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OPERATING MECHANISM FOR ELEVATORS

Filed Jan. 14, 1941

2 Sheets-Sheet 1

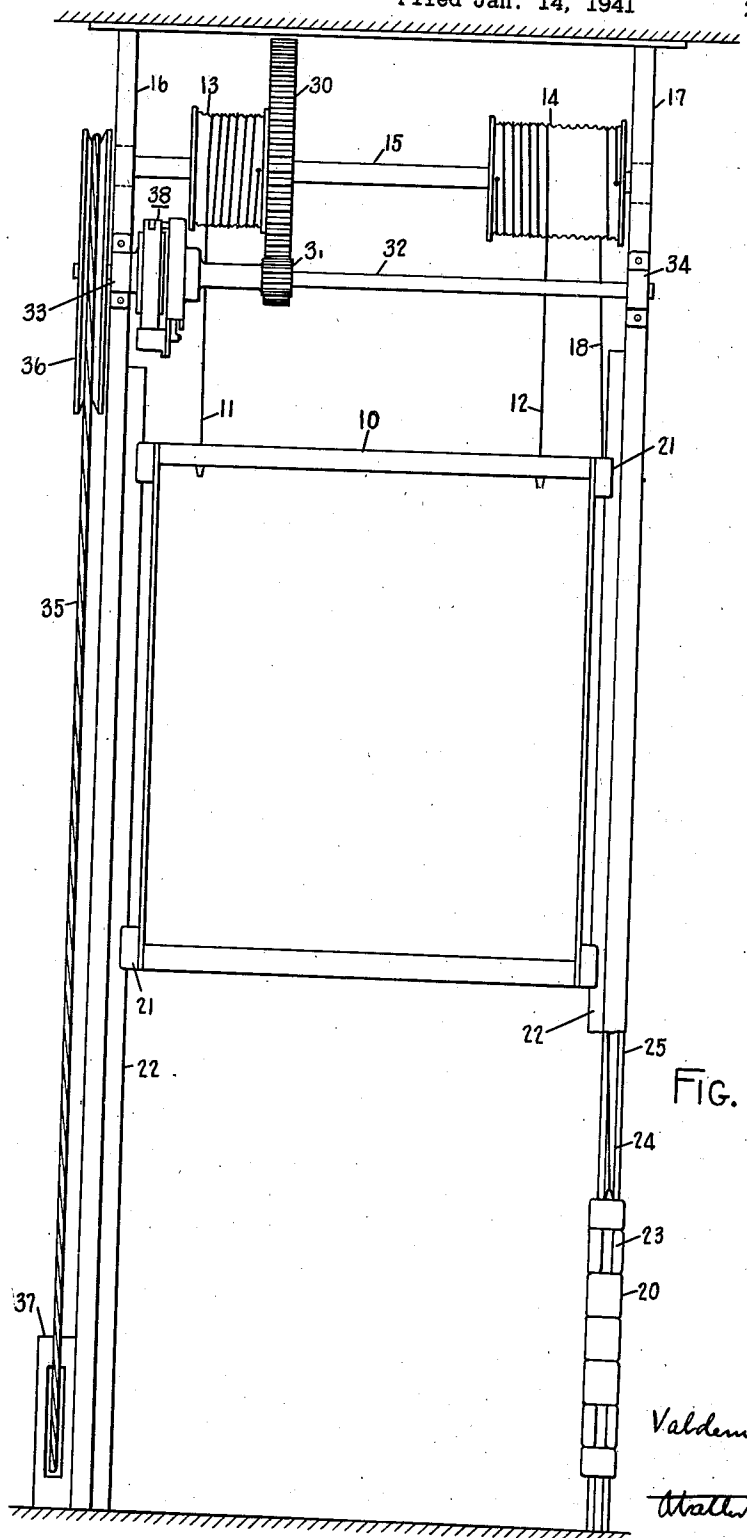


FIG. 1

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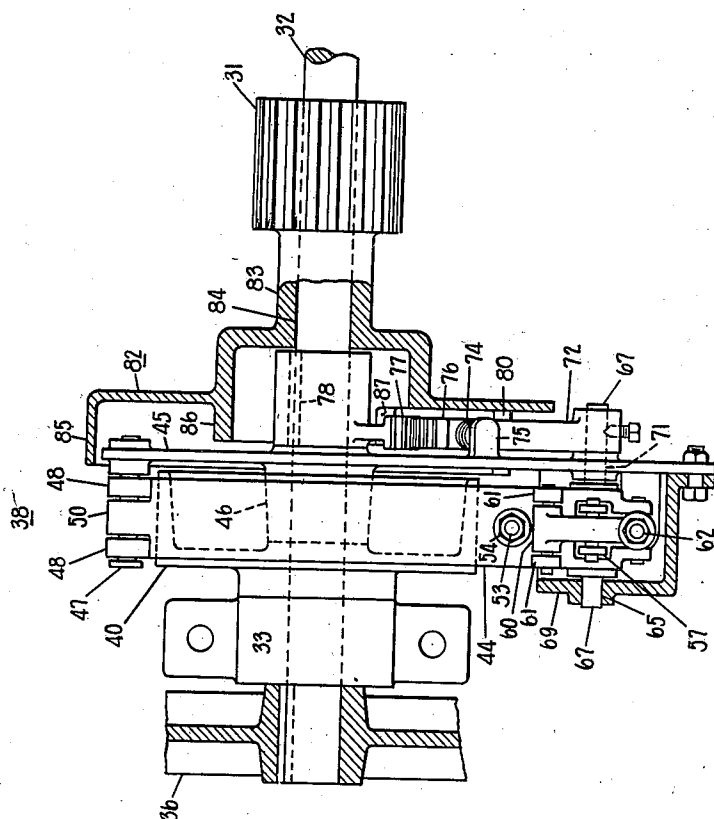


FIG. 2

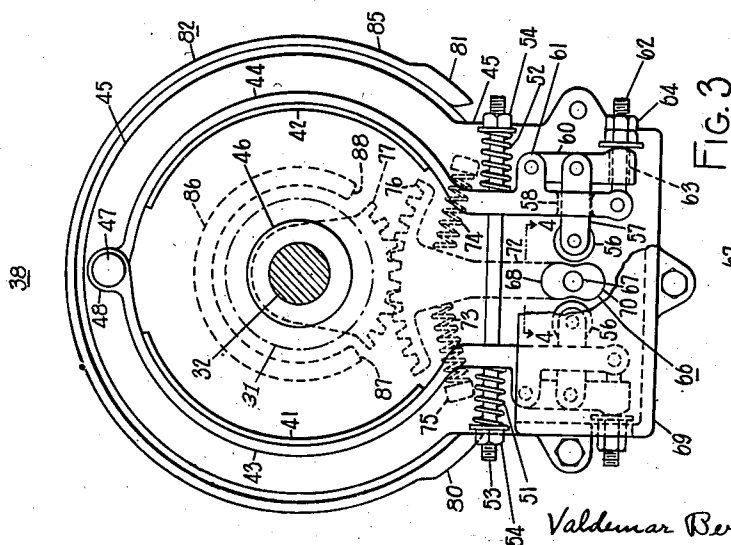


FIG. 3

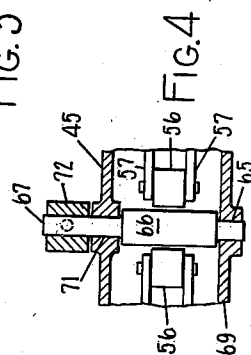


FIG. 4

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UNITED STATES PATENT OFFICE

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OPERATING MECHANISM FOR ELEVATORS

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5 Claims. (Cl. 192—8)

The invention relates to operating mechanism for elevators, especially hand power elevators.

There are various types of hand power elevators such as dumbwaiters, basement lifts and the like. These elevators are usually operated by pull ropes or cranks. It is usual in such elevators to suspend the car by roping attached to the car at the center or by roping attached to the car on each side of the center as at the sides of the car. Furthermore, the car may be overcounterweighted or undercounterweighted and in the basement type for example there may be no counterweight at all.

