May 21, 1929. T. BRADY 1,714,460

DOOR OPERATING MECHANISM

Filed May 28, 1927 2 Sheets-Sheet 1

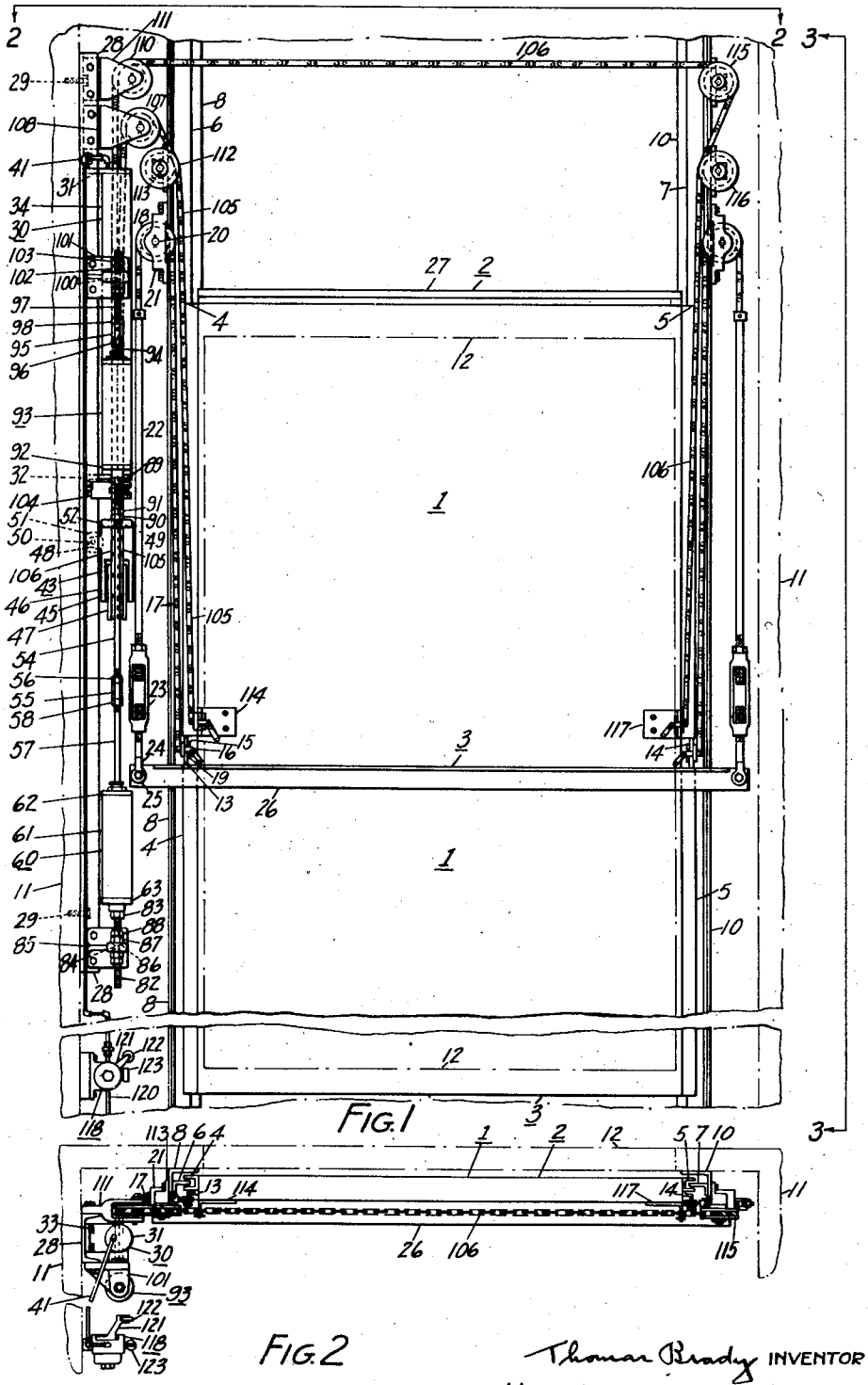


FIG. 1

FIG. 2

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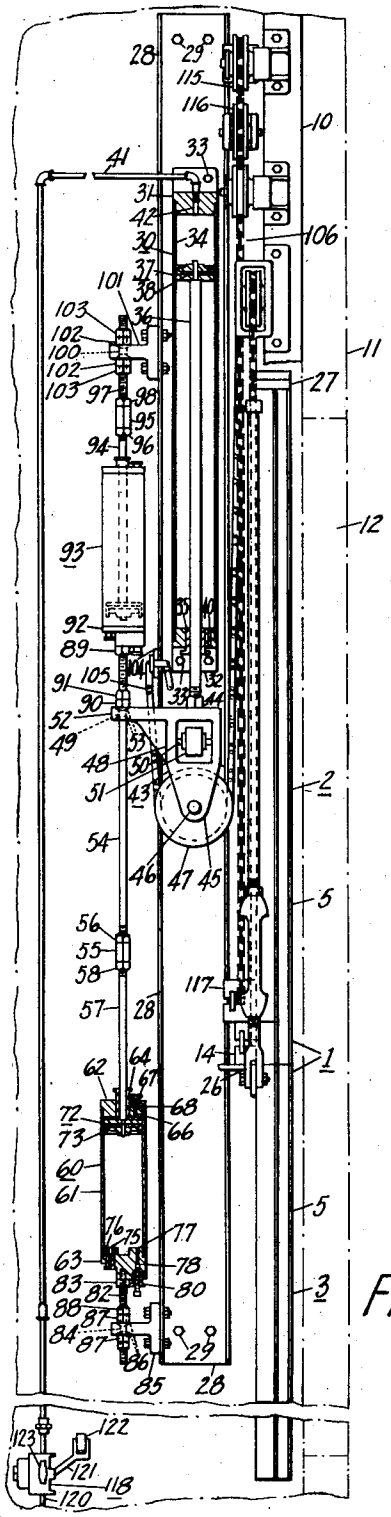


FIG. 3

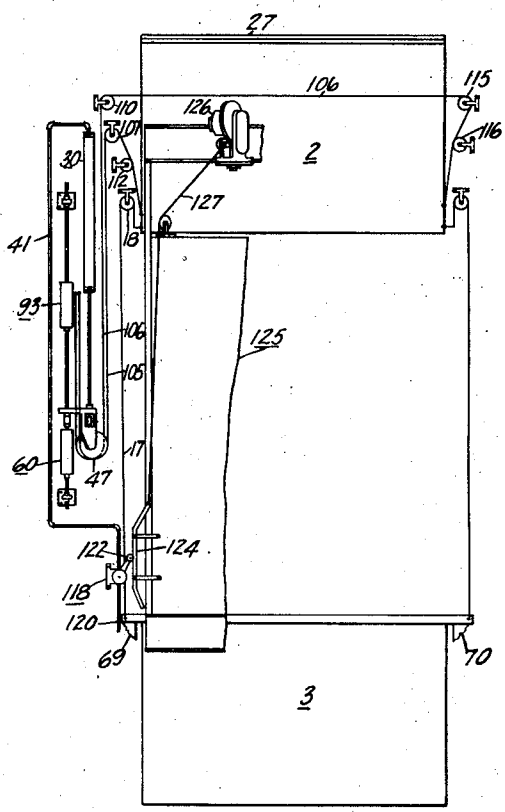


FIG. 4

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Patented May 21, 1929. 1,714,460

UNITED STATES PATENT OFFICE.

THOMAS BRADY, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

DOOR-OPERATING MECHANISM.

Application filed May 28, 1927. Serial No. 194,973.

This invention relates to door operating mechanism and particularly to pneumatic power operating mechanism for vertically sliding elevator hatchway doors.

One feature of the invention is to provide a door operating mechanism of the above character that is of simple construction and which is easily installed and operated.

Another feature of the invention is the provision of a door operating mechanism of the above character that is positive and silent in operation.

