

April 14, 1959

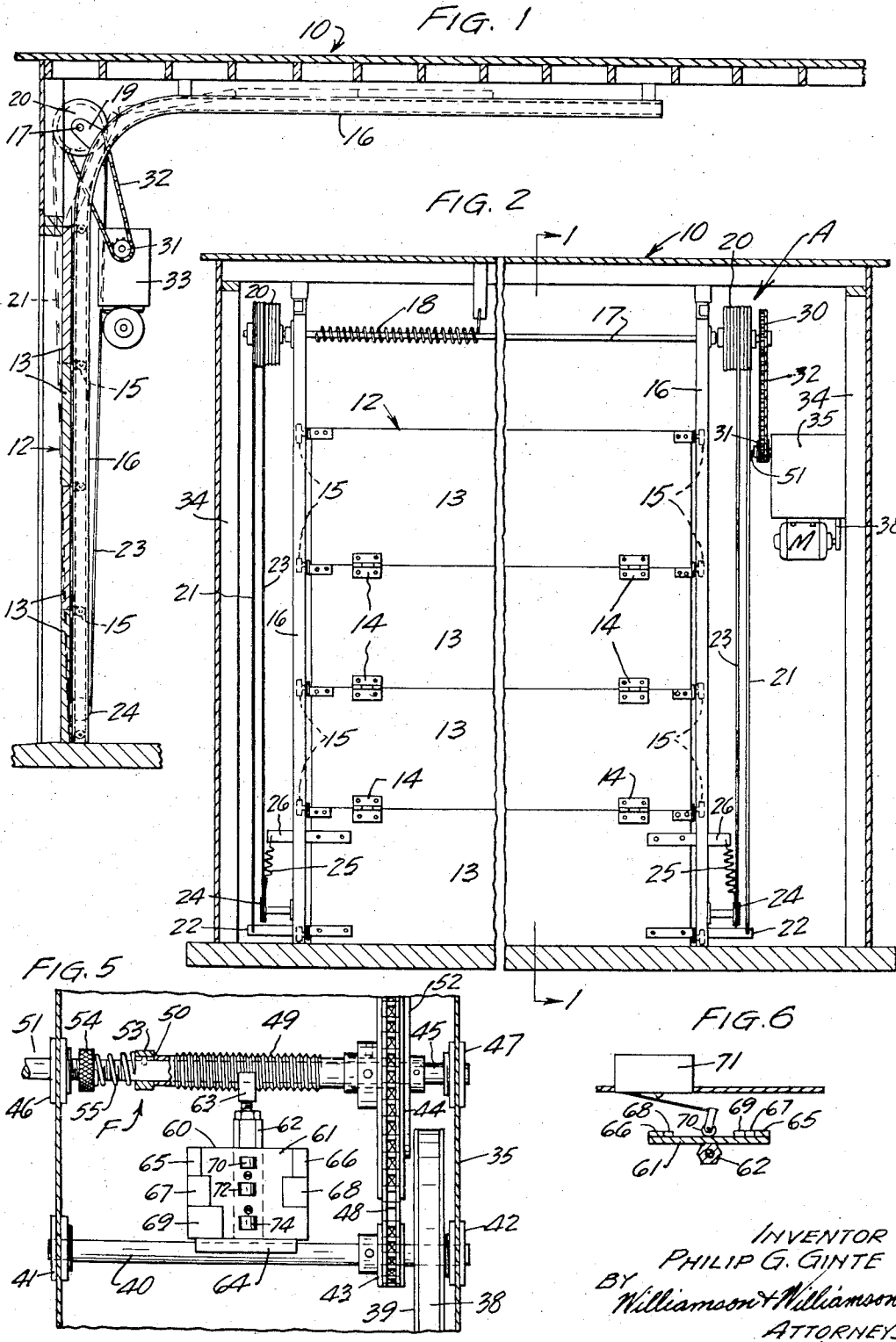
P. G. GINTE

2,882,044

GARAGE DOOR ACTUATING DEVICE

Filed Oct. 15, 1952

2 Sheets-Sheet 1



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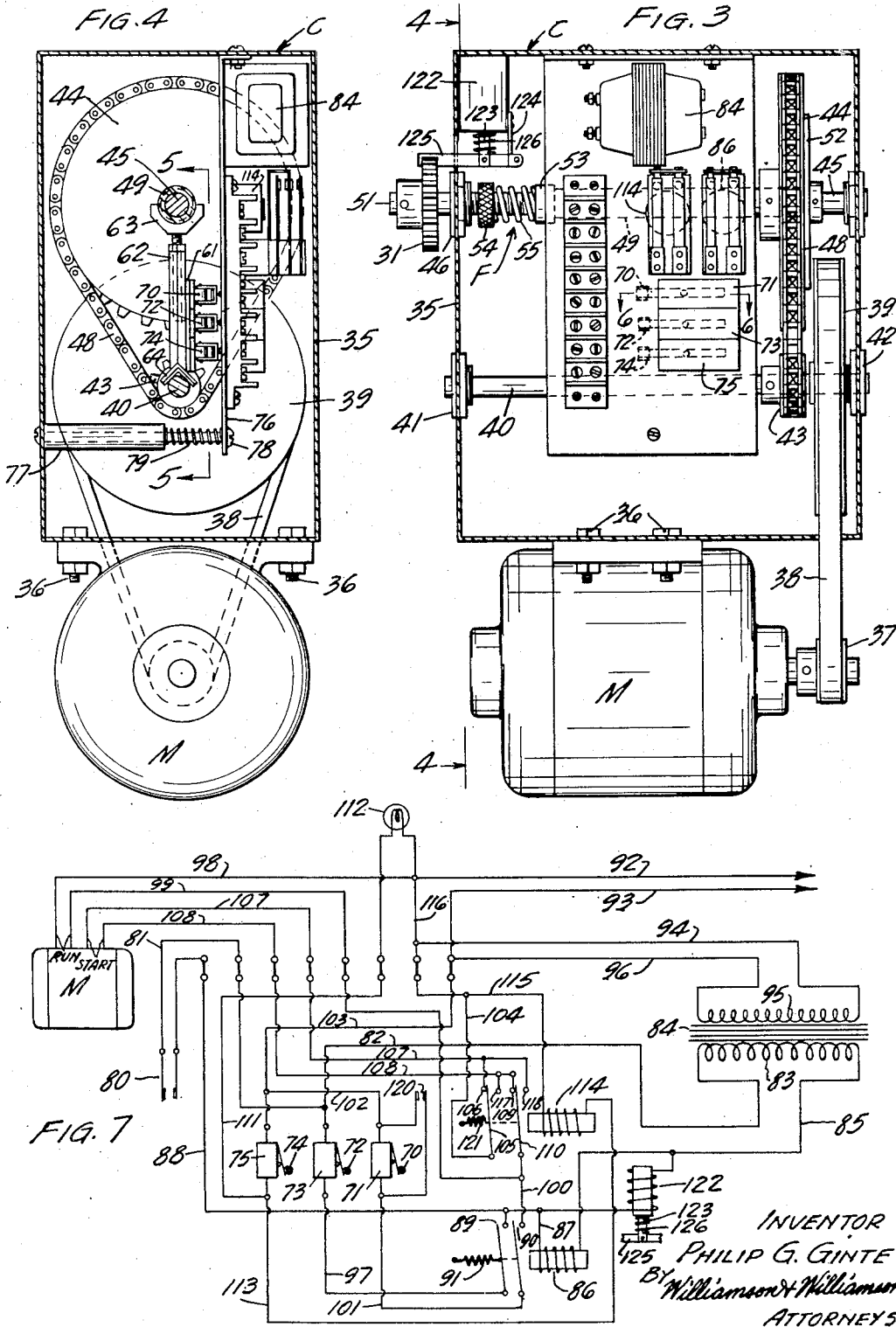
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GARAGE DOOR ACTUATING DEVICE

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Application October 15, 1952, Serial No. 314,914

11 Claims. (Cl. 268—59)

This invention relates to mechanism for actuating and controlling doors and more particularly for opening and closing hinged panel doors of the garage type which are counterbalanced and adapted to move from a lower closed position to an upper open position adjacent the ceiling of the garage.

Various devices have been proposed for automatically opening and closing garage doors most of which have been extremely cumbersome and space-consuming and which do not provide for complete safety to persons, objects, or the device itself in case of faulty operation or failure of the controlling mechanism. To my knowledge there is no previous automatic door actuating and controlling device which can be mounted in such a small space as to always be out of the way and in response to which the door will exert but a negligibly small pressure on any foreign object with which it comes into contact so as to cause no damage thereto nor to the motor, which will run during such contact only for a predetermined time before stopping, nor which device subsequent to such performance will not be rendered inoperative until specially adjusted and corrected. Some of the old devices have provided elaborate carriages taking up considerable head room and have provided for complicated means for disengaging the motor from the door actuating mechanism to stop the running of the motor completely and thereby rendering the entire device inoperative, or to merely stop the movement of the door but still allow the motor to run continuously until it is manually stopped or until it burns out.