The object of the invention is to provide especially for hand power elevators operating mechanism including a mechanical brake which is released automatically upon the application of power to operate the elevator and which is applied automatically to stop the car in either direction of car travel upon the discontinuance of the application of power, regardless of whether the car is overcounterweighted or undercounterweighted or whether it has any counterweight at all.

Features and advantages of the invention will become apparent from the specification and appended claims.

According to the arrangement which will be described, the brake comprises a pair of brake arms pivotally mounted on a mounting member which in turn is rotatably mounted on the operating shaft of the elevator. The operating shaft is arranged to be manually rotated as by a sheave secured to the shaft and provided with a pull rope. The brake arms are provided with brake shoes for engaging a stationary drum concentric with the operating shaft. The brake arms are biased to brake applying position. Means are provided to spread the brake arms against their bias to permit rotative movement of the mounting member with respect to the drum. This spreading means is actuated, upon rotative movement of the operating shaft in either direction, by a member secured to the shaft. An operating pinion for the car is carried by a frame rotatably mounted on the operating shaft. This frame is arranged so that, upon operation of said actuating member to effect the spread of the brake arms, it is picked up and actuated by said actuating member when a load is to be lifted and is held against and rotates with said mounting member when a load is to be lowered. The pinion meshes with the operating gear of the elevator so that rotation of the frame causes operation of the elevator car, the direction of

car movement depending upon the direction of rotation of the shaft. The spreading means for the brake arms is biased to neutral position so that upon the discontinuance of the application of power to the operating shaft the brake shoes are applied with full pressure upon the drum. This brings the mounting member upon which the brake arms are mounted to a stop, which in turn prevents further rotative movement of the frame, thereby bringing the car to a stop.

In the drawings:

Figure 1 is a schematic representation of a hand power elevator installation embodying the invention;

Figure 2 is a side view of the brake mechanism of Figure 1 with parts in section;

Figure 3 is an end view of the same with parts removed; and

Figure 4 is a view taken along the line 4—4 of Figure 3.

Referring to Figure 1, the elevator car 10 is illustrated as suspended by a pair of hoisting ropes 11 and 12 secured to the top of the car at the sides thereof. These ropes extend upwardly to a pair of hoisting drums 13 and 14 respectively. The end of each rope is secured to the drum and is wound thereon in a spiral groove provided on the drum. These drums are secured to a shaft 15 mounted in bearings supported by uprights 16 and 17. Drum 14 is illustrated as longer than drum 13 to elongate the spiral groove for accommodating a rope 18 which suspends the counterweight 20. The end of this rope is secured to the drum and it is wound on the drum oppositely to the hoisting rope so as to unwind as the hoisting rope is wound and vice versa. The elevator car is provided with guide shoes 21 cooperating with guide rails 22 secured to the uprights 16 and 17. The counterweight 40 is also provided with guide shoes 23 cooperating with guide rails 24 secured to upright 17 and an additional upright 25.

A gear 30 is secured to shaft 15 at the drum 13. This gear is driven by a pinion 31 rotatably mounted on operating shaft 32. Shaft 32 is supported by bearings 33 and 34 mounted on uprights 16 and 17. The operating shaft is illustrated as actuated by a pull rope 35 passing over a sheave 36 secured to the end of the shaft, this pull rope being a closed loop and extending at its bottom through a guide slot in member 37. Braking mechanism 38 is associated with pinion 31 to bring the elevator to a stop and hold it while at rest, details of this mechanism being shown in Figures 2, 3 and 4.

