Aug. 29, 1961 G. T. ADAMS 2,998,245

POWER OPERATOR FOR ELEVATOR DOORS AND THE LIKE

Original Filed April 20, 1959 2 Sheets-Sheet 1

FIG. 1

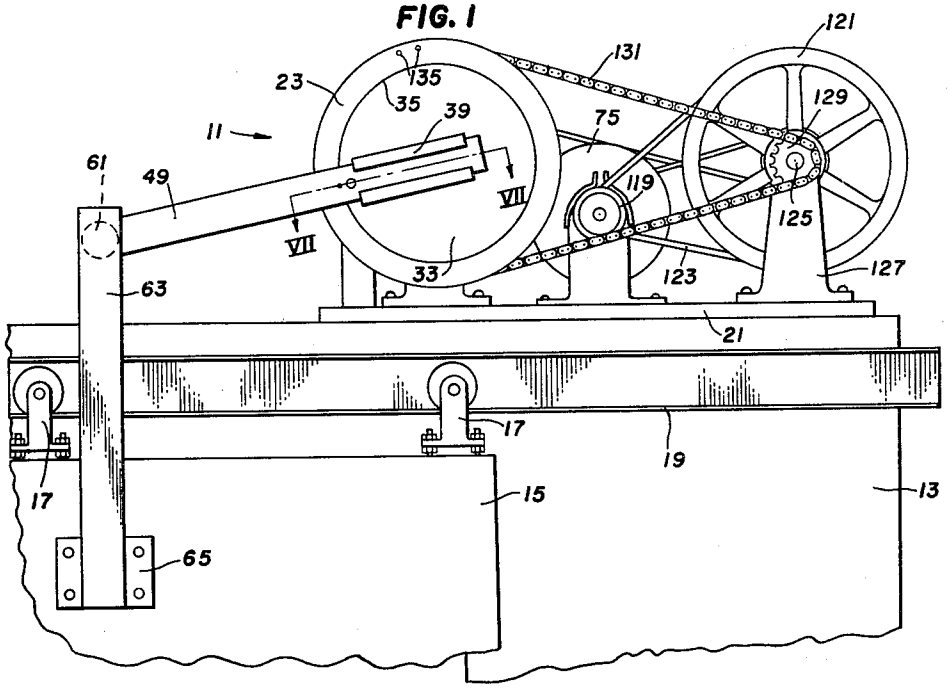
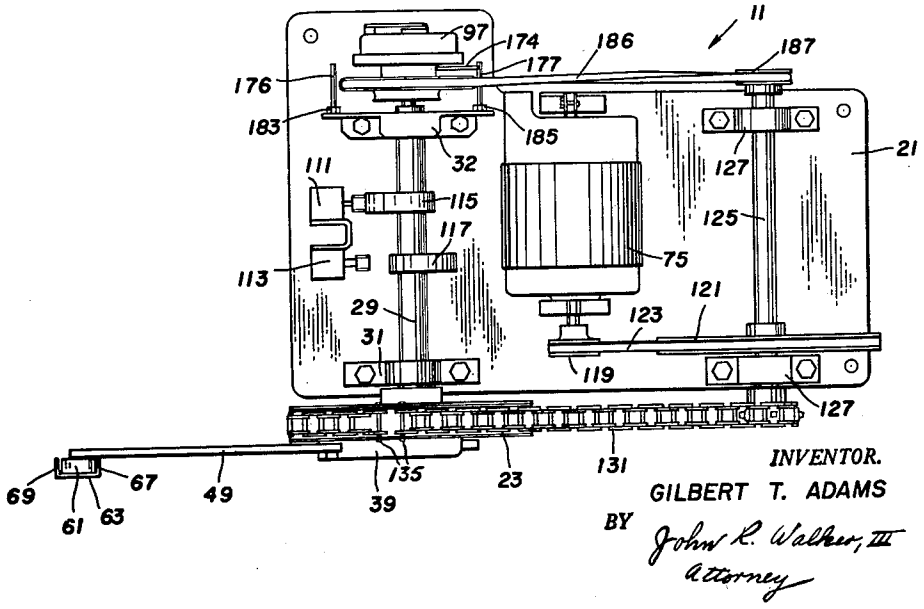


