United States Patent [19]

Reddy

[11] **3,745,705**

[45] **July 17, 1973**

[54] **INTEGRATED LINEAR DOOR OPERATOR**

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[73] Assignee: **Vapor Corporation,** Chicago, Ill.

[22] Filed: **Apr. 24, 1972**

[21] Appl. No.: **247,177**

[52] **U.S. Cl.** **49/139,** 49/362

[51] **Int. Cl.** **E05f 15/14**

[58] **Field of Search** 49/139, 362; 74/424.8, 89.15

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Primary Examiner—J. Karl Bell

Attorney—Julian Falk

[57] **ABSTRACT**

A door operator for driving a track guided door through opening and closing cycles, including a rotating shaft and drive member movable therealong in response to rotation wherein the drive member is resiliently coupled to a door. A locking mechanism is provided for locking the door in closed position and an emergency device enables opening of the door when power is not available.

14 Claims, 12 Drawing Figures

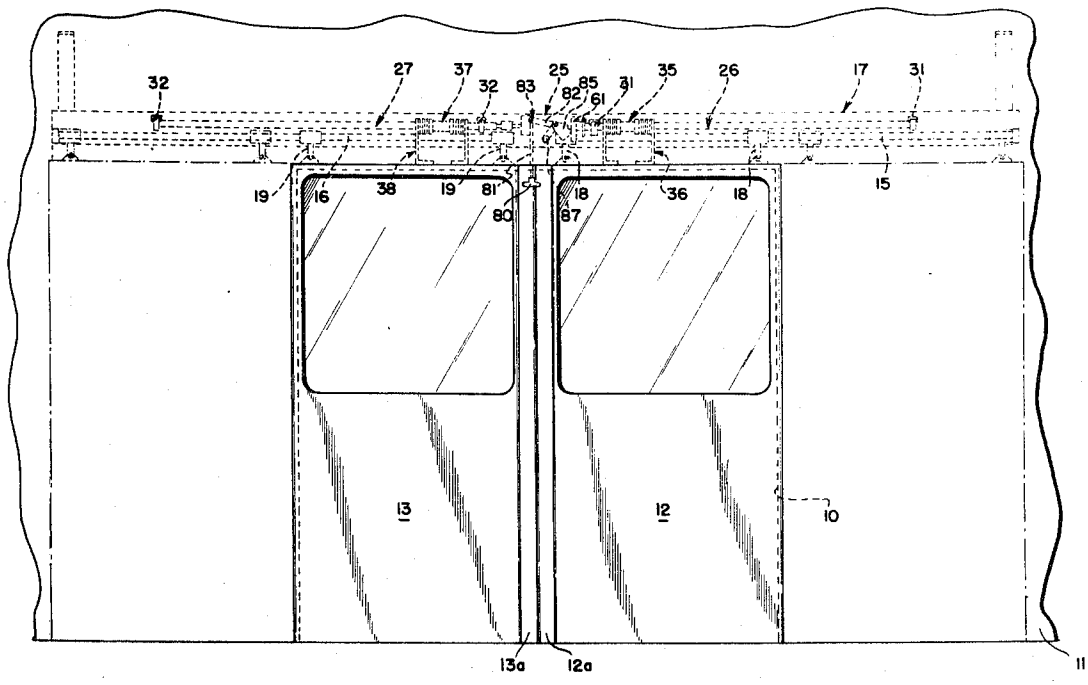
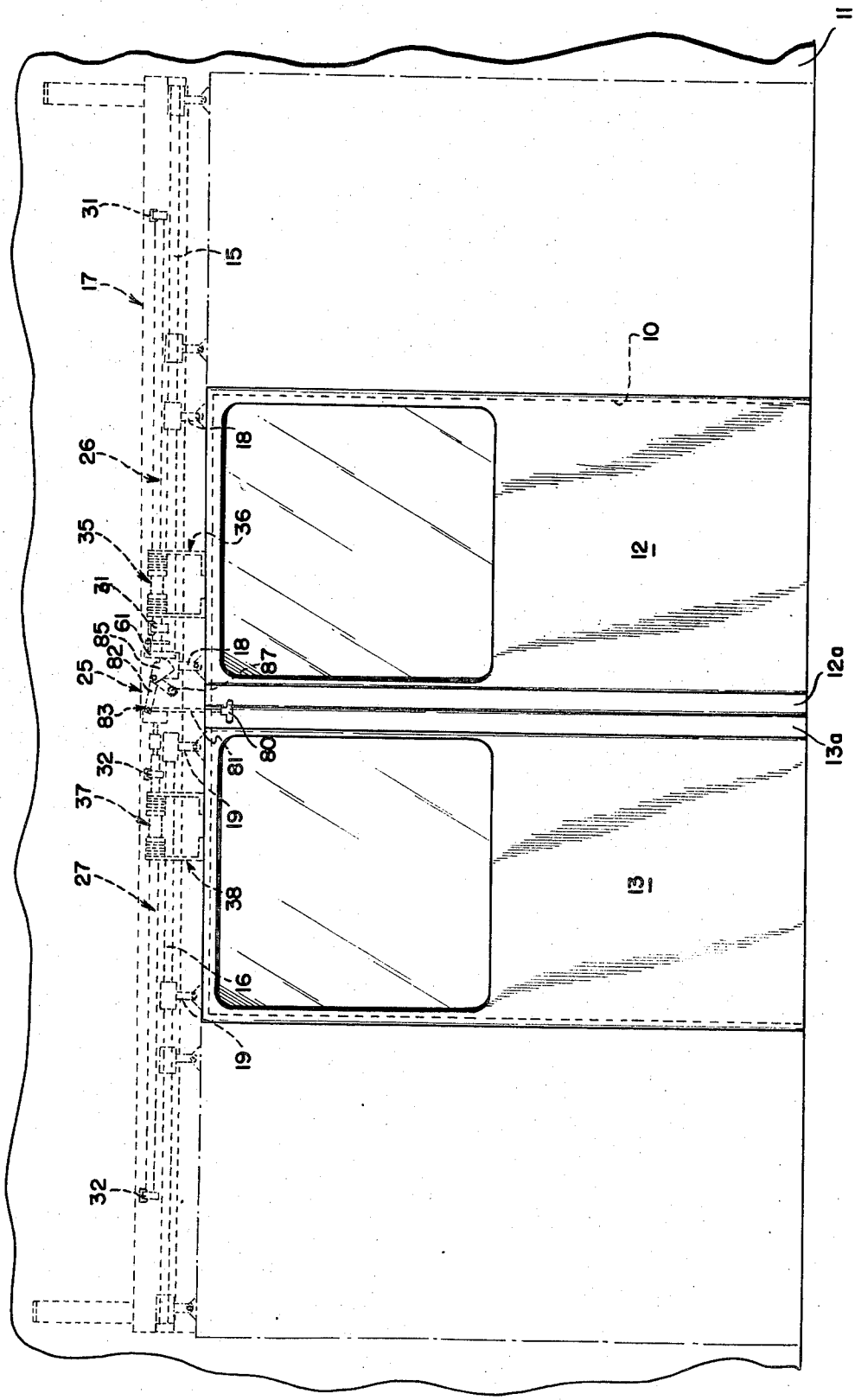