Referring to these figures, a brake drum 40 is formed integral with or secured to bearing 33. This drum is engaged by a pair of brake shoes 41 and 42, secured to brake arms 43 and 44 respectively. The brake arms are mounted on a plate 45, loosely mounted on shaft 32. The plate is formed with a hub 46 through which the opening for shaft 32 extends to provide adequate bearing surface. A bearing pin 47 is secured to plate 45 at the top thereof. At the upper end, brake arm 43 is provided with a pair of lugs 48 and brake arm 44 with a lug 50 intermediate lugs 48. These lugs are provided with aligned apertures through which the pivot pin 47 extends to form a pivotal mounting for the brake arms. The brake arms are biased to brake applying position by springs 51 and 52. These springs are arranged on a cross rod 53, extending through apertures in the brake arms beneath the brake drum. The ends of rod 53 are threaded to receive adjusting nuts 54. The springs are arranged on the cross rod between the brake arms and washers abutting the adjusting nuts. The nuts are set to place the springs in a state of compression, such as to provide the desired braking force of the brake shoes against the drum.

The brake shoes are actuated by spreading the brake arms about their pivot against the force of the biasing springs. Each brake arm is provided with an operating roller 56, these rollers extending inwardly to face each other but in spaced relation. For purposes of adjustment each roller is mounted between two links 57, extending through a guide aperture 58 in the brake arm and pivotally connected to an adjusting lever 60 intermediate the ends of this lever. At its upper end lever 60 is pivotally connected to lugs 61 formed on the brake arm. An eye bolt 62 is pivotally secured to the lower end of the brake arm and extends through an aperture 63 in the lower end of lever 60. Adjusting and lock nuts 64 are provided on the eye bolt for adjusting the position of roller 56, with respect to the brake arm.

An operating cam 66 is arranged between the operating rollers 56. This cam is secured to or formed on a shaft 67 for rotary movement to engage the rollers, being disengaged therefrom when the elevator car is at rest. The cam is formed with an upper camming portion 68 and a lower camming portion 70. These camming portions are of the same contour on each side of a vertical centerline so as to engage the operating rollers and effect the spread of the brake arms upon rotary movement of shaft 67 in either direction. Shaft 67 is pivotally supported in an aperture 71 formed in plate 45 and an aperture 65 in a bracket 69 secured to the plate and is operated by a lever 72 secured to the shaft on the rear of the plate. The lever 72 is biased to neutral position, i. e., with the cam 66 in vertical position between the operating rollers, by centering springs 73 and 74. Each of these springs is positioned between a lug 75 formed on the rear of plate 45 and the lever. The upper end of the lever is formed with a gear segment 76. Meshing with this segment is another gear segment 77 secured as by a key 78 to operating shaft 32. Thus upon rotary movement of the operating shaft in either direction lever 72 actuates cam 66 to engage the operating rollers to spread the brake arms.

To hold the car when the brake shoes are not spread, one or the other of a pair of lugs 80 and 81 formed on a frame 82 engages the edge of

plate 45. The frame 82 is loosely mounted on operating shaft 32 and is formed with a hub 83 provided with an opening 84 through which the shaft extends. The lugs 80 and 81 are at the ends of an arcuate flange 85 concentric with shaft 32 and formed on the frame. Flange 85 extends over plate 45 thereby positioning the plate in the path of movement of the lugs. Another arcuate flange 86 concentric with but of smaller diameter than flange 85 is formed on frame 82. Flange 86 is of a size such that its ends 87 and 88 are in the path of movement of gear segment 77. Clearance exists between the ends of this flange and gear segment 77. The operating pinion 31 for the car is formed integral with or secured to the frame at the hub 83. Thus if the load is such as to tend to rotate pinion 31 counterclockwise as viewed in Figure 3, lug 80 is in engagement with the edge of plate 45 to hold the car, whereas if the load is such as to tend to rotate pinion 31 clockwise lug 81 is in engagement with the other edge of plate 45 to hold the car.