Other features and advantages will become apparent from the specification, taken in connection with the accompanying drawings wherein one embodiment of the invention is illustrated.

In the drawings:—

Figure 1 is a view from within the hatchway of the door operating mechanism applied to a vertically sliding hatchway door, the door being illustrated in closed position;

Figure 2 is a view taken along the line 2—2 of Figure 1;

Figure 3 is a view taken along the line 3—3 of Figure 1; and

Figure 4 is a schematic representation illustrating the elevator car at a landing with the hatchway door in open position.

Referring to Figures 1, 2 and 3 the hatchway door is designated as a whole by the reference numeral 1 and comprises an upper panel 2 and a lower panel 3. Panels 2 and 3 of door 1 are provided at their vertical edges with vertically extending guide grooves 4 and 5. Stationary guide members 6 and 7 extend into the grooves 4 and 5 and are arranged to guide the panels 2 and 3 in their movement. Guide members 6 and 7 are secured to vertically extending angle bars 8 and 10. Angle bars 8 and 10 are secured to the hatchway wall 11 and are positioned adjacent the door opening 12.

A hitch plate 13 is secured to one edge of door panel 2 near the bottom of this door panel. A similar hitch plate 14 is secured to the other edge of door panel 2 near the bottom of this panel. Each of these hitch plates is connected in a similar manner to the door panel 3. Since these connections are similar, only one of them, viz, the connection between hitch plate 13 and the door panel 3, will be described.

Hitch plate 13 is provided with a slot 15 that conforms to a link 16 of a chain 17. Link 16 is positioned within the slot 15 and is retained within this slot by a U-shaped pin 19 that extends through apertures provided in the hitch plate 13 at opposite sides of the slot 15. Chain 17 extends upwardly from hitch plate 13 and over a sheave 18 that is rotatably mounted on a pin 20. Pin 20 is threaded into a bracket 21 that is secured by bolts to the angle bar 8. From the sheave 18 the chain 17 extends downwardly and is connected to the upper end of a vertically extending rod 22. The lower end of rod 22 is threaded into the upper end of a turnbuckle 23. The lower end of this turnbuckle is threaded upon the upper portion of a yoke member 24. The lower portion of yoke member 24 is bifurcated and is connected by a bolt 25 to one end of an angle bar 26. The bolt 25 extends through aligned apertures provided in the yoke member 24 and in one leg of the angle bar 26. The angle bar 26 extends across the top of door panel 3 and is secured to this door panel. The other end of angle bar 26 is connected to the hitch plate 14.

The connecting of the door panels 2 and 3 in the manner above described causes either of these door panels to act as a counterbalance for the other. This counterbalancing of each of the door panels reduces to a minimum the force that is necessary to move these panels apart in opening the door 1.

The upper panel 2 is made somewhat heavier than the lower panel 3, as by securing weights 27 to the top of the upper panel, so as to cause these panels to move toward each other so that the door will be closed under the action of gravity when an operating force holding them apart is removed.

According to the preferred arrangement, a channel shaped wall plate 28 is secured by screws 29 to the hatchway wall 11. A pneumatic or fluid pressure cylinder 30 has a cylinder head 31 and a cylinder base 32 secured to the wall plate 28 by screws 33 extending through apertures in these members and threaded into the wall plate. The cylinder head 31 is threaded into the upper end of a hollow cylindrical portion 34 of the pneumatic cylinder 30. The cylinder base 32 extends into the lower end of the hollow cylindrical portion 34. A guide sleeve 35 is threaded into a central aperture provided in the cylinder base 32. The guide sleeve 35 is arranged to guide a piston rod 36 that extends into the pneumatic cylinder 30. Piston rod

36 has a piston 37 secured to its end within the cylinder 30. Piston 37 is provided with a cup leather 38 which prevents leakage of compressed air from the upper side to the under side thereof. Apertures 40 provided in the cylinder base 32 permit the free passage of air into and out of the pneumatic cylinder below the piston 37. Compressed air may be fed to the cylinder 30 above the piston by means of piping 41 threaded into an aperture 42 provided in the cylinder head 31.