FIG. 2



INVENTOR.
GILBERT T. ADAMS
BY John R. Walker, III
Attorney

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FIG. 3

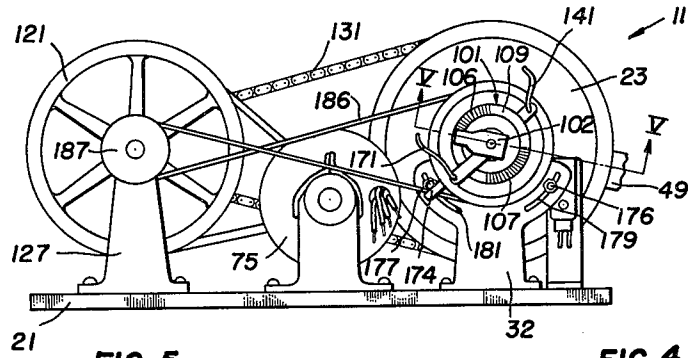


FIG. 5

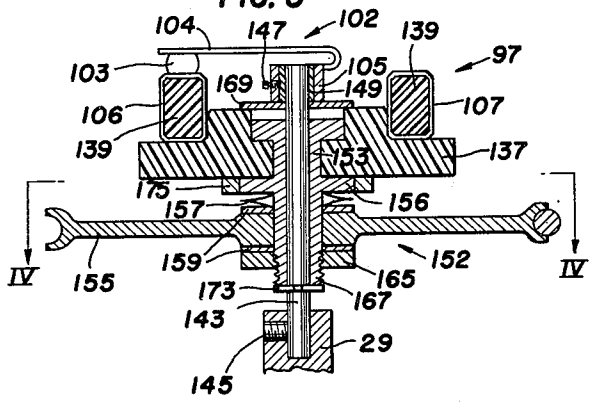


FIG. 4

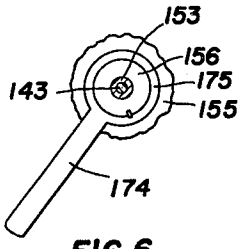


FIG. 6

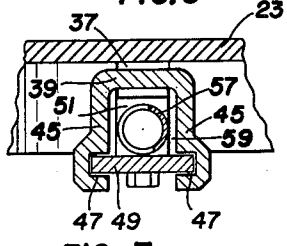
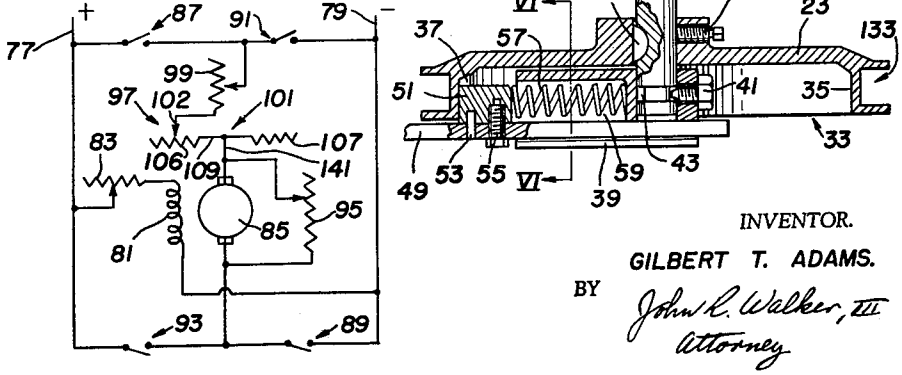


FIG. 7

FIG. 8



INVENTOR.

GILBERT T. ADAMS.