For convenience in describing operation of the mechanism, it will be assumed that the weight of the counterweight is greater than empty car to provide an overbalanced system. In describing the operation, directions of rotation referred to, unless otherwise indicated, will be viewed in Figure 3. It will be further assumed that the load in the car is such as to overbalance the counterweight, thereby tending to effect counterclockwise rotation of pinion 31 so that the load is supported by lug 80 in engagement with the edge of plate 45 as illustrated. Under such conditions the clearance between the gear segment 77 and the end 87 of flange 86 is less than that between the segment and end 88 of the flange. To raise the elevator car, the pull rope 35 is pulled in a direction to effect clockwise rotative movement of the operating shaft 32. This rotates gear segment 77 clockwise to take up the clearance between it and the end 87 of flange 86. Continued movement of the shaft after the segment engages the flange causes clockwise rotative movement of frame 82 to move lug 80 away from plate 45. During this movement lever 72 is moved counterclockwise against spring 73. This moves cam 66 into engagement with operating rollers 56 to gradually spread the brake arms. A point is reached where the pressure exerted by the brake shoes on the brake drum becomes low enough to permit rotative movement of plate 45 about shaft 32 to follow the frame 82. The brake arms are adjusted so that this point is reached before lug 81 engages the opposite edge of plate 45. Continued pulling on the rope causes the continued rotative movement of frame 82 and thus pinion 31 to cause the lifting of the elevator car. The brake shoes are maintained on the point of drag so that upon the pull on the pull rope being discontinued, spring 73 acts against its lug 75 to force plate 45 clockwise about the shaft 32 to re-engage lug 80 on frame 82 and thereafter to move the lever back to neutral position to cause full application of the brake.

To lower the elevator car under the load conditions assumed, pull rope 35 is pulled in the opposite direction to effect counter-clockwise movement of shaft 32. This rotates gear segment 77 counter-clockwise to decrease the clearance between it and the end 88 of flange 86. During this movement lever 72 is moved clockwise against spring 74 to engage cam 66 with rollers 56 to spread the brake arms until the pressure of

the brake shoes on the drum is relieved sufficiently to permit plate 45 to rotate counter-clockwise with gear segment 77. As the load is acting through pinion 31 and lug 80 of frame 82 tending to rotate plate 45 counter-clockwise, the pressure of the brake shoes on the drum at the point of drag is greater than when the load was being lifted. The clearances between the ends of flange 86 and gear segment 77 are such that the point of drag is reached without the space between the segment and end 88 of the flange being taken up. Lug 80 is maintained in contact with the edge of plate 45 as continued rotative movement of shaft 32 takes place so that frame 82 follows plate 45, thereby lowering the elevator car. The car drags through the brake in lowering so that upon the pull on the pull rope being discontinued the car acts through frame 82 to continue the counter-clockwise movement of plate 45 about shaft 32 which, assisted by spring 74, returns lever 72 to neutral to apply the brake shoes with full pressure, thus bringing the car to a stop.

Assume now a load condition in which the car is empty so that the counterweight overbalances the car. Under such conditions the car is held by the engagement of lug 81 with the edge of plate 45 and the spacing between the ends of flange 86 and gear segment 77 is reversed so as to provide greater clearance between end 87 and the gear segment. To lower the elevator car under such conditions the pull rope is pulled in a direction to effect counter-clockwise movement of shaft 32. This rotates gear segment 77 counter-clockwise to take up the clearance between it and the end 88 of flange 86. Continued movement of shaft 32 after the segment engages the flange causes rotary movement of frame 82 to move lug 81 away from plate 45. As this movement takes place lever 72 is moved clockwise, acting through cam 66 after the engagement thereof with operating rollers 56 to spread the brake arms. When the point of drag is reached, plate 45 is allowed to rotate to follow frame 82 so that continued pulling on the pull rope causes continued rotative movement of frame 82 to effect the lowering of the elevator car. Upon the pull on the pull rope being discontinued, spring 74 acts to force plate 45 counter-clockwise to re-engage lug 81 and thereafter to move lever 72 into position to effect the full application of the brake.

To raise the elevator car under such conditions the pull rope is pulled in a direction to effect clockwise movement of shaft 32. This rotates gear segment 77 clockwise to decrease clearance between it and the end 87 of flange 86. During this movement lever 72 is moved counter-clockwise to engage cam 66 with rollers 56 to spread the brake arms until the point of drag is reached. As the counterweight is acting through lug 81 on frame 82 tending to rotate plate 45 clockwise the pressure of the brake shoes on the drum is greater than when the car was being lowered. Lug 81 is maintained in contact with plate 45 as continued rotative movement of shaft 32 takes place so that frame 82 follows plate 45, thereby lifting the elevator car. Upon the pull on the pull rope being discontinued the counterweight acts through frame 82 to continue the clockwise movement of plate 45 which, assisted by spring 73, returns lever 72 to neutral to apply the brake shoes with full pressure, bringing the elevator car to a stop.

