl 42 permitting the wheel to revolve freely in such direction, as before stated. When the belts are shifted to revolve shaft 15 in the opposite direction to unwind the cable and lower the car, the action of the screw-thread connection between said shaft and the drum is such that the latter is caused to move slightly away from the ratchet-wheel at first, whereupon the weight of the car instantly causes an accelerated movement of the drum and moves it again into engagement with said wheel; but, the latter being held against movement with the drum by its pawl, the shaft again overtakes the drum and again moves it away from the wheel, to be followed by another movement of the drum back to the latter. The unwinding movement of the drum thus consists of a succession of engagements with and releasings from the ratchet-wheel; but such intermissions in its movements are so slight as to be almost imaginary, the practical movement of said drum being continuous so long as shaft 15 is positively revolved by its driving mechanism. With such construction it will be obvious that should there be a breakage of any of the driving-gears or other part of the machinery by which the revolving movement of shaft 15 is stopped the weight of the car will securely lock the drum and ratchet-wheel together, and, the latter being held from movement by its pawl, the descent of the car will be instantly stopped. Accidents from such cause are thus entirely prevented, and the spur-gear-operating mechanism is rendered as safe as worm-gear mechanism would be.

It frequently happens that an elevator encounters some obstruction in its downward movement which prevents further movement thereof until the obstruction be removed, and unless the unwinding movement of the drum be stopped at once the cable will become slacked to such an extent as to require much time and trouble to get it properly arranged upon the drum again, and to provide for such a contingency I have devised what I term a "slack-stop mechanism," which is constructed as follows: Two arms 44 are mounted midway between their ends upon shaft 15 by means of collars 45, loosely embracing said shaft, one of said arms being located adjacent to drum 39 upon one side of the latter and the other adjacent to gear-wheel 14 upon the opposite side of said drum, which arms are united at their ends by rods 46. One of said rods carries an anti-friction sleeve 47, which is normally retained in engagement with the cable, as shown in Fig. 3, by a weight 48, suspended from the rod at the opposite end of said arms. A ratchet-disk 49, having its teeth upon the side thereof, is secured upon shaft 15 adjacent to the outer end of the arm 22 on the shipper-pulley by means of a spline and feather, whereby said disk is free to have a slight movement longitudinally upon the shaft, but is compelled to revolve with the latter. The hub of said ratchet-disk is provided with an annular groove 50, into which groove project flanges upon the ends of two pins 51, which pins extend through sockets in the adjacent hanger 2, and are provided with heads at their opposite ends. The ends of said pins lie adjacent to one of the collars 45 of the arms 44, and upon the face of said collar are secured two cam-plates 52 by means of set-screws passing through slots in said plates, as shown in Fig. 9, whereby said plates are adjustable about said collar. The ends of said plates are beveled, as shown, whereby two depressions are formed between their adjacent ends in the working-face of the collar, and the ends of the pins 51 are caused to normally project within said depressions by coil-springs 53, located within the sockets in the hanger and bearing against the heads of said pins, the pins when in such position withdrawing ratchet-disk 49 out of engagement with the spring-pressed pin 23 at the end of arm 22, before described. The cam-plates 52 are of such thickness that a slight rocking movement of the arms 44 upon the shaft as a center will cause the beveled ends of said plates to force the pins 51 and ratchet-disk 49 toward the shipper-pulley until the teeth on said disk engage said pin 23 on arm 22, and said teeth are so inclined that should the shaft 15 and said disk be revolving in the direction to unwind the cable and lower the car said teeth will move the arm 22 and the shipper-pulley in a direction to ship the operative belt to its loose pulley and stop the movement of the winding-drum, whereas said pin 23 will ride over the teeth on said disk, should it be turning in the opposite direction, without causing any movement of the shipper-pulley. It follows from such construction and arrangement of the parts that when the arms 44 occupy their normal position, with sleeve 47 in engagement with the

cable, the cam-plates 52 can be adjusted to cause the depressions between their ends to register with the ends of the pins 51 regardless of the particular diameter of the cable or the angle which it makes with the winding-drum. It follows, furthermore, that when said plates are so adjusted any slacking of the cable will permit the weight 48 to rock the arms 44 upon the shaft sufficiently to stop the movement of the winding-drum, as just described. The continued unwinding of the cable after the stoppage of the car by some obstruction is thus entirely prevented.

