April 22, 1969 H. J. STRETTON 3,439,454

POWER-OPERATED SLIDING DOOR GEAR

Filed March 17, 1967 Sheet 1 of 2

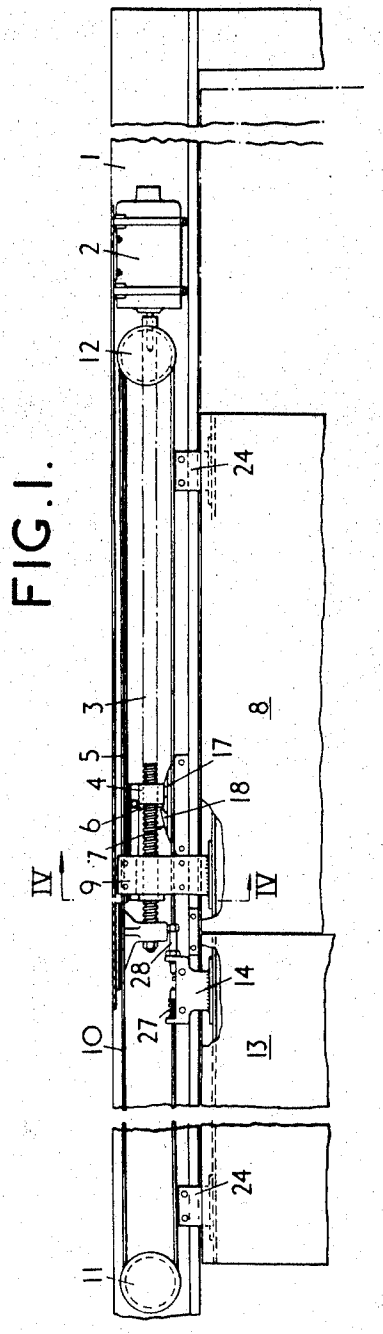


FIG. 1.

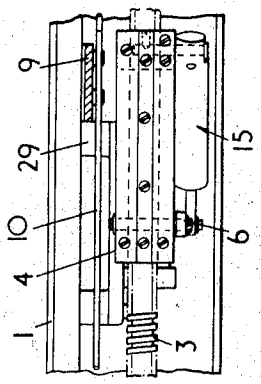


FIG. 3.

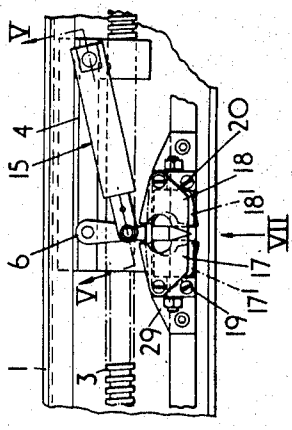


FIG. 2.

April 22, 1969 H. J. STRETTON 3,439,454

POWER-OPERATED SLIDING DOOR GEAR

Filed March 17, 1967 Sheet 2 of 2

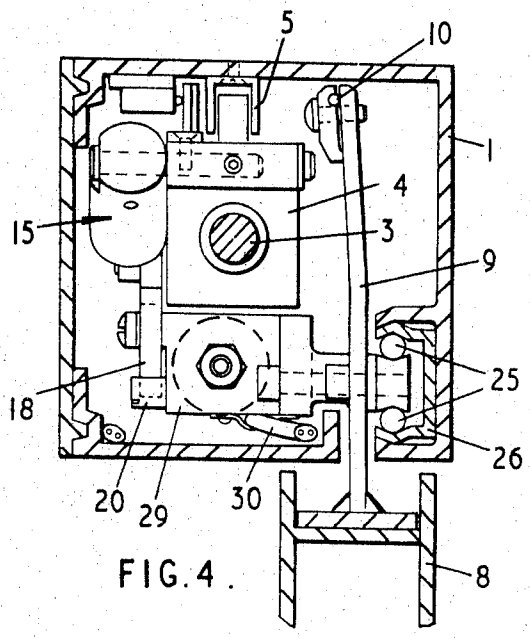


FIG. 4.