FIG. 1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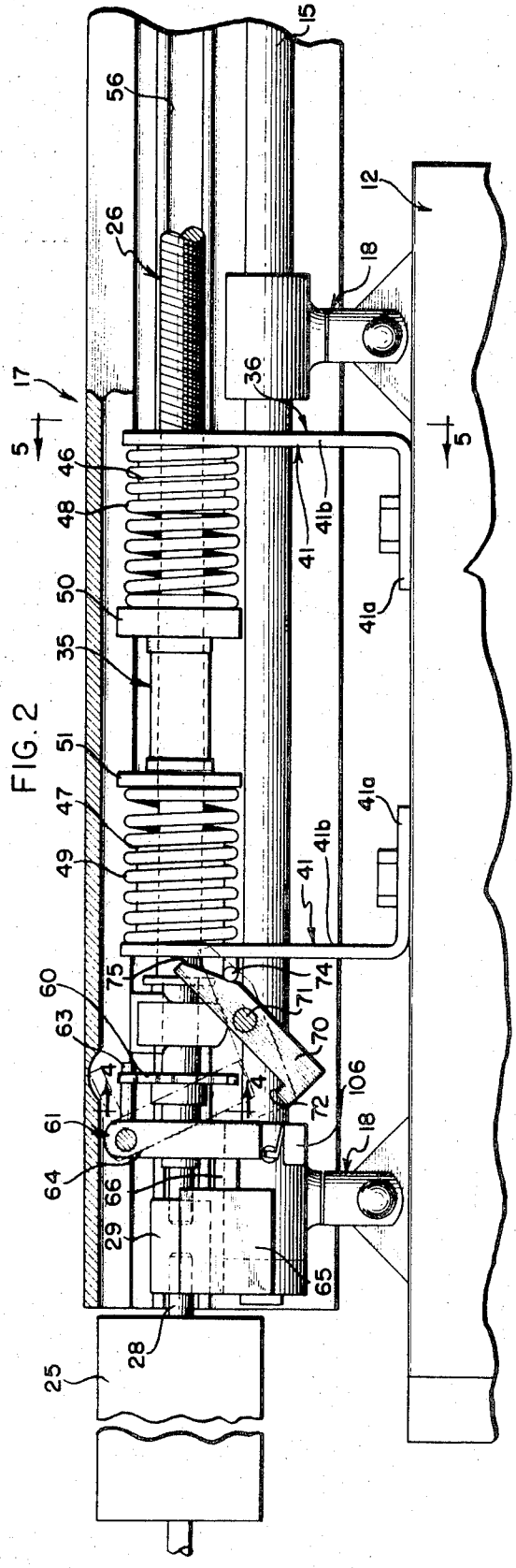
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FIG. 2

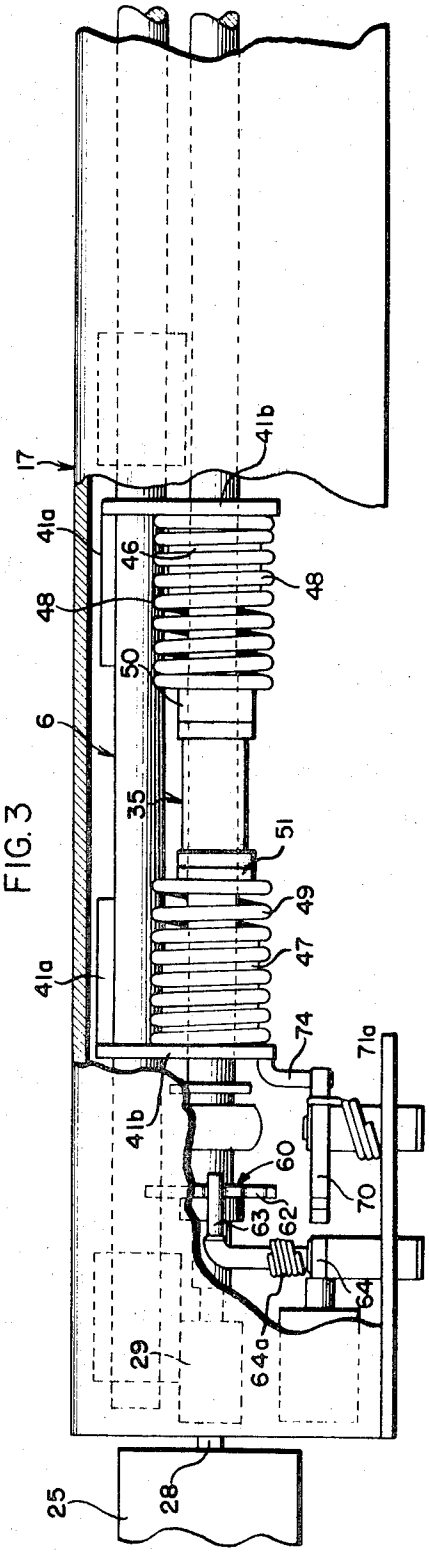
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FIG. 3