BY John R. Walker, III

Attorney

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2,998,245
POWER OPERATOR FOR ELEVATOR DOORS AND THE LIKE

Gilbert T. Adams, Memphis, Tenn., assignor to Dover Corporation, Washington, D.C.

Original application Apr. 20, 1959, Ser. No. 807,368. Divided and this application Jan. 11, 1960, Ser. No. 1,785

4 Claims. (Cl. 268—53)

This invention relates to an apparatus for operating the doors in an elevator system and the like. This application is a division of my co-pending application Serial No. 807,368, filed April 20, 1959.

One of the objects of the present invention is to generally improve upon and simplify the construction of the various forms of elevator door operators now in general use, yet provide an operator which is highly effective in performing the functions for which it is intended.

A further object is to make manual door opening possible in the event of failure of the power source.

In carying out the present invention, a unique coupling means is provided between the actuator wheel and the operating arm of the device so that rotational motion may be transmitted from the wheel to the operating arm for the operation of the door, yet this unique coupling means permits the operating arm to be moved relative to said actuator wheel without moving the wheel when opening pressure is applied to the door.

Other objects, features and advantages of the present invention will appear upon consideration of the following detailed description and of the drawings, in which

FIG. 1 is a fragmentary elevational view of the upper part of an elevator car, showing the power operator embodying the present invention employed therewith.

FIG. 2 is a top plan view of the power operator, per se, and shows how the roller on the end of the operating arm engages the channel shaped guide.

FIG. 3 is an elevational view of the same as viewed from the side opposite that shown in FIG. 1, and with only a fragmentary portion of the operating arm being shown.

FIG. 4 is a fragmentary sectional view on a larger scale than FIG. 3, and taken as on the line IV—IV of FIG. 5.

FIG. 5 is a further enlarged fragmentary sectional view taken as on the line V—V of FIG. 3.

FIG. 6 is an enlarged fragmentary sectional view taken as on the line VI—VI of FIG. 7.

FIG. 7 is a fragmentary sectional view on a scale reduced from that of FIGS. 5 and 6, taken as on the line VII—VII of FIG. 1, and with parts being shown in elevation plan and being broken away for purposes of clarity.

FIG. 8 is schematic diagram of a portion of the electrical circuit employed in the present invention.

Referring now to the drawings, in which the various parts are indicated by numerals, the power operator 11 of the present invention is illustrated in the drawings in conjunction with an elevator car 13, which includes the usual door 15 suspended by roller hangers 17 from a track 19. In addition, it will be understood that elevator car 13 forms a part of the overall elevator system, not shown, which includes the usual hoisting means, guide rails, etc.

Although the invention is shown in use with an elevator car, it is not intended that the invention be so limited since it may be used to actuate horizontally rolling doors of any kind without departing from the spirit and scope of the present invention.

Power operator 11 is mounted on a base 21 fixedly supported on the top of elevator car 13. An actuator wheel 23 is fixedly secured by a key 25 and a set screw 27 to a shaft 29, rotatably supported in bearing stands 31, 32, which, in turn, are mounted on base 21. Actuator wheel 23 is provided with a recess 33 in the forward face thereof to establish a smooth inner annular rim face 35. A notch 37 is provided in rim face 35 with the sides of the notch being substantially radial and parallel.

A casting or coupler 39 is rotatably mounted on the end of shaft 29 adjacent actuator wheel 23 in recess 33 and is rotatably secured to the shaft by means of a dog-point screw 41, the point of which rides freely in an annular groove 43 provided in shaft 29. Coupler 39 includes a pair of spaced sides 45 which are respectively provided with oppositely disposed and longitudinally extending grooves 47 in the inner faces thereof, which grooves slidably receive the opposite side edges of an elongated operating arm 49 so that the arm is slidably supported by coupler 39. A detent block 51 is rigidly fastened to operating arm 49 as by means of a pin 53 and a screw 55 or the like. Detent block 51 is shaped to engage notch 37 into which it is urged by a spring 57 housed in a recess 59 in coupler 39.