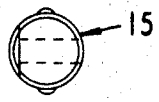


FIG. 6.

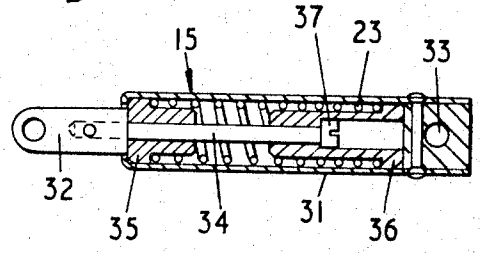
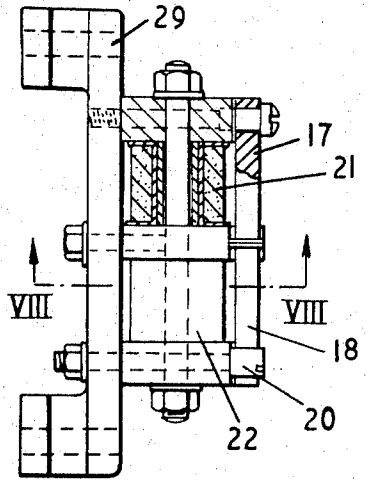


FIG. 5.

FIG. 7.



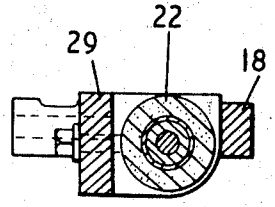


FIG. 8.

United States Patent Office

3,439,454

Patented Apr. 22, 1969

3,439,454

POWER-OPERATED SLIDING DOOR GEAR

Henry Jackson Stretton, Stoke Poges, England, assignor to G. D. Peters & Co. (Engineering) Limited, Slough, Buckinghamshire, England, a British company

Filed Mar. 17, 1967, Ser. No. 624,019
Claims priority, application Great Britain, Apr. 21, 1966, 17,554/66
Int. Cl. E05p *11/34, 11/40*
U.S. Cl. 49—362 3 Claims

ABSTRACT OF THE DISCLOSURE

A power-operated sliding door gear which incorporates a lead screw and travelling nut, a spring-loaded trigger pivoted on the nut, two pawls pivoted on a carriage connected to a door, and an electromagnet for holding the pawls in a position in which they can be engaged by the trigger. If power fails the pawls drop clear of the trigger and the door can be manually opened; if the door sticks the trigger overrides the pawls.

It has long been the practice to fit swinging doors to the entrance of public buildings and in many communities it is a statutory regulation that the doors should swing outwards. This feature facilitates the rapid exit of the occupants of a building in the event of a fire or other such disaster which may give rise to panic.

The introduction of power operated sliding doors has been made difficult by such statutory conditions. A power operated sliding door is necessarily rigidly supported at its top and bottom edge so that it shall constitute a secure burglar-proof closure when a building is unoccupied. If the door is motivated by an apparatus depending on the supply of electricity, it is very possible that conditions which could give rise to panic among the occupants of the building could also disrupt the supply of electricity to the door. Any mechanism used to drive the door leaves to one or other side or both of the opening should therefore become automatically disconnected from the door leaves themselves in the event of a power failure, to enable the door leaf or leaves to be manually slid to one side easily and permit the exit of the occupants. Even under far less severe conditions of damage such as a power failure or supply fault such a facility would enable the doors to be used manually until an effective supply was restored. Means already exist whereby the door leaf can be carried in a sliding sub-frame and can be hinged at its outer edge in the manner of a swing door but this method of overcoming the problems of power failure and panic is complicated and adversely affects the finished appearance of the whole installation.