FIG.4

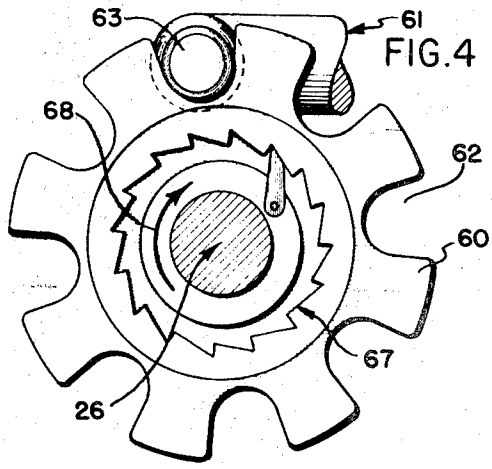


FIG.5

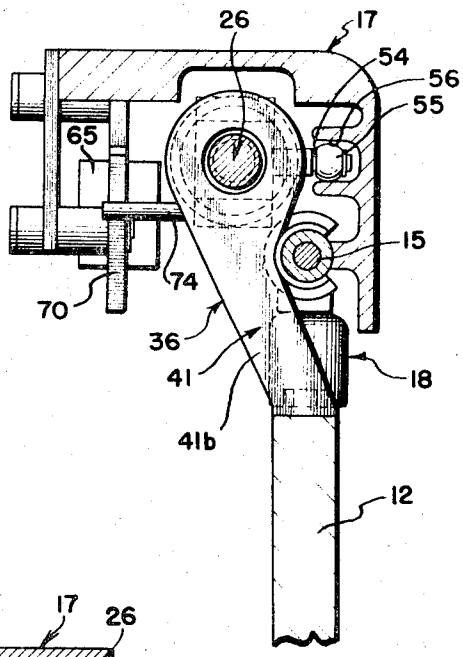
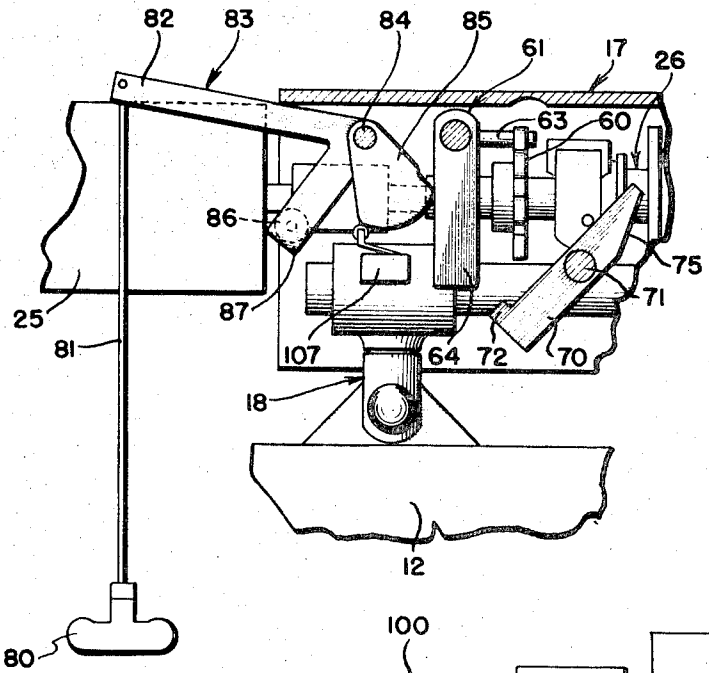