It is therefore a principal object of the invention to provide for an automatic device for actuating and controlling counterbalanced doors such that the structural parts thereof will be extremely simple and efficient and the operation thereof automatic and fool-proof.

It is a further object of the invention to provide for a door operating device which will exert insufficient pressure upon the door to cause damage in case the door strikes an obstruction but which device may be utilized to retract the door from its position in contact with the obstruction to a normal position without requiring adjustment or attention on the part of the operator other than that employed in the usual operation of the mechanism.

It is another object of the invention to provide for a door opening and closing device adapted to be remotely started and in which controlling means responds linearly to the rotation of a motor so as to cause the motor to operate for a number of revolutions sufficient to open or close the door and subsequently to stop the running of said motor regardless of the actual position of the door.

It is a further object of the invention to provide for a counterbalanced door actuating and controlling mechanism in which the opening and closing movement normally responds linearly to the revolution of a reversible motor, the drive means for said door having an adjustable slip clutch interposed between the controlling mechanism and the door.

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It is a still further object of the invention to provide for a door controlling mechanism responding proportionately to the rotation of a reversible motor which normally stops the motor at the end of the travel thereof in either direction and which is further equipped with limit safety switches which will positively stop the running of said motor in case the limit switches should fail to function or if the operator should manually operate the mechanism improperly.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a vertical section of the front portion of a garage taken on the lines 1—1 of Fig. 2 and showing an ordinary sectional door furnished with my device which is attached to the wall of the garage;

Fig. 2 shows a rear elevation of the door of a domestic garage with the surrounding portions in section and with the central portion cut away;

Fig. 3 is a side view of the motor and control box having the cover removed therefrom (electrical wires and connections not shown);

Fig. 4 is another side view, being a vertical section through the control box on the lines 4—4 of Fig. 3;

Fig. 5 is a detail of the control traveler in an intermediate position corresponding to an intermediate point in the operation of the motor and looking in the direction of the arrows 5—5 in Fig. 4;

Fig. 6 is a detailed sectional view of the control traveler and micro switch arrangement taken in the direction of the arrows 6—6 in Fig. 3; and

Fig. 7 is the wiring diagram for the complete control of my device.

Referring now more particularly to the drawings, an ordinary frame garage is indicated generally at 10 and has mounted at the front end thereof a door 12 consisting of a plurality of panels or sections 13 which are attached together by means of hinges 14. Roller elements 15 are mounted on the sections 13 adjacent the hinged juncture. These rollers 15 are disposed at either side of the door and travel in tracks or guides 16 which are vertically disposed at the front wall and horizontally disposed beneath the ceiling of the garage 10. The door 12 is supplied with some counterbalancing means such as the bar 17 around which a torsion spring 18 is disposed, one end of which is fixed and the other end attached to the bar 17, so that the spring is tensioned to assist in supporting the weight of the door when it is in lower position as shown in Fig. 1, and which will be unwound at the upper position when the door is horizontally disposed underneath the ceiling of the building and has no effective weight to maintain. It is understood, of course, that the degree of tensioning will substantially counterbalance the door at any intermediate position between its open and closed positions. In the particular arrangement of counterbalancing shown the torsion bar 17 is journaled at 19 across the tracks or guides 16 with ends of bar or shaft 17 extending through the journals 19 for a distance sufficient to support a grooved pulley 20 at each end thereof. Each of the grooved pulleys 20 has a rope or cable 21 extending to a bracket 22 fixed to the bottom panel 13 of the door so that cable or rope 21 is unwound from pulley 20 when the door 12 is in its lower position as shown in Fig. 2. A cooperating cable 23 likewise extends from the drum 20 under an idler pulley 24 attached to the outside of guide 16. The end of the rope or cable 23 is attached to a spring member 25 which is in turn fastened to a bracket 26 secured to the bottom panel of the door 12. As the door is raised the rope or cable 21 is wound upon the grooved drum

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20 while the rope or cable 23 is unwound to compensate for the lengthening of the cable or rope 23 as it passes over idler pulley 24. Thus when the door is at its uppermost position the cable 21 will be completely wound upon the grooves of drum 20 and the cable 23 will be unwound therefrom. During the closing of the door tension is placed on the other cable 23 and the door is pulled via its connection to bracket 26 to the lowermost position as shown in Fig. 2, the torsion spring 18 being actuated to counterbalance the weight of the door in both its upward and downward movements. Other means of counterbalancing garage doors are within the contemplation of this invention and it is not necessarily restricted to the preferred type which is illustrated herewith. It is understood, however, that the door arrangement is to be counterbalanced and at the same time provided with means for positively actuating the door in a downward direction for closing and in an upward direction for opening.