According to the invention there is provided a power-operated sliding door gear including a driving mechanism for transmitting a driving force to at least one door leaf, which mechanism includes a power-operated coupling device arranged and adapted to transmit the driving force only when door-operating power is present. Thus the device will, in the event of a failure in the power supply, automatically disengage so that the door is free to be moved manually. According to a further feature of the invention the device which will disengage its driving and driven parts in the event of resistance to movement due to an obstruction interfering with any part of the driven portion of the mechanism or the door leaf or leaves. According to a further feature of the invention the device will automatically re-engage the driving and driven parts when the power supply is restored or the obstruction removed.

According to a preferred embodiment of the invention

the device itself serves to transmit thrust and includes two pawls carried by one of the parts, the pawls having a normal rest position and a second position in which they are held electromagnetically when the door-operating power supply is on and in which they can be engaged by a pre-determinedly spring-loaded trigger member carried by the other of the parts. The pawls face each other with a space between just big enough to receive the trigger. Thus, normally, when the power is on, door-opening and closing forces are transmitted from trigger to pawl (or vice versa). If the power fails the pawls return to their first position and the driving connection between the driving and driven parts of the mechanism is broken so that the door or doors can be moved by hand. To break the driving connection if, when the power is on, a moving door meets an obstruction, the trigger can pivot against the spring restoring force to ride over the operative pawl. In either case the driving connection is restored when normal operation is resumed, by return of the pawls to their second position and/or the trigger riding over the pawls into the said space.

The preferred embodiment of the invention will be further described with reference to the accompanying drawings, in which:

FIGURE 1 is a front view of a door operating mechanism incorporating the invention;

FIGURE 2 is a rear view of part of the mechanism, on an enlarged scale, showing the device for breaking the driving connection;

FIGURE 3 is a plan view of the part shown in FIGURE 2;

FIGURE 4 is a cross-section on line IV—IV of FIGURE 1, on the same scale as FIGURES 2 and 3;

FIGURE 5 is a sectional view, on line V—V of FIGURE 2, of a detail of the device; FIGURE 6 showing the same detail in end view;

FIGURE 7 is a view, partly in section, in the direction of arrow VII in FIGURE 2, of a further detail; and

FIGURE 8 is a cross-section on line VIII—VIII of FIGURE 7.

FIGURE 1 shows a box section beam **1** (one wall being omitted to show the contents) in which is a door operating mechanism including an electric motor **2** driving a lead screw **3** on which is a nut **4** prevented from rotating by a guide **5**. Thus operation of motor **2** moves nut **4** along screw **3**.

FIGURE 1 also shows bi-parting door leaves **8** and **13**, suspended by brackets **9**, **14** and **24** from balls **25** running in a track **26** in beam **1** (FIGURE 4). Bracket **9** carries leaf **8** and is clamped to a wire rope **10** which passes around idler pulleys **11**, **12** and is joined at its ends to a bracket **14**, which carries leaf **13**, by means of a compression spring **27** and a screw **28** serving to set and maintain the tension of the rope. Thus leaf **13** will move in sympathy with but in the opposite direction to leaf **8**.

Nut **4** forms the driving part of a dis-connectable coupling device and is connected, in operation, to leaf **8** by a device indicated generally at **7** in FIGURE 1 and shown in more detail in FIGURES 2 to 8. The main components of the device **7** are two opposed pawls **17**, **18** pivoted on a bracket **29** which also carries coils **21**, **22**. A hanging trigger **6** is pivoted on nut **4** and a double-acting spring-loaded plunger unit **15** is mounted on nut **4** and serves to hold trigger **6** in a vertical position. Bracket **29** is connected to bracket **9**, but could be connected to leaf **8** directly.

The natural tendency of pawls **17**, **18** is to adopt a first position as shown by broken lines 17^1, 18^1 under the action of their own weight; in this position they are clear of trigger **6**. Coils **21**, **22** are connected to the

motor power supply by a trailing lead **30** and are energized, when the power is on, so as to hold the pawls in the second position, shown in full lines, in which the pawls and trigger will touch on axial movement of either.