Although the invention has been described as applied to an overcounterbalanced elevator, it is

to be understood that it is also applicable to installations in which the car is undercounterbalanced, including those in which no counterweight is employed. It is also to be understood that the manner of supporting the car may be varied and that the operating shaft may be actuated by other means. In addition, various alterations may be made in the construction of the braking mechanism and many apparently widely different embodiments of the invention may be made without departing from the scope thereof. It is, therefore, intended that all matter contained in the above description or shown on the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Operating mechanism for an elevator car comprising, an operating shaft, a stationary brake drum concentric with said shaft, a plate rotatably mounted on said shaft, a pair of brake arms disposed on opposite sides of said drum, each arm carrying a shoe for engaging said drum and being pivotally mounted at one end thereof on said plate, a pair of brake springs, one for each arm, for forcing said shoes against said drum, camming means rotatably mounted on said plate between said arms at the other ends thereof, a gear segment secured to said camming means for effecting rotative movement thereof, a second gear segment secured to said shaft and meshing with the first segment for effecting rotative movement thereof to cause said camming means to spread said arms upon rotative movement of said shaft in either direction, thereby decreasing the pressure of said shoes on said drum to permit rotative movement of said plate with respect to said drum, and a member rotatably mounted on said shaft and operable upon rotative movement thereof in one direction to raise said car and in the other direction to lower the car, said member being engaged and operated by said second gear segment when a load is being lifted and engaging and moving said plate when a load is being lowered.

2. Operating mechanism for an elevator car comprising, a hoisting shaft, a gear secured to said shaft, a pinion meshing with said gear, an operating shaft, said pinion being loosely mounted on said operating shaft, a stationary brake drum concentric with said operating shaft, a plate loosely mounted on said operating shaft, a pair of brake arms disposed on opposite sides of said drum, each arm carrying a shoe for engaging said drum and being pivotally mounted at one end thereof on said plate, a pair of brake springs, one for each arm, for forcing said shoes against said drum, a cam rotatably mounted on said plate between said arms at the other ends thereof and adapted upon rotative movement thereof to cause spreading of said brake arms, a gear segment secured to said cam for effecting rotative movement thereof, means for biasing said segment to neutral position, a second gear segment secured to said operating shaft and meshing with the first segment for effecting rotative movement thereof against said biasing means to cause operation of said cam to spread said arms upon rotative movement of said operating shaft in either direction, thereby decreasing the pressure of said shoes on said drum to permit rotative movement of said plate with respect to said drum, and a frame carried by said pinion and having abutments adapted when a load is to be lifted to be engaged by said second gear segment to effect rotation of

said pinion and having additional abutments for engaging said plate to cause said frame to follow said plate and thus effect rotation of said pinion when a load is being lowered.

3. Braking mechanism for an elevator car comprising, an operating shaft, a stationary brake drum concentric with said shaft, a rotatable member rotatably mounted on said shaft, a pair of brake arms disposed on opposite sides of said drum, each arm carrying a shoe for engaging said drum and being pivotally mounted at one end thereof on said rotatable member, means for biasing said brake arms to position with said shoes pressed against said drum, an operating member secured to said shaft, means operable by said operating member upon the application of power to said shaft to effect rotative movement thereof in either direction for spreading said arms to decrease the pressure of said shoes on said drum and thus permit rotative movement of said rotatable member with respect to said drum, operating means rotatably mounted on said shaft and connected to said car to effect the raising and lowering thereof, said operating means having an abutment on each side of said operating member but spaced therefrom, one or the other of which, depending upon the direction of rotative movement of said operating member, is adapted when a load is to be lifted to be engaged by said operating member upon rotation thereof in effecting the spreading of said brake arms to effect rotation of said operating means upon continued rotation of said shaft and having an additional abutment on each side of said rotatable member and spaced a distance greater than the width of said rotatable member, one or the other of which is adapted when a load is to be lowered to engage and effect rotative movement of said rotatable member upon the pressure of said brake shoes being sufficiently decreased, thereby effecting rotation of said rotatable means, and means for biasing said spreading means to position to enable the said biasing means fully to apply said shoes to said drum to stop said rotatable member and thus said operating means upon discontinuance of the application of power to said operating shaft.