Operating arm 49 extends radially outward from actuator wheel 23 and is provided with a roller 61 rotatably mounted from the end thereof remote from the actuator wheel, which roller rollingly engages a vertical channel-shaped guide 63, that is rigidly attached adjacent its lower end to door 15 as by means of a bracket 65 or the like.

The above-described mechanism furnishes the means by which the door is adapted to be opened in the event of electrical failure. Thus, in FIG. 1, it will be seen that a force applied to the right on door 15 will tend to slide operating arm 49 to the right, as well as to rotate it counterclockwise. If this force exceeds the bias of spring 57, detent block 51 will be disengaged from notch 37; and coupler 39, together with arm 49 will rotate counterclockwise about shaft 29 with the detent block sliding along the smooth rim face 35, without moving actuator wheel 23. When door 15 is pushed closed again, detent block 51 will re-enter notch 37 under the urging of spring 57. Likewise, if power is again resumed to rotate actuator wheel 23, in a manner to be described later, and if the door is in an open position or in any other position in which block 51 is disengaged from notch 37, rotation of wheel 23 in the proper direction will cause the wheel to move relative to detent block 51 until the notch 37 is in alignment with the detent block, at which time the detent block will re-enter the notch. From the foregoing, it will be understood that a very effective, unique and simple means is provided for providing disengagement of the door from the power drive, yet which is automatically re-engageable.

In FIG. 1, it will be understood that door 15 is shown in the closed position and that counterclockwise movement of actuator wheel 23 will cause operating arm 49 to swing in the same direction (when detent block 51 is

engaged in notch 37, as is normally the case) to urge door 15 towards the right into an open position by means of roller 61 bearing against the flange 67 of guide 63 as the roller moves downwardly in the guide. It will also be understood that substantially the reverse of this operation will take place when actuator wheel 23 is driven clockwise to swing the operating arm 49 in the same direction and upwardly which causes roller 61 to bear against the flange 69 of guide 63 to close the door. The control and drive means which effects the drive of actuator wheel 23 to open and close the door, as above mentioned, will be hereinafter described.

A reversible shunt wound direct current motor 75 is supported from base 21 and preferably wired in the manner shown in FIG. 8. In this figure, numerals 77, 79 (also the + and — signs, respectively) represent the two main leads from the direct current supply, not shown, whether from the utility or from a suitable rectifier or other source. The field winding 81 of motor 75 is connected to lead 79 and is connected to lead 77 through adjustable resistor 83. The armature 85 of motor 75 is connected to leads 77, 79 by two contacts 87, 89 for running the motor in a direction to open door 15, or is connected by two contacts 91, 93 for running the motor in a direction to close the door. These contacts 87, 89, 91 and 93 are parts of magnetic contactors, not shown, well-known to those skilled in the art, and which are operated by various maens when door 15 is to be opened or closed. An adjustable resistor 95 is connected in shunt with armature 85 to serve for dynamic braking of the armature when it is to be rapidly decelerated. A rheostat 97, together with an adjustable resistor 99, for setting the maximum motor speed, are connected in series with armature 85. Rheostat 97, later to be described in more detail, includes a resistive conductor 101 contacted by a brush 102, which includes a brush head 103 carried by a resilient arm 104 that is mounted from a hub 105. Resistive conductor 101 comprises a pair of resistive elements, as resistive windings 106, 107; and a contact strip 109, having substantially negligible resistance. Resistance windings 106, 107 are connected together at one end of each to contact strip 109 and the contact strip is connected to armature 85 whereby when brush 102 is positioned on the contact strip the resistance of rheostat 97 is at a minimum and when the brush is positioned on windings 106, 107 adjacent the unconnected ends thereof remote from the contact strip, the resistance of the rheostat is at a maximum.