In normal operation, therefore, coils **21, 22** hold pawls **17, 18** up, and trigger **6** lies between the pawls as shown. When nut **4** is moved by screw **3**, trigger **6** engages one or the other pawl to move leaf **8** and hence leaf **13**, with pivoting of trigger **6** being prevented by unit **15**.

If the power fails the pawls will drop to rest against non-magnetic pins **19, 20** on bracket **29**. The door leaves are then disconnected from nut **4** and can be moved by hand.

If the circumstance arises whereby the mechanism of the door is in operation but an obstruction prevents the door leaves from moving or stops them from completing their movement, then the trigger **6** will tend to be deflected out of the vertical position and will apply a load to the double acting plunger unit **15**. If the obstruction to the door movement is sufficient to overcome the predetermined compressive force of spring **23** (FIGURE 5) contained within the unit **15** then the trigger **6** will be deflected until it disengages from the pawls even though these are supported in their fully upwards position by the magnetic lines of force emanating from the coils **21** and **22**.

The device **7** therefore not only disconnects the door from its mechanical linkage in the event of a power failure but proves an additional safety feature to meet overload conditions which may occur at the vertical edges of the door leaves themselves or at the tracks, hangers or guides. This feature will prevent serious injury being caused to a person using the door and having part of their body or a limb trapped between the closing edges of a door leaf or leaves.

It will be seen that, if the trigger is disengaged from the pawls either by a forcible restraint of the door leaf or as a result of a power failure, then when the restraint is removed or the electrical supply restored, at some point during the first sequence of operations following these events the trigger **6** will re-engage with the two pawls. Depending on the direction of approach, either pawl **17** or pawl **18** will be deflected downwards by the trigger **6** until the edge of the trigger meets the undeflected pawl, when the deflected pawl will revert to its operating attitude and the door gear will be ready for normal use.

The sectional view in FIGURE 4 of the door operating mechanism shows how this can be sufficiently compact to be contained within a housing **1** which is sufficiently compact in form to constitute the lintel or transom member of the door frame, having regard to the modern

requirement for such members to be slim and compact in appearance.

As FIGURES 5 and 6 show, unit **15** consists of a cylinder **31** having at one end an eye **32** for attachment to trigger **6** and at the other end a hole **33** for pivoting on nut **4**. Eye **32** is attached to rod **34** which passes through spring seats **35** and **36** has a head **37** behind seat **36**. Spring **23** acts between seats **35, 36**. Thus eye **32** can move in either axial direction carrying with it one spring seat while the other seat is stationary, thus compressing spring **23** to provide a restoring force.

I claim:

1. Electrically-operated sliding door gear including a driving mechanism for transmitting a driving force to at least one door leaf, said mechanism including a power operated coupling device, said coupling device comprising driving and driven parts, two pawls carried by one of the parts, a predeterminedly spring-loaded trigger member carried by the other of the parts, the pawls having a normal rest position clear of the trigger member and a second position in which they can be engaged by the trigger member, and electromagnetic means for holding the pawls in their second position when the door-operating power supply is on whereby said pawls become disengaged from the trigger member when door-operating power is absent and override the trigger member when resistance to movement of the driven part exceeds a predetermined amount and subsequently re-engage the trigger member automatically on further operation of the door gear.

2. The electrically-operated sliding door gear as claimed in claim **1**, in which the driving mechanism includes a lead screw and a non-rotatable nut threaded on the screw, and said nut constituting the driving part of the coupling device.

3. The electrically-operated sliding door gear as claimed in claim **1**, in which said trigger is pivoted on the driving part and the pawls are pivoted on the driven part of the coupling device.

References Cited

FOREIGN PATENTS

126,362 12/1947 Australia.
421,433 12/1934 Great Britain.

DAVID J. WILLIAMOWSKY, *Primary Examiner.*

J. KARL BELL, *Assistant Examiner.*

U.S. Cl. X.R.

49—28, 118, 123, 139