FIG.6



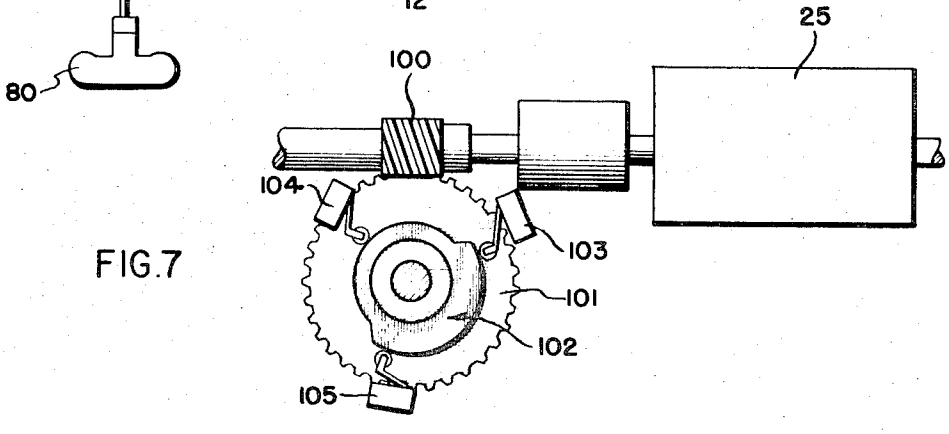


FIG.7

FIG.8

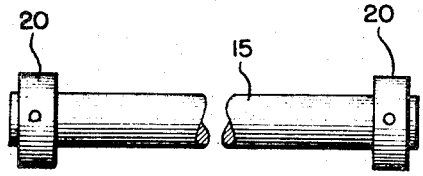


FIG.9

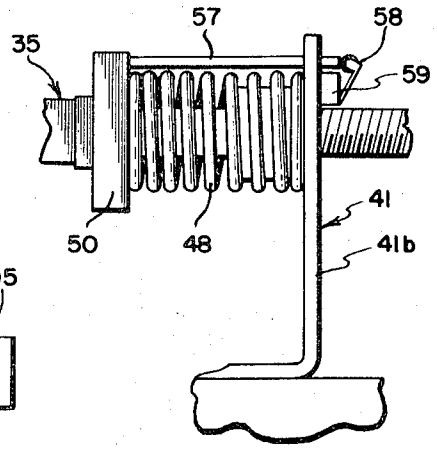


FIG.10

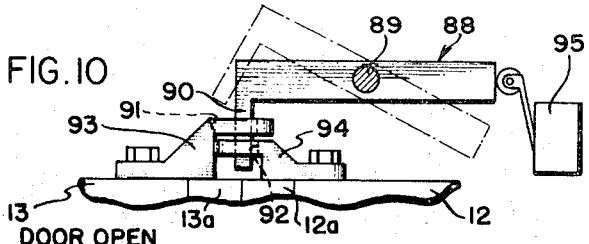


FIG.11

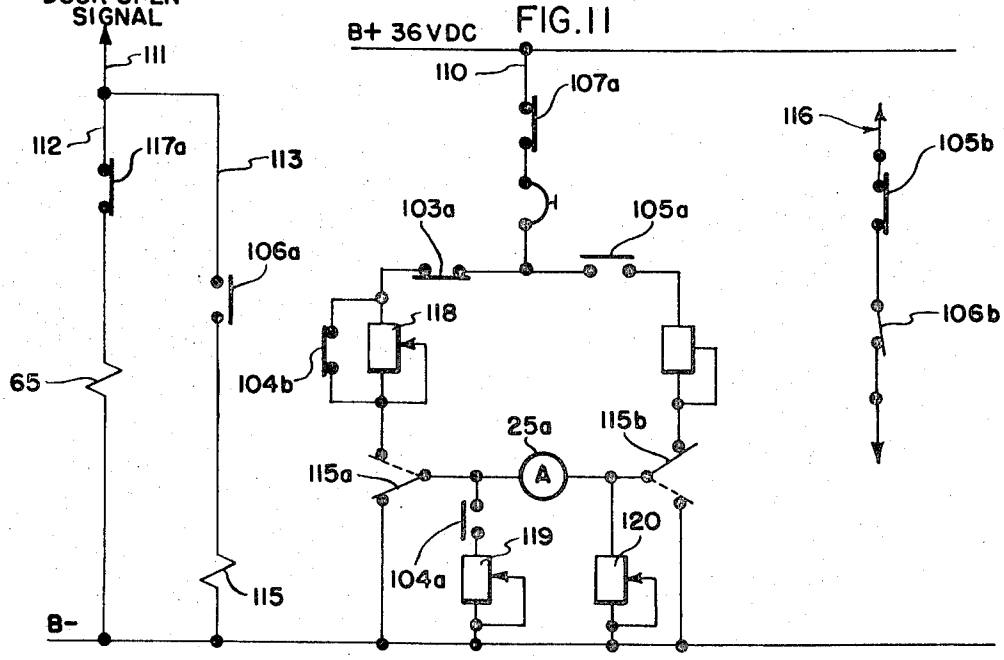
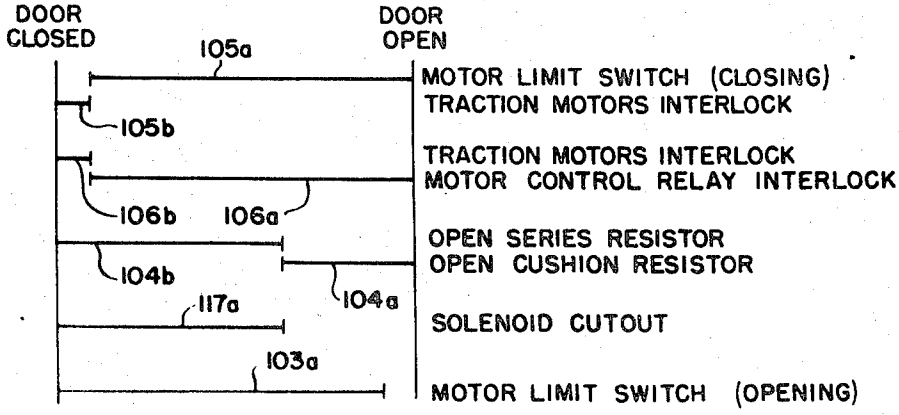


FIG.12



INTEGRATED LINEAR DOOR OPERATOR

This invention relates in general to door operators, and more particularly to an integrated linear door operator for use with track guided doors in passenger vehicles to permit ingress or egress or for use in buildings where heavy pedestrian traffic is encountered.

The integrated linear door operator of the invention includes a threaded shaft rotatably mounted adjacent to a door being operated thereby and a nut driven along the shaft and coupled to the door. Preferably, the shaft-nut arrangement will be of the type where the shaft is threaded and the nut includes ball bearing threads wherein the efficiency of the arrangement is extremely high, therey enabling the door to be pushed manually between open and closed positions by causing rotation of the screw shaft through a force applied to the nut through the door. The door operator is illustrated as being mounted in compact relation with a door suspension system and therefore in spaced relation above the upper edge of the door. It should be appreciated, however, that the door operator of the invention could be mounted below the lower edge of a door in the floor especially in the event that there was not sufficient room to mount the operator above the door. In most instances it can be expected that sufficient space will be available for mounting the operator above the door.