My invention comprises an actuating and controlling device for operating a door such as that just described and includes mechanism indicated generally at A for opening and closing the door, together with a driving connection such as the sprocket 30 and pinion sprocket 31 interconnected by a chain or belt 32. The motor M and the controlling means C as shown in detail in Figs. 3 and 4 are respectively mounted upon and housed within a box 35 which may be attached to a side wall 34 of the garage 10. The housing box 35 is adapted to be attached either to a wall or the ceiling and by simple interchange of wires may be caused to operate in a reverse manner if it is desired to take off power from the pinion 31 when disposed at the right side with the box turned side-for-side instead of at the left side shown in Fig. 2. Since the likeliest available space in a garage is associated with the upper corners thereof there will always be some suitable location for my device so that it may be mounted for proper operation and still be out of the way of the automobile and other objects which may be placed in the garage.

Referring now to Figs. 3 and 4 the box 35 contains the control means mounted at the inside thereof and the motor M mounted at the outside thereof by means of bolts 36 or other suitable securing means. The drive pulley 37 is secured to the shaft of the motor M with drive belt 38 in driving connection between it and pulley 39 through an opening in the box 35. The pulley 39 is secured to shaft 40 which in turn is journaled across the box 35 in bearings 41 and 42. A sprocket pinion 43 is likewise fixed to shaft 40 adjacent the pulley 39 and is aligned with the sprocket wheel 44 which in turn is mounted for rotation upon shaft 45 journaled across the box 35 parallel to shaft 40 and rotatable within bearings 46 and 47. I prefer to use a roller chain 48 for the interconnecting drive between shafts 40 and 45. The shaft sprocket 44 has rotatably mounted thereon a sleeve 49 fixed to sprocket wheel 44, said sleeve having a threaded intermediate length as shown in Fig. 5. The shaft 45 terminates in an extension 51 which extends beyond the bearing 46 for driving sprocket 31. Clutch means are provided for transmitting rotary power to shaft 45 and driving member 32. In pressing engagement with collar 53 is the end face 50 or sleeve 49, the collar 53 being slidably mounted upon the shaft 45. Nut 54 is threadably engaged with a portion of shaft 45 so as to vary the degree of compression on spring 55 which is interposed between the nut 54 and the collar 53 which in turn transmits pressure by the side face of sprocket 44 upon a friction plate 52 attached to shaft 45. The parts associated with shaft 45 comprise a friction or slip clutch indicated generally by the letter F. The friction clutch F may be adjusted so as to operate in a positive manner within a given pressure limit. Beyond the given pressure the clutch F will slip without translating motion through the pinion gear 31. It is to be noted, however, that regard-

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less of the slippage of clutch F the sprocket 44 together with its threaded sleeve 49 will always operate in proportional rotation to the rotation of the motor M during the time that it is energized.

As a portion of the means positively connecting the rotary element or sprocket 44 in driving relation with the motor-stopping switch-operating roller 72, is a traveler 60 interposed across shafts 45 and 40 comprising a flat plate 61 and a transverse rod or bar 62 affixed thereto. A semicircular threaded yoke member 63 is adjustably attached to one end of the rod 62 for engagement with the threaded portion 49 of shaft 45 and at the other end of rod 62 is a V-shaped trough 64 which is adapted to slidably engage the shaft 40 during rotation thereof for travel in a direction parallel to both the shaft 40 and 45. It will be seen that the traveler 60 is positively connected to the motor through a direct mechanical linkage including the yoke 63, threaded sleeve 49, sprocket 44, chain 48, sprocket 43, shaft 40, pulley 39 and belt 28. The flat plate 61 has raised cam portions or abutments 65, 66, 67, 68 and 69 which are adapted in a manner to be described later in detail to engage rollers 70 on micro switch 71, roller 72 on micro switch 73 and roller 74 on micro switch 75 of the motor control mechanism. The microswitch 73 comprises a limit switch for normally causing deenergization of the motor M at the normal limits of movement of the traveler 60 which correspond to the normal limits of movement of the garage door; the microswitch 75 comprises a reversing switch which is operated when the traveler 60 is in an intermediate position between the normal limits of movement thereof for preconditioning the motor M for reverse running when the motor is subsequently deenergized and then reenergized; and the switch 71 comprises a safety switch to ultimately cause deenergization of motor M when the door and traveler 60 are in their extreme positions and when the limit switch 73 has failed to deenergize the circuit for such reasons as manual holding of the starting switch 80. The roller elements 70, 72 and 74 are shown diagrammatically in Fig. 5 but the entire switch mechanism is shown in greater detail in other views as at Fig. 6. It should be noted that the switches and rollers attached thereto are in stationary relation with the control box 35 while the plate 61 of the traveler operates to the left or right as shown in Fig. 5 and in contact with the roller elements so as to maintain the micro switch, such as at 71 in Fig. 6, in closed position since the roller 70 is in contact with the intermediate lower area of the plate 61 of the traveler. Should the roller 70 come in contact with and be lifted upon the raised cam portions 65 or 66 the micro switch 71 would then be open as hereafter described in more detail. The switches and wiring are secured to panel 76 which is adjustably mounted upon post 77 so that turning screw 78 against compression spring 79 may place the micro switches in operative clearance with traveler 60.