Two limit switches, i.e., a closing limit switch 111 and opening limit switch 113, are provided to break the circuit to motor 75 at the two extremes of travel of actuator wheel 23. The closing limit switch 111 interrupts the circuit to the closing magnetic switch (only contacts 91, 93 thereof being shown) by contact with a cam 115 carried by shaft 29, while limit switch 113 breaks the circuit to the opening magnetic switch (only contacts 87, 89 thereof being shown) when the door is fully opened by contact with cam 117 carried by shaft 29.

A small pulley 119 mounted on the shaft of motor 75 is coupled to a larger pulley 121 by means of a belt 123. Pulley 121 is fixedly mounted on a shaft 125 which shaft, in turn, is rotatably supported from base 21 by bearing stands 127. A sprocket 129 is fixedly mounted adjacent one end of shaft 125, and a chain 131 couples sprocket 129 to actuator wheel 23. Chain 131 rides in a peripheral groove 133 provided in actuator wheel 23 and is led over sprocket 129. The opposite ends of chain 131 are respectively fixedly secured to actuator wheel 23 as by pins 135 or the like, so that wheel 23 is adapted to rotate substantially one-half of a revolution.

Rheostat 97, which controls the acceleration and deceleration of motor 75 is more particularly shown in FIGS. 3 and 5, and the construction thereof is preferably as follows: An insulating rheostat body 137 fixedly carries on one face thereof resistance windings 106, 107 wound on an annular insulating core 139. Windings 106, 107 each occupy only a sector of the total angle, and they are joined by contact strip 109 which also occupies only a sector of the total angle, as best seen in FIG. 3. A flexible terminal 141 is attached to contact strip 109. The brush 102 of rheostat 97 is insulated from but carried by an extension 143 which forms a part of shaft 29 and extends into a socket in the end of the main part of the shaft where it is secured as by means of a set screw 145 for rotation with the main part of the shaft. Likewise, brush 102 is secured to extension 143 for rotation therewith as by means of a set screw 147 carried by hub 105. A resilient insulating ring 149 is disposed between hub 105 and extension 143 for the insulation of brush 102 from the extension.

In addition to extension 143 carrying rheostat 97, as above described, the extension carries other parts of an assembly of parts, which is designated by numeral 152, and includes a bushing 153 rotatably supported on extension 143 and which bushing carries rheostat body 137, fixedly secured thereto. In addition, assembly 152 includes a grooved pulley 155 rotatably mounted on bushing 153 and coupled to the bushing by friction means to control rotation of rheostat body 137, which friction means includes a flange 156 of bushing 153, Belleville Spring 157, friction washers 159 on either side of the hub of pulley 155, and retaining nut 165 threadedly engaged on the threaded end portion 167 of bushing 153. This friction arrangement causes pulley 155 to normally cause rotation of rheostat body 137 carrying with it resistive conductor 101, yet permits pulley 155 to continue rotating after the rotation of rheostat body 137 has been stopped by means hereinafter described. In addition to the above described parts, assembly 152 includes a contact washer 169 which, in turn, is attached to a flexible lead 171. Contact washer 169 is disposed between the outer face of rheostat body 137 and hub 105 which provides the means whereby electricity is conducted to brush 102 from lead 171 which, in turn, is connected to adjustable resistor 99.

Rheostat 97 is arranged so that brush head 103 slidably contacts resistive conductor 101 and due to the resilient arm 104, pressure is exerted on contact washer 169 by hub 105 to urge assembly 152 towards the main body of shaft 29. To resist this pressure and prevent movement of the assembly longitudinally on extension 143, snap-ring 173 engages a groove in extension 143 and the end of bushing 153 bears thereagainst.

A stop-arm 174, which includes a hub 175, is mounted on bushing 153 with the hub being keyed to flange 156 of the bushing as best seen in FIG. 4. A pair of spaced stops 176, 177 are mounted from bearing stand 32 in the path of movement of stop-arm 174 so that the stops are contacted by the stop-arm to limit rotation of rheostat body 137. Stops 176, 177 are respectively adjustably mounted from the bearing stand 32 by means of the stops respectively extending through elongated slots 179, 181 provided in stand 32 and by retaining nuts 183, 185 for holding the stops at the desired location.