The movable driving nut is resiliently coupled to the door by a coupling means to facilitate the cushioning of the operator when striking an obstruction and to permit closing the door under pressure to effect proper sealing of a door sealing edge relative an opening. Further, door edge obstruction sensing means is mounted on the coupling means to sense an obstruction encountered by the door during closing and either recycle the door to open position or interrupt the closing cycle. A unique locking mechanism is provided for locking the door in closed position and which is unlatched at the beginning of an opening cycle by a suitable power device to start the door opening cycle and automatically latched at the end of a closing cycle by movement of the door. An emergency device is also provided for permitting the unlocking and opening of the door in the absence of power to the door operator or otherwise malfunctioning of the door operator. Control of the door operator motor is accomplished by a unique limit switch actuator in the form of a worm wheel driven by a worm gear on the rotatable threaded shaft of the operator which actuates a plurality of limit switches. Door stops are built into the operator thereby eliminating the need to provide same on the car body. A manually operable lock for locking the doors in closed position and cutting the operator out of the train door system is also built into the operator. Moreover, a crew switch can be built into the operator.

It is therefore an object of the present invention to provide a new and improved integrated linear door operator for use on track guided doors.

Another object is to provide a completely integrated door operator with all necessary operating features being built in.

Another object of this invention is in the provision of a linear door operator for use in compact relation with a door hanging arrangement and which provides smooth and easily controlled door opening and closing cycles.

Another object of this invention is in the provision of a linear door operator resiliently coupled to the door to enable the door to be closed under pressure and effect a good sealing relation in closed position.

A further object of the invention is to provide a unique locking mechanism for locking the door or doors driven by the operator in closed position.

A still further object of the invention is to provide a unique limit switch actuator for a linear door operator.

Another object of this invention is to provide an integrated linear door operator having a built-in manually operable door lock that when actuated to locked position bypasses the operator in the train door system.

Other objects, features and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

FIG. 1 is a front elevational view of a pair of track guided doors on a passenger vehicle driven by the linear door operator of the invention;

FIG. 2 is an enlarged front elevational view of the door operator with some parts broken away for simplicity and other parts omitted, and where the parts shown in solid lines illustrate the position of the parts when the door is in closed and locked position, and the parts in dotted lines show the locking mechanism in unlocked position;

FIG. 3 is an enlarged top plan view of the door operator and especially of the parts illustrated in FIG. 2;

FIG. 4 is a cross-sectional detailed view taken generally along line 4—4 of FIG. 2;

FIG. 5 is an enlarged end elevational view of the door operator shown in FIG. 2 and taken generally along line 5—5 of FIG. 2;

FIG. 6 is an enlarged detailed front elevational view of the door operator and illustrating particularly the emergency lever arrangement;

FIG. 7 is a front elevational view of a limit switch actuator as driven from the linear door operator;

FIG. 8 is a broken elevational view of a door hanger rail with door stops mounted on the ends;

FIG. 9 is a detailed elevational view of the obstruction sensor;

FIG. 10 is a somewhat fragmentary elevational view of bi-parting doors and a manually operable lock associated therewith;

FIG. 11 is an electrical schematic diagram of the operator control circuitry; and

FIG. 12 is a switch diagram illustrating the relationship of the actuation of the switches to the door opening and closing movements.

Referring now to the drawings and particularly to FIG. 1, a door opening 10 in a side wall 11 of a passenger vehicle is illustrated as being selectively opened and closed by a pair of bi-parting track guided door panels 12 and 13, each of which respectively have at their leading edge flexible sealing edges 12a and 13a. The doors are respectively guided along rails or tracks 15 and 16 which are in turn supported by an elongated mounting bar 17 that is in turn suitably fastened to the car body. The door 12 is suspended from the rail 15 by means of a pair of trolleys 18, while the door 13 is suspended from the rail 16 by a pair of trolleys 19. Door stops 20, FIG. 8, are mounted at the opposite ends of the rails 15 and 16 to limit travel of the door panels by limiting travel of the trolleys. The stops are preferably

in the form of rubber discs pinned to the rail, and they function to additionally eliminate the need to build stops in the car body. While the operator is shown for driving doors along a straight line, it should be appreciated it could also be used to drive a door that would rotate when opening or have a plug action.

The linear door operator of the present invention is also mounted on the mounting bar **17** above the doors and includes a reversible motor **25** that may be either electric, hydraulic, or pneumatic, a pair of screw shafts **26** and **27**, one right-hand threaded and the other left-hand threaded, arranged co-axially with the output shaft **28** of the motor and suitably coupled directly to the motor shaft by means of couplings **29** and **30.** The screw shaft **26** is rotatably supported by bearing members **31,** while the screw shaft **27** is rotatably supported by the bearing members **32.**

A nut **35** is driven along the screw shaft **26** during rotation thereof and is connected to the door **12** by a bracket assembly **36** whereby driving of the nut effects sliding movement of the door. Similarly, a nut **37** is driven along the screw shaft **27** and suitably connected to the door **13** by means of a bracket assembly **38.** Any type of screw nut drive may be used where the efficiency is such as to allow the doors to be opened in an emergency without power, such as where the application of force to the leading edge of a door by a person will allow the nut to drive the screw shaft, thereby permitting the nut to move along the screw shaft and the door to be moved to an open position. Preferably, a ball bearing nut and screw drive arrangement will be used. It will be appreciated that the threads of the screw shafts **26** and **27** will be of opposite hand wherein rotation together in one direction will effect opening of the doors, and rotation together in the opposite direction will effect closing of the doors.