It will be observed that the elevator-operating mechanism thus constructed and arranged is very compact and occupies but a comparatively small space, is quick and positive in all of its movements, and insures safety with the use of spur-gears, so far as the breakage of said gears or other portion of the machinery is concerned.

While I have shown and described the particular construction and arrangement of the several parts composing the mechanism which I prefer to employ, I do not intend to limit myself strictly thereto, since it is obvious that modifications in the details thereof can be made without departing from the spirit of my invention. For example, I have herein shown and described the friction safety device composed of the laterally-movable winding-drum and the ratchet-wheel, with their corresponding frictional surfaces in connection with a main shaft, the power to which is transmitted by means of fast and loose pulleys and reversely-speeded belts, while it is perfectly obvious that said safety-friction device would operate in precisely the same manner regardless of the manner in which the power is applied to said main shaft, and I desire to so cover it in my invention.

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

1. The elevator apparatus herein described, comprising, in combination, a main shaft carrying fast and loose pulleys, a secondary shaft carrying a winding-drum, said shafts having a common axis, and spur-gear connections between said shafts, arranged and operating substantially as set forth.

2. In an elevator apparatus, a main shaft carrying fast and loose pulleys, a secondary shaft carrying a winding-drum and having loosely mounted thereon a shipper-pulley provided with a cam-plate, the face of which is parallel with the periphery of said pulley, a belt-shifting bar movable in a plane parallel with the face of said cam-plate and operatively connected with the latter, and gear-connections between said main and secondary shafts, combined and operating substantially as described.

3. In an elevator apparatus, a main shaft carrying fast and loose pulleys, a secondary shaft carrying a winding-drum and having gear-connection with said main shaft, said secondary shaft being threaded for a portion of its length and having clamped thereto at each end of said threaded portion a collar provided with a laterally-projecting lug, an internally-threaded collar embracing the threaded portion of said shaft and having an arm projecting radially therefrom and a lug projecting laterally from each end thereof in the plane of the lugs on said first-mentioned collars, a shipper-pulley loosely mounted upon said secondary shaft and having extending laterally therefrom an arm which has a sliding connection with the radial arm on said collar, whereby the latter is normally prevented from revolving with the shaft, and a belt-shifting bar for shifting the belts to and from said fast and loose pulleys operatively connected with said shipper-pulley, combined and operating substantially as set forth.

4. In an elevator apparatus, a main shaft carrying fast and loose pulleys and a secondary shaft having gear-connection with said main shaft, a winding-drum mounted upon said secondary shaft and connected thereto by means of a spirally-disposed groove and feather or screw-thread, whereby said drum is capable of having a limited revolving and progressive movement upon said shaft, a ratchet-wheel loosely mounted upon said secondary shaft adjacent to said drum, said drum and wheel being provided with corresponding frictional surfaces upon their adjacent ends, and a pawl engaging said wheel and preventing movement thereof in one direction, combined and operating substantially as and for the purpose set forth.

5. The combination, with the winding-drum and shipper-pulley of an elevator apparatus, of a slack-stop mechanism for stopping the movement of said drum upon the slacking of the cable which passes around said drum, the same consisting, essentially, of a pivoted arm engaging the cable and carrying a cam, a ratchet-disk secured upon the shaft which carries said drum and pulley by means of a spline and feather, whereby it is adapted to have a limited sliding movement upon said shaft, said disk engaging a rigid portion of the shipper-pulley when moved to its nearest position to said pulley in such manner as to move the latter in one direction, rigid connections between the cam on said cable-engaging arm and said disk, whereby movement of said arm will move the latter toward the shipper-pulley, and a spring or springs normally holding said disk out of engagement with said pulley, arranged and operating substantially as described.