Pulley 155 is coupled by means of a crossed belt 186 to a pulley 187, which is fixedly mounted on shaft 125 for rotation therewith. Because of the crossing of belt 186, when the moving parts are actuated, rheostat body 137 and therefore resistive conductor 101 tends to rotate in the opposite direction to all other parts, while brush 102 rotates in the same direction.

In the operation of power operator 11 to open door 15, contacts 87, 89 are closed, admitting current to the motor armature 85. Brush 102 will then be at the end of resistance winding 106, as shown in FIG. 3, making the armature current a minimum. The motor rotates counterclockwise as viewed in FIG. 1, (clockwise as viewed in FIG. 3) turning shafts 29 and 125 in the same direction and beginning door opening (to the right as viewed in FIG. 1). Brush 102 will then begin to move in the same direction (clockwise as viewed in FIG. 3), cutting

out the resistance **106** from the circuit. Due to the fact that belt **186** is crossed, pulley **155** and rheostat body **137** will rotate in opposite directions, greatly increasing the rate at which resistance **106** is cut out of the circuit and accelerating the motor quickly to full speed. As brush **102** rides on contact strip **109**, stop-arm **174** meets stop **176**, halting the rotation of rheostat body **137**, but brush **102** continues to be rotated by shaft **29**.

As door **15** approaches the open position, brush **102** leaves contact strip **109** and travels over resistance winding **107**, cutting it into the armature circuit and reducing the voltage applied to armature **85**, thereby slowing it. As the door reaches fully open position, brush **102** reaches the far end of winding **107**, reducing the speed of motor **75**, and consequently, that of door **15**, to a minimum. At this point, limit switch **113** is opened by cam **117**, opening contacts **87**, **89** and deenergizing the motor armature. As the field is still energized, any remaining energy of rotation is dissipated quickly in resistance **95**.

The closing operation is similar to that above described for opening. Thus, in the operation of power operator **11** to close door **15**, contacts **91**, **93** are closed, admitting current to motor armature **85**. Brush **102** will then be at the end of resistance winding **107** making the armature current a minimum. The motor rotates clockwise as viewed in FIG. 1, (counterclockwise as viewed in FIG. 3) turning shafts **29** and **125** in the same direction to begin door closing. Brush **102** will then begin to move in the same direction (counterclockwise as viewed in FIG. 3), cutting out the resistance **107** from the circuit. Due to the fact that belt **186** is crossed, pulley **155** and rheostat body **137** will rotate in opposite directions, greatly increasing the rate at which resistance **107** is cut out of the circuit and accelerating the motor quickly to full speed. As brush **102** rides on contact strip **109**, stop-arm **174** meets stop **177**, halting the rotation of rheostat body **137**, but brush **102** continues to be rotated by shaft **29**.

As door **15** approaches the closed position, brush **102** leaves contact strip **109** and travels open resistance winding **106**, cutting it into the armature circuit and reducing the voltage applied to armature **85**, thereby slowing it. As the door reaches fully closed position, brush **102** reaches the end of winding **106**, reducing the motor **75**, and consequently, the door **15**, speed to a minimum. At this point, limit switch **111** is opened by cam **115**, opening contacts **91**, **93** and de-energizing the motor armature.

From the foregoing description, it will be apparent that a unique and simplified power operator **11** is provided, which has, among other things, a unique release mechanism so that the door can be disconnected from the power operator by manual pressure when power fails or in any emergency.

Although the invention has been described and illustrated with respect to a preferred embodiment thereof, it is to be understood that it is not to be so limited since changes and modifications may be made therein which are within the full intended scope of this invention as hereinafter claimed.