Although the door operator of the invention is shown in connection with driving bi-parting door panels, it should be appreciated that it could likewise be used for a single door where a single screw shaft and nut assembly would be utilized. Further, while the operator is shown located above a door, it could be located below the floor. A Referring now to FIG. **2,** the bracket assembly **26** for interconnecting the door **12** and the nut **35** includes a pair of facing L-shaped brackets **41** having base legs effects a abutting against and secured to the top edge of the door **14** and upstanding legs **41*b*** with openings through which the screw shaft **26** freely extends. It should be appreciated the brackets could be formed as a U-shaped single bracket. Each of the brackets **41** at their vertical portion supports inwardly extending tubular spring guides **46** and **47** through which the screw shaft **26** freely extends. Springs **48** and **49** of equal length and having the same spring rate are supported on the guides **46** and **47** and bottomed at one end on the legs **41*b*** of the plates **41** and at the other end on collars **50** and **51** carried at the opposite ends of the nut **35.** Accordingly, the nut **35** is spring mounted between the plates **41** to thereby define a resilient coupling between the nut and the door. If desired, the springs could be of unequal length and different spring rates, such as where it might be desired to have more resiliency on closing the doors. The nut **35** is prevented from rotating with the threaded shaft **26** by a guide pin **54** extending laterally therefrom, having a roller **55** mounted on the end and engaging in a track **56** formed longitudinally of the mounting bar **17** as seen most particularly in FIG. **5.** The bracket assembly **38** for coupling the nut **37** to the door **13** is identical to bracket **36.**

The resilient coupling connecting the door to the movable nut enables closing of the door to pressure the sealing edge by such overtravel of the nut as to cause compression of the spring **49.** In the event the door strikes an obstruction during opening or closing, a cushioning of the obstruction force is provided by the springs **48** and **49** of the coupling. While coil springs have been illustrated, it should be appreciated that other types of springs may be used to define the spring coupling between the nut and the door. For example, leaf springs could be employed. Further, it should be appreciated that any type of resilient member could be used and as an example of one other than a spring, an elastomeric member could be used to provide the resilient connection between the nut and the door. It should also be appreciated that an obstruction sensor for detecting an obstruction at the leading edge of a door panel during closing can be built into the operator. As shown in FIG. **9,** the sensor can be incorporated in the resilient coupling between the nut and door panel and includes a pin **57** extending from the collar **50** through a hole in bracket portion **41*b*** to align with the actuating arm **58** of a switch **59** mounted on the bracket portion **41*b*.** Collapse of spring **48** caused by an obstruction encountered by the door panel will actuate the switch **59** that may be in a circuit to cause the door panel to recycle open and then close, or to cause the door panel to stop until the obstruction is removed, or cause a reduction of the driving force for the operator. The switch may be provided at either end of the coupling.

The door is locked in closed position against movement by a lock wheel **60** mounted on the threaded shaft **26,** and a lock pawl **61** which is pivotally mounted on the mounting bar **17** to pivot on an axis extending perpendicular to the shaft **26.** The lock wheel **60** is provided with a plurality of circumferentially spaced notches or slots **62** at its periphery into which the pawl portion **63** of the lock pawl engages when the lock pawl is in locking position. The arm portion **64** of the lock pawl **61** normally extends along the vertical when the lock pawl is in locking position, as shown in solid lines in FIG. **2,** and is movable to an inclined position, as shown in dotted lines to raise the pawl portion **63** when it is desired to unlock the shaft **26.** A solenoid **65** having a plunger **66** engagable with the arm portion **64** of the lock pawl is employed for driving the lock pawl to its unlock position upon being energized. The solenoid is suitably mounted on the mounting bar **17.** It should be appreciated that any other type of power actuator may be used to drive the lock pawl to its unlock position.

A one-way clutch **67,** FIG. **4,** is provided between the threaded drive shaft **26** and the lock wheel **60** so that the shaft overruns the lock wheel during closing rotation, indicated by the arrow **68,** thereby preventing inadvertent breaking of any of the lock weeel teeth or the lock pawl. While any type of one-way clutch may be provided, a pawl and ratchet type is illustrated in FIG. **4.** Accordingly, when the lock pawl **61** is in locking position with respect to the lock wheel **60,** rotation of the shaft **26** in the closing direction allows the overrunning of the lock wheel but prevents rotation of the shaft in the direction which would cause opening of the door panel. Accordingly, the smooth closing of the door

panel, preloading of the door panel leading edge, and locking is accomplished at least in part by the clutch mounting of the lock wheel. It should also be appreciated that another type of relationship between the lock pawl and lock wheel could be established which would solve the problem of avoiding damage to the wheel and pawl. For example, the lock pawl might be mounted so that it is spring biased in one direction relative to the rotation of the lock wheel.

Since it is not practical to maintain the solenoid **65** in energized condition during the entire opening and closing cycle of the door, a holding latch **70**, shown in FIG. **2** in solid lines in unlatched position, is actuated to its latched position as shown in dotted lines, upon opening movement of the door to retain the lock pawl in unlocked position and thereafter permit the de-energization of solenoid **65**. The holding latch **70** is pivotally mounted to the mounting bar **17** by a pivot pin **71** and continually resiliently biased in a clockwise direction to its actuated position by means of a spring **71***a*. A nose portion **72** is defined at one end of the holding latch to engage the lower free end of the lock pawl arm portion **64** when the holding latch is in actuated position. When closing the door and moving the coupling between the nut and the door toward closed position, the holding latch is de-actuated to trip the lock pawl and allow it to move to locked position by means of a release pin **74** carried on the leading L-shaped plate **41** of the bracket assembly. The pin **74** engages a cam surface **75** defined on the holding latch to cam the latch in a counterclockwise rotation and thereby release the lock pawl **61**. While the weight of the lock pawl arm portion **64** is such as to gravitationally drive the lock pawl to its locking position, it should be appreciated that a spring may be provided to assert a bias on the lock pawl toward its locked position such as indicated at **64***a*, thereby providing a more positive movement toward the locked position. Therefore, in event the spring fails, the lock pawl moves to locked position gravitationally.