The lower end of piston rod 36 is threaded into an aperture provided in a bracket 43 and is secured within this aperture as by a lock nut 44 threaded on the piston rod and abutting against the bracket 43. Bracket 43 has a pair of depending apertured lugs 45. A pin 46 extends through the apertures in lugs 45 and carries a sheave 47. Bracket 43 also has a pair of horizontally extending apertured lugs 48. A pin 50 extends through the apertures in lugs 48 and carries a roller 51. Roller 51 contacts with the wall plate 28 and is arranged to guide the bracket 43 during movement of this bracket. Bracket 43 has a horizontally extending portion 52. Portion 52 is provided with a vertically extending aperture 49 having countersunk portions 53.

A connecting rod 54 extends through the aperture 49. The lower end of the connecting rod 54 is threaded into a nut 55. A lock nut 56 that is rounded at one end and abutting at its other end against the nut 55, secures this end of the connecting rod 54 to the nut 55. The upper end of a piston rod 57 is also threaded into the nut 55 and is secured to this nut by a lock nut 58. Piston rod 57 is a part of a pneumatic check 60. Pneumatic check 60 comprises a central hollow cylindrical portion 61 closed at its upper end by a cylinder head 62 and at its lower end by a base 63. The cylinder head 62 is threaded into the upper end of the central portion 61 of the check 60. An aperture 66 extends through the cylinder head 62. A sleeve 67 is threaded into an enlarged portion of the aperture 66 and retains a screen 68 within this aperture. The screen 68 serves to prevent foreign matter from passing through aperture 66 into the check cylinder. The piston rod 57 extends through a guide sleeve 64 that is threaded into a central aperture provided in the cylinder head 62. Piston rod 57 has a check piston 72 secured to its lower end within the central portion 61. Check piston 72 is provided with a cup leather 73 which prevents the leakage of air from the under side to the upper side thereof.

The base 63 is threaded into the lower end of the central hollow cylindrical portion 61. A ball valve 75 is threaded into an aperture 76 provided in the base 63 and permits fluid to pass through aperture 76 into the central portion 61 but prevents the escape of fluid from the central portion 61 through this aperture. A passage 77 extends through the base 63 from the interior of the check 60 to the exterior thereof. A needle valve 78 is threaded into a sleeve 80 that in turn is threaded into an aperture provided in the base 63. The needle valve 78 extends into the passage 77 and may be adjusted so as to restrict this passage to any desired extent.

The upper end of a rod 82 is threaded into a recess provided in the base 63. A lock nut 83 is threaded on the rod 82 and abuts against the base 63, thereby securing this rod to the pneumatic check 60. The lower portion of rod 82 extends through an aperture 84 in a bracket 85. Aperture 84 has countersunk portions 86. Bracket 85 is secured by bolts to the wall plate 28. Rod 82 is attached to the bracket 85 by nuts 87 having beveled heads in engagement with the countersunk portions 86. Lock nuts 88 secure the nuts 87 in position on the rod 82.

A nut 90 having a rounded end is positioned on the connecting rod 54 at a point above the bracket 43. A lock nut 91 abuts against the other end of nut 90 and retains this nut in fixed position on the connecting rod 54. The upper end of connecting rod 54 is threaded into a recess provided in the base 92 of a pneumatic check 93. A lock nut 89 is threaded on the connecting rod 54 and abuts against the base 92, thereby securing the connecting rod to the pneumatic check 93. Pneumatic check 93 is similar in construction to pneumatic check 60. Pneumatic check 93 would, therefore, appear to require no further description. The upper end of the piston rod 94 of pneumatic check 93 is threaded into a nut 95. A lock nut 96 secures this end of the piston rod 94 to the nut 95. The lower end of a rod 97 is also threaded into the nut 95 and is secured to this nut by a lock nut 98. The upper portion of rod 97 extends through an aperture 100 provided in a bracket 101 that is similar to bracket 85. Bracket 101 is secured by bolts to the wall plate 28. Rod 97 is attached to the bracket 101 by nuts 102 having beveled heads. Lock nuts 103 secure the nuts 102 in position on the rod 97.