I claim:

1. In an operating device for a door and the like, a rotatably mounted actuator wheel, said wheel being provided with a recess in the face thereof to establish an inner annular rim face having a notch therein, a rotatably mounted coupler, means connecting said coupler to said door including an operating arm movably supported by said coupler and being arranged for end-wise movement of the operating arm relative to said coupler and for pivotal movement of the operating arm relative to said wheel, a detent block fixedly mounted on said operating arm and being adapted to slidably engage said rim face, resilient means urging said detent block against said rim face and urging said operating arm outwardly end-wise in a direction away from said wheel, said resilient means being arranged to urge said detent block into said notch when the detent block is in alignment therewith to lock said operating arm relative to said wheel, said operating arm being slidable end-wise against said resilient means upon a force being exerted against said door in an opening direction to disengage said detent block from said notch and permit said door to be manually opened independent of said actuator wheel, drive means for reversibly rotating said wheel to swing said operating arm and cause opening and closing of said door when said detent block is engaged in said notch.

2. In an operating device for a door and the like, a rotatably mounted drive shaft, an actuator wheel fixedly mounted on said drive shaft, said wheel being provided with a recess in the face thereof to establish an inner annular rim face having a notch therein, a coupler rotatably mounted on said drive shaft, an upstanding guide mounted on said door, an operating arm having a roller rotatably mounted adjacent one end thereof, said roller rollingly engaging said guide, said operating arm being slidably supported adjacent the end thereof opposite from said roller by said coupler for end-wise slide of the operating arm relative to said coupler and for pivotal movement of the operating arm relative to said wheel, a detent block fixedly mounted on said operating arm and being adapted to slidably engage said rim face, resilient means urging said detent block against said rim face and urging said operating arm outwardly end-wise in a direction away from said wheel, said resilient means being arranged to urge said detent block into said notch when the detent block is in alignment therewith to lock said operating arm relative to said wheel, drive means for reversibly rotating said drive shaft and said wheel to swing said operating arm and cause opening and closing of said door when said detent block is engaged in said notch, said operating arm being slidable end-wise against said resilient means upon a force being exerted against said door in an opening direction to disengage said detent block from said notch and permit said door to be manually opened independent of said drive means.

3. In an operating device for a door and the like, a rotatably mounted actuator wheel, said wheel being provided with a recess in the face thereof to establish an inner annular rim face having a notch therein, a rotatably mounted coupler, means connecting said coupler to said door including an operating arm movably supported by said coupler and being arranged for end-wise movement of the operating arm relative to said coupler and for pivotal movement of the operating arm relative to said wheel, a detent block fixedly mounted on said operating arm and being adapted to slidably engage said rim face, resilient means urging said detent block against said rim face and urging said operating arm outwardly end-wise in a direction away from said wheel, said resilient means being arranged to urge said detent block into said notch when the detent block is in alignment therewith to lock said operating arm relative to said wheel, drive means for reversibly rotating said wheel to swing said operating arm and cause opening and closing of said door when said detent block is engaged in said notch, said operating arm being slidable end-wise against said resilient means upon a force being exerted against said door in an opening direction to disengage said detent block from said notch and permit said door to be manually opened independent of said drive means.

4. Motion transmission means comprising a wheel, an arm, a coupler for said arm and said wheel including means rotatably mounting said coupler for rotation independently of said wheel about the axis thereof, said coupler including means for slidably supporting said arm for end-wise movement radially relative to said wheel, locking means cooperating between said arm and said wheel for operably joining said wheel and said arm upon rotation of said wheel, said locking means being arranged for movement between a locked position in which said arm is locked to said wheel for swinging movement therewith and an unlocked position in which said arm is freely

swingable relative to said wheel, said arm and said locking means being so arranged that movement of said arm end-wise in one direction unlocks said locking means, means operably coupled to said arm for yieldingly urging said arm end-wise in a direction opposite from said one direction to normally hold said locking means in said locked position and yet permit unlocking thereof upon end-wise movement of said arm in said one direction, when in said locked position said wheel and said arm being positively and unyieldingly locked against unlocking by swinging movement of said wheel and only unlockable by end-wise movement of said arm in said one direction.

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