In the event that power is not available or in an emergency where it is desired to open the door, an emergency handle **80** connected to a link **81** suspended from an arm **82** of an emergency lever **83** may be pulled downwardly to rotate the emergency handle in a counterclockwise direction about its pivot **84** to drive a cam member **85** against the lock pawl arm **64** and raise the pawl portion **63** to its unlocked position, and further rotation of the emergency lever **83** will cause a roller **86** carried on an arm **87** of the emergency lever to engage the adjacent door trolley **18** and drive it toward the open position. Because of the efficiency of the nut-screw shaft drive, it is then possible to move the door to open position by the exertion of pressure against the leading edge of the door.

Where it may be desired to remove an operator from service and at the same time lock the doors driven thereby in closed position, a manually operable locking device also essentially built into the door operator may be provided, such as that shown in FIG. **10**. A locking bar **88** is pivotally mounted on a pivot **89** carried by the door operator frame, and includes a bolt **90** selectively movable into openings **91** and **92**, respectively, of brackets **93** and **94**, which are respectively mounted on the upper edges of the doors **13** and **12**. The brackets **93** and **94** overlap so their holes align when the doors are in closed position, wherein the insertion of the bolt **90** by manual movement of the locking bar **88** to the position shown in solid lines effects the locking of the doors in closed position. At the same time a bypass or cutout switch **95** is actuated by the locking bar **88** to bypass the operator and essentially remove it from the operation of the door train line.

Controlling the operation of the door operator motor and solenoid may be accomplished by the actuation of limit switches operated in time sequence with the opening and closing cycles. While any sort of arrangement may be employed to actuate limit switches, one form according to the invention is illustrated in FIG. **7** which includes a worm gear **100** mounted on the threaded shaft of the operator for rotation therewith and in engagement with a worm wheel **101** rotatably carried by the mounting bar. Dogs may be mounted on the worm wheel adjacent its periphery for engagement with and actuation of limit switches mounted adjacent thereto, or a cam member may be mounted on the worm wheel for rotation therewith, having a peripheral formation capable of suitably operating the necessary limit switches. It can be appreciated that the relationship between the worm gear and the worm wheel will be such that no more than one and preferably about one-half a revolution of the worm wheel will be effected during the opening or closing cycle of the door operator.

As seen in FIG. **7**, a cam **102** is mounted on and rotatable with the worm wheel **101** for actuation of limit switches **103**, **104** and **105** arranged in the electrical circuitry for controlling operation of the door operator. Additionally, limit switch **106**, FIG. **2**, is actuated by the lock pawl **61** when it moves to unlock position and limit switch **107**, FIG. **6**, is actuated upon operation of the emergency lever **83**.

The operation of the door operator can best be understood by reference to the electrical schematic diagram of FIG. **11** and the switch diagram of FIG. **12**. It should be appreciated that the positions of the switches in the electrical schematic diagram of FIG. **11** are such as when the door is in closed position. The lines on the switch diagram extending horizontally between the vertical "Door Closed" and "Door Open" lines, identified by the switch contacts legends, indicate when the contacts are closed. Otherwise, the contacts are open.

Line **110** is connected to the supply potential and when a door open signal is applied to line **111**, the opening cycle of the operator is initiated. The door open signal applies an unlock signal to line **112**, thereby causing energization of the lock solenoid **65** to drive the lock pawl **61** to unlock position. The lock pawl thereby actuates switch **106** which closes the motor control relay interlock contacts **106***a* in the motor control relay line **113** to energize the motor control relay **115**. At the same time traction motor interlock contacts **106***b* are opened in the traction motors circuit **116** thereby preventing energization of the traction motors when the door is opening or in open position and until the door comes back to closed position to actuate the switch **106** and close contacts **106***b*.

Upon energization of the motor control relay **115** contact arms **115***a* and **115***b* are swung to the positions shown in dotted lines on FIG. **11** to apply power to the armature **25***a* of the operator motor **25** and drive it in the direction to drive the threaded shaft **26** and cause the nut and door panel **36** connected thereto to move toward open position. The motor **25** is schematically illustrated as a permanent magnet motor although it

should be appreciated that any other type of motor may be used, and in that event the circuitry for the door operator will need to be revised accordingly. As the motor 25 ontinues to drive in the direction of the opening cycle, it causes driving of the switch actuator, FIG. 7, in the direction of arrow 114, to first actuate the closing limit switch 105 and close contacts 105*a* so they are conditioned for the closing cycle. At the same time contacts 105*b* in the traction motors circuit are opened. As the door operator continues to move the door panel toward open position, it also continues to activate the switch actuator wheel and cam 102, and when the door is about 70 percent open, limit switch 104 is actuated to close contacts 104*a* and connect into the motor circuit an open cushion resistor 119 to provide dynamic braking to the motor and cushion the final portion of the opening cycle to prevent slamming of the door panel. Contacts 104*b*, which are in a circuit to short out the opening series resistor 118 when closed, are opened at the same time to connect the opening series resistor 118 in the motor circuit to assist in slowing down the motor. Simultaneously, limit switch 117 is actuated by the cam 102 to open contacts 117*a* and to de-energize the locking solenoid 65 so that it is not energized when the door is in the open position and during the closing cycle.