A hitch plate 104, of the same construction as hitch plates 13 and 14, is secured to the wall plate 28 adjacent the pneumatic cylinder 30. Chains 105 and 106 are secured to the hitch plate 104 and extend downwardly from this hitch plate. These chains pass around the sheave 47. From the sheave 47 these chains extend upwardly. Chain 105 passes over a sheave 107 that is rotatably carried by a bracket 108 secured to the wall plate 28, while chain 106 passes over a sheave 110 that is rotatably carried by a bracket 111, also secured to the wall plate 28. From the sheaves 110 and 107 these chains separate. Chain 105 extends downwardly over a sheave 112 that is carried by a bracket 113 secured

to the angle bar 8. Below this sheave 112 chain 105 is attached to a hitch plate 114 that is secured by bolts to the upper panel 2 of hatchway door 1. Chain 106 extends from sheave 110 over sheaves 115 and 116 carried by brackets mounted on the angle bar 10. Below these sheaves chain 106 is attached to a hitch plate 117 that is also secured by bolts to upper panel 2 of hatchway door 1.

An air valve 118 is arranged to connect a compressed air main 120 to the piping 41. Valve 118 has an operating lever 121 that carries a roller 122. Operating lever 121 is biased to the position shown in Figures 1 and 2. In this position of lever 121, the compressed air main 120 is shut off from the pneumatic cylinder 30 and piping 41 leading to this cylinder is connected to the valve exhaust opening 123 so that the air pressure within the cylinder 30 is atmospheric.

As shown in Figure 4 a retiring cam 124 carried by the elevator car 125 is arranged to be extended so as to engage the roller 122 and move the operating lever 121 into the position shown in this figure. A retiring cam motor 126 is provided as an operating device for retiring the cam 124. This motor has an operating connection 127 extending from its driving shaft to the retiring cam 124. With the operating lever 121 in the position illustrated in Figure 4, the compressed air main 120 is connected by valve 118 to the pneumatic cylinder 30.

The operation of the pneumatic power operating mechanism is as follows:

When the elevator car is not at the landing, illustrated in Figures 1, 2 and 3, the door 1 at this landing is in its closed position with the panels 2 and 3 in engagement. A suitable lock (not shown) may be provided, if desired, for locking these panels in engagement when the elevator car is not at the landing.

With the elevator car at the landing, should it be desired to open the door 1, the retiring cam motor 126 is deenergized permitting the retiring cam 124 to extend under the action of gravity and move the valve operating lever 121 into the position shown in Figure 4. This movement of valve operating lever 121 causes compressed air to enter the pneumatic cylinder 30 above the piston 37. Piston 37 is forced downwardly by the air pressure within cylinder 30 and causes bracket 43 and sheave 47 to move downwardly. As sheave 47 commences to move downwardly it creates a tension in chains 105 and 106 and causes these chains to act through hitch plates 114 and 117 and exert an upward pull upon the upper panel 2. As this upward pull becomes substantially equal to the difference in weight between the upper and lower panels of the door 1, the door commences to open, the upper panel 2 moving upwardly and the lower panel 3 moving downwardly. During the downward movement of the sheave 47, the chains 105 and 106 ride over it, and the horizontal portion 52 of bracket 43 slides along connecting rod 54. At a predetermined point near the end of the movement of the bracket 43, the lower countersunk portion 53 of this bracket strikes against the rounded end of lock nut 56 mounted on the connecting rod 54. Further movement of the bracket 43 causes the pneumatic check 60 to operate to check the motion of the moving parts. Bracket 43 acting through nuts 56, 55 and 58 causes piston rod 57 to move the check piston 72 downwardly within the cylindrical portion 61 of the pneumatic check 60. Air trapped below the check piston 72 is thusly compressed, the ball valve 75 being closed, causing the piston 72 to resist and effect the slowing up of this downward movement. This compressed air below the piston 72 escapes slowly through the restricted passage 77 into the atmosphere. During this downward movement of the piston 72 the cylinder portion of the pneumatic check 93 also moves downwardly, but this check does not resist such downward movement owing to the free egress of air through the aperture in the cylinder head of this check and the free ingress of air through ball check in the base 92.