6. In an elevator apparatus, the combination, with a main shaft carrying two fast and two loose pulleys and a brake-wheel, of a secondary shaft having spur-gear connection with said main shaft and carrying a winding-drum, a shipper-pulley loosely mounted upon said secondary shaft and having secured to its periphery a face-cam and a cam-plate having two reversely-disposed cam-grooves

therein, a pivotally-supported brake-lever carrying at one end a shoe adapted to bear upon said brake-wheel on the main shaft and having its opposite end adapted to be engaged by the face-cam on said shipper-pulley, and two belt-shifter bars, each of which carries at one end a loop for a belt and is provided at its opposite end with a stud which projects within one of the grooves in the cam-plate on said shipper-pulley, substantially as described.

7. In an elevator apparatus, a main shaft carrying at one end fast and loose pulleys and at its opposite end a spur-gear, a tubular secondary shaft surrounding said main shaft between said pulleys and gear and carrying a winding-drum and gear-wheel, and a third shaft carrying at one end a gear-wheel and at its opposite end a spur-gear, which mesh, respectively, with the spur-gear and gear-wheel on said main and secondary shafts, combined and operating substantially as described.

8. In an elevator apparatus, the combination, with a main shaft carrying fast and loose pulleys, of shaft 15, having spur-gear connection with said main shaft and carrying winding-drum 39, said shaft being threaded for a portion of its length, shipper-pulley 20, loosely mounted upon said shaft and having arm 22 projecting laterally therefrom, collars 24, clamped upon said shaft at each end of the threaded portion of the latter and having lugs 25 projecting from their adjacent ends, and threaded collar 26, located upon said threaded portion of the shaft, said collar having lugs 27 projecting from its opposite ends and having the radial arm 28, which is forked to engage said arm 22 on the shipper-pulley, substantially as set forth.

9. In an elevator apparatus, the combination, with shaft 15, carrying drum 39 for cable 40, and having loosely mounted thereon shipper-pulley 20, said pulley being provided with arm 22, of ratchet-disk 49, having a spline-and-feather connection with said shaft and having its hub provided with the annular groove 50, sliding pins 51, engaging at one end the groove in said hub, a collar, as 45, revolubly mounted upon said shaft and having upon one end thereof a cam-surface adapted to bear against the ends of said pins 51, an arm rigidly connected with said collar and projecting in opposite directions therefrom, one end of said arm carrying a roll which bears against the cable 40 and the opposite end thereof supporting a weight, and a spring or springs retaining the ends of said pins 51 in engagement with the cam-surface on said collar, substantially as and for the purpose described.

10. In an elevator apparatus, the combination, with main shaft 3, of tubular shaft 15, having spur-gear connection with said main shaft, said shaft 15 having an entire or partial screw-thread formed thereon, winding-drum 39, mounted upon said shaft and connected therewith by a corresponding screw-thread, said drum having upon one end thereof the frictional surface 43, ratchet-wheel 41, loosely mounted upon said shaft and having a corresponding frictional surface, and pawl 42, pivoted to a fixed support and engaging the teeth on said ratchet-wheel, arranged and operating substantially as and for the purpose set forth.

11. In an elevator apparatus, the girders 1, having depending therefrom hangers in which are journaled the shafts 3, 15, and 11, said shaft 3 carrying pulleys 4 5 6 7 and spur-gear 9, said shaft 15 carrying drum 39 and gear-wheel 14 and having loosely mounted thereon shipper-pulley 20, and said shaft 11 carrying gear-wheel 10, which meshes with gear 9, and spur-gear 13, which meshes with gear-wheel 14, combined and operating substantially as set forth.

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