Just as the door panel is about to reach fully open position and after it has traveled about 90 percent of its entire opening movement, the switch actuator cam 102 actuates the open limit switch 103 to open contacts 103*a* in the motor circuit and cause de-energization of the operator motor and allow coasting of the door panel to the fully open position.

Removal of the door open signal on the door train line 111 de-energizes the motor control relay 115 and removes the voltage signal from the solenoid unlock line 112 wherein the motor control relay contact arms 115*a* and 115*b* resume their original positions as shown in solid lines to cause the operator motor to be energized in the reverse direction for driving the threaded shaft 26 in the direction of clsoing rotation so that the nut 35 and door panel 12 connected thereto is driven toward closed position. Closing resistor 120 is in the motor circuit during the closing cycle in order to reduce the speed of the motor and the linear speed of the door as it moves from open to closed position. When the door panel reaches closed position, it is preloaded by driving the nut so as to slightly compress the spring 49 so as to assure a good seal at the sealing or leading edge of the door panel. As the door panel nears closed position, the closing limit switch 105 operated by the cam 102 is actuated to open the contacts 105*a* in the motor circuit and de-energize the operator motor. Also, the release pin 74 carried on the bracket 41 forces the holding latch 70 to move into release position and allow the lock pawl 61 to pivot into locking position with the lock wheel 60. The lock pawl 61 actuates switch 106 which closes the traction motors interlock contacts 106*b* in the traction motor circuit and opens motor control relay interlock contacts 106*a* in the motor control relay line 113. Cam operated switch 105 is actuated during the closing cycle to close the traction motors interlock contacts 105*b* in the traction motors circuit, thereby allowing the traction motors to be energized. The interlock contacts 105*b* of switch 105 back up interlock contacts 106*a* of the lock pawl operated switch 106, so in case of failure of switch 106, when the door has not yet been closed, the traction motor circuit will still be open.

Operation of the emergency lever 83 actuates switch 107 to open contacts 107*a* in the motor circuit and thereby prevent operation of the motor 25. Movement of the emergency lever causes driving of the lock pawl 61 to release the lock wheel 60. The roller 86 on the emergency lever then engages the adjacent trolley 18 to initiate movement of the door panel toward open position, after which pressure applied on the leading edge will enable movement of the door to fully open position.

From the foregoing, it will be appreciated the door operator of the present invention is substantially completely self-contained as an integrated unit that does not depend upon the usual car constructed supporting apparatus.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claims.

The invention is hereby claimed as follows:

1. A linear door operator for driving a track guided door between open and closed positions, said operator comprising an elongated screw-threaded shaft rotatably mounted on a support, a reversible motor connected to said shaft to rotate same, a nut on said shaft, means resiliently coupling the nut to the door, said shaft and nut drive having an efficiency such that pressure on the door capable of being exerted manually will cause rotation of the screw without power to move the nut and allow sliding of the door, means for locking the door in closed position including a lock wheel mounted on and rotatable with the shaft at least during its rotation for the opening cycle and a lock pawl carried by said support coacting with the lock wheel, means mounting said lock pawl for movement between a first position in engagement with the wheel to lock the shaft against rotation for the opening cycle and a second position to unlock the shaft so it is free to rotate, means for moving the lock pawl into said second position at the beginning of an opening cycle, and means holding the lock pawl in said second position through the opening cycle and substantially the entire closing cycle.

2. A linear door operator as defined in claim 1, and a one-way clutch between the shaft and lock wheel permitting overrunning by the shaft during closing rotation.

3. A linear door operator as defined in claim 1, wherein said resilient coupling means includes a bracket assembly secured to the door and resilient means interposed between the bracket assembly and the nut.

4. A linear door operator as defined in claim 1, wherein said resilient coupling means includes a pair of spaced apart arms attached to the door, one arranged on each side of the nut, and a spring between the nut and each arm.

5. A linear door operator as defined in claim 1, wherein said lock wheel includes a plurality of circumferentially spaced pawl notches.

6. A linear door operator as defined in claim 1, wherein said lock pawl moving means includes a solenoid having a plunger engaging the lock pawl when energized to move it into said second position.

7. A linear door operator as defined in claim 1, wherein said lock pawl holding means inludes a latch spring biased to engage and hold the lock pawl in said second position, and means on said coupling means engaging the latch to release the lock pawl as the door returns to closed position.

8. A linear door operator as defined in claim 1, and an emergency lever mounted on said support movable between a first position at rest and a second position which causes the lock pawl to move into said second position.

9. A linear door operator as defined in claim 8, wherein said emergency lever includes an arm engaging the door to move it toward open position.

10. A linear door operator as defined in claim 1, and a limit switch actuator driven by said shaft.

11. A linear door operator as defined in claim 10, wherein said limit switch actuator includes a worm on said shaft and a worm wheel in engagement with said worm and rotatably mounted on said support.

12. A linear door operator as defined in claim 1, and an obstruction sensing means responsive to said resilient coupling means.

13. A linear door operator as defined in claim 1, wherein the motor is connected directly to the screw-threaded shaft to drive same at the same speed as the motor.

14. A linear door operator as defined in claim 1, and manual operable locking means for locking the doors in closed position including a bolt movable and coacting with means on the doors, and a cutout switch operable upon actuation of the locking means to remove the operator from the door train line when the doors are locked.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,745,705 Dated July 17, 1973

Inventor(s) Redreddy Sukumar Reddy

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 15, change "therey" to --thereby--;
Col. 3, line 43, delete "A" and begin new paragraph with "Referring";
line 44, change "26" to --36--;
line 46, delete "effects a" and insert after "legs" --41a--;
Col. 4, line 59, change "weeel" to --wheel--;
Col. 7, line 4, change "ontinues" to --continues--; and
line 41, change "clsoing" to --closing--.

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

USCOMM-DC 60376-P69
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