4. Braking mechanism for an elevator car comprising, an operating shaft, a stationary brake drum concentric with said shaft, a plate rotatably mounted on said shaft, a pair of brake arms disposed on opposite sides of said drum, each arm carrying a shoe for engaging said drum and being pivotally mounted at one end thereof on said plate, a pair of brake springs, one for each arm, for forcing said shoes against said drum, a gear segment secured to said shaft, a second gear segment pivotally mounted on said plate and meshing with said first named gear segment to be rotated thereby upon the application of power to said shaft to effect rotative movement thereof in either direction, means operable by said second gear segment upon rotative movement thereof in either direction for spreading said arms to decrease the pressure of said shoes on said drum and thus permit rotative movement of said plate with respect to said drum, an operating gear for said car rotatably mounted on said shaft, a frame carried by said gear and having a pair of abutments one on each side of said first gear segment but spaced therefrom, one or the other of which, depending upon the direction of rotative movement of said

second gear segment, is adapted when a load is to be lifted to be engaged by said first gear segment upon rotation thereof to effect rotation of said gear upon continued rotation of said shaft after effecting decrease in the pressure of said brake shoes and having additional abutments one on each side of said plate and spaced a distance greater than the width of said plate, one or the other of which is adapted when a load is to be lowered to engage said plate and to effect rotative movement thereof upon the pressure of said brake shoes being sufficiently decreased, thereby effecting rotation of said gear, and means for biasing said second named segment to neutral position to enable the said springs fully to apply said shoes to said drum to stop said plate upon discontinuance of the application of power to said operating shaft, said car being brought to a stop upon the stopping of said plate by the stopping of said frame through the engagement of one or the other of its additional abutments, depending upon the load, with said plate.

5. Braking mechanism for an elevator car comprising, a hoisting shaft, a gear secured to said shaft, a pinion meshing with said gear, an operating shaft, said pinion being rotatably mounted on said operating shaft, a stationary brake drum concentric with said operating shaft, a plate rotatably mounted on said operating shaft, a pair of brake arms disposed on opposite sides of said drum, each arm carrying a shoe for engaging said drum and being pivotally mounted at one end thereof on said plate, a pair of brake springs, one for each arm, for forcing said shoes against said drum, a cam rotatably mounted on said plate between said arms at the other ends thereof and adapted upon rotative movement thereof to cause spreading of said brake arms, a gear segment secured to said cam for effecting rotative movement thereof, a second gear segment secured to said operating shaft and meshing with the first segment for effecting rotative movement thereof to cause operation of said cam to spread said arms upon rotative movement of said operating shaft in either direction by the application of power thereto, thereby decreasing the pressure of said shoes on said drum to permit rotative movement of said plate with respect to said drum, a frame carried by said pinion and having a pair of abutments one on each side of said second gear segment but spaced therefrom, one or the other of which, depending upon the direction of rotative movement of said second gear segment, is adapted when a load is to be lifted to be engaged by said second gear segment upon rotation thereof in effecting the spread of said brake arms to effect rotation of said pinion upon continued rotation of said shaft and having additional abutments one on each side of said plate and spaced a distance greater than the width of said plate, one or the other of which is adapted when a load is to be lowered to engage and effect rotative movement of said plate upon the pressure of said brake shoes being sufficiently decreased, thereby effecting rotation of said pinion, and means for biasing said first named segment to neutral position to enable the said springs fully to apply said shoes to said drum to stop said plate and thus the car upon discontinuance of the application of power to said operating shaft.

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