The striking of the base 74 by the lower end of the piston rod 57 brings the moving parts to rest with the door 1 in its open position as illustrated in Figure 4. In this position of the door 1 the upper surface of the angle bar 26 of door panel 3 is flush with the floor landing and this angle bar rests upon the stop members 69 and 70. The lower edge of the door panel 2 is at the top of the door opening.

To effect the closing of the door 1, the retiring cam motor 126 is again energized causing the retiring cam 124 to be retracted and permitting the valve operating lever 121 to move into the position illustrated in Figures 1 and 2, thereby effecting the shutting off of the supply of compressed air to the pneumatic cylinder 30 and connecting this cylinder to the exhaust opening 123. The escape of the air within the pneumatic cylinder 30 through the exhaust opening 123 eliminates the air pressure upon the piston 37 and permits the upper door panel 2 to move under the action of gravity towards closed position. This movement of panel 2 causes door panel 3 and bracket 43 to move upwardly, the horizontal portion 52 of this bracket, sliding along the connecting rod 54. At a predetermined point near the end of the closing movement of the door 1, the upper countersunk portion 53 of bracket 43 strikes against the rounded end of nut 90. Further movement of the door 1 and of bracket 43 causes the connecting rod 54, the base 92 and the cylindrical portion of the pneumatic check 93 to move upwardly.

Since the piston rod 97 of this pneumatic check is held stationary by the bracket 101 the air below this piston is compressed and escapes slowly through the restricted passage in the base 92, thereby checking the closing movement of the door 1. During this checking operation, the piston rod 57 and piston 72 of pneumatic check 60 move along with connecting rod 54, but this pneumatic check does not resist the upward movement owing to the free egress of air from the aperture 66 and the free ingress of air through the ball valve 75 during the motion. Thus the moving parts are brought to rest with the door in its closed position, as illustrated in Figures 1 and 2.

In the event that the supply of compressed air should fail, the hatchway door will close automatically by gravity, thereby eliminating the possibility of accident or damage due to the door being open.

It is to be noted that with the arrangement of the checks employed no stuffing boxes are necessary. This insures positive and uniform action of the checks at all times.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Hatchway door operating mechanism comprising, a valve, a pneumatic cylinder, a piston operating within said pneumatic cylinder, a piston rod secured to said piston, a bracket secured to said piston rod, a sheave carried by said bracket, chains passing over said sheave and connected to a door to be operated, a connecting rod extending through an aperture in said bracket, a member mounted on said connecting rod and arranged to be engaged by said bracket, and a check connected to said connecting rod, said valve being arranged to be operated so as to admit compressed air to said pneumatic cylinder and cause said piston, together with said piston rod, said bracket and said sheave to move and effect through movement of said chain the opening operation of the door, said bracket during this opening operation striking the member mounted on said connecting rod and actuating this rod to cause the operation of said check and effect the checking of the door at the end of the opening movement.

2. Operating mechanism for vertically sliding hatchway doors arranged to close under the action of gravity comprising; a pneumatic cylinder; apparatus connecting said pneumatic cylinder to a door to be operated, said apparatus comprising, a plurality of chains, each of said chains being connected at one end to a door and at its other end to a fixed point in the hatchway, and a sheave engaging said chains intermediate their ends; a valve for controlling the admission of compressed air to said pneumatic cylinder, said valve being biased to closed position, in which position the supply of compressed air is shut off from the pneumatic cylinder and this cylinder is connected to the atmosphere so that the door is held in its closed position under the action of gravity; means for operating said valve to open position, thereby admitting compressed air to the pneumatic cylinder and causing said cylinder to act through said connecting apparatus to effect the opening of the door; and check means associated with said connecting apparatus for the purpose of checking the door towards the end of its opening movement.

In testimony whereof, I have signed my name to this specification.

THOMAS BRADY.