In the operation of the device, referring to the diagrammatic layout of the wiring in Fig. 7, a manual switch 80 which may be mounted in a position remote from the control mechanism and which further may consist of several such switches connected in parallel so that the mechanism may be operated from a number of remote points, is closed to initiate either the opening or the closing of the door. For purposes of illustration, let us assume that the garage door is in closed position as shown in Fig. 2. When the switch 80 is closed the circuit is established through conductors 81, 82, secondary winding 83 in transformer 84, through conductor 85, solenoid 86, conductors 87, and 88 and back to the switch 80. A low voltage current, preferably in the neighborhood of 24 volts, is taken from the transformer 84 to energize the solenoid 86. Immediately upon the energization thereof the double pole single-throw switch 89-90 is moved against the tension of spring 91, which normally urges the switch 89-90 to open position, and the switches

89—90 are thereby closed. It is to be noted that whenever the solenoid 86 is energized the motor M will be started and will continue to run except when the safety switch is open as hereafter will be described. The direction which the reversible motor M will run is predetermined by the condition of the micro switch 75 as will also be subsequently described.

The transformer 84 is energized from leads 92 and 93 connected to a source of alternating current. The circuit established through the transformer is from conductor 92 through conductors 116 and 94, through the primary winding 95 of the transformer 84, through conductor 96 and back to lead conductor 93.

Referring to Fig. 5 with the door closed the traveler 60 will be at the extreme right position so that rollers 72 and 74 on micro switches 75 and 73 will be open by virtue of raised cam portions 67 and 69 but the roller 70 will normally remain against the flat bottom portion of plate 61 so as to maintain switch 71 in closed position except in case of accidental operation such as manually continuing to hold closed the starting switch 80 in which event the micro switch 71 will function as a safety device when the traveler 61 overruns one of its normal terminal positions so as to be opened by either raised cam portions 65 or 66. Now as the traveler 60 responds to the rotation of motor M and the door 12 begins to open the movement of the traveler plate 60 will be from right to left (Fig. 5), and the roller 72 of the limit micro switch 73 will be the first to close as it drops over the edge of raised cam portion 67. If the switch 80 were manually disengaged prior to the time that roller 72 dropped to the lower surface 61 of a traveler 60, motor M would stop and the entire operation would stop. It then becomes necessary to again close the switch 80 until the limit micro switch 73 has been closed. Since this period corresponds to the normal overrun of the motor in not having stopped instantaneously at the end of the previous operation, it requires several seconds before the limit micro switch 73 becomes closed. At this point the solenoid 86 is locked into the circuit which energizes it and the switch 80 may be disengaged for the duration of the opening period of the door. The lock circuit established is through conductor 82 from secondary winding 83 of the transformer 84 through limit micro switch 73 (now closed) through conductor 97, through switch 89, conductor 87, solenoid 86, and conductor 85 back to the secondary winding 83.

As previously pointed out the motor M starts whenever the solenoid 86 becomes energized and the run windings of the motor are energized through the circuit beginning at the lead 92 through conductor 98 to the run windings of the motor M, back through the conductor 99 through conductor 100, switch 90, conductor 101, safety micro switch 71, conductor 102, conductor 103 and back to lead 93. Since the type of motor illustrated is a single phase motor with a starting winding to determine the direction which the motor will run, the starting circuit must also be energized at the same time that the run windings are energized. If the starting windings are reversed with respect to the run windings then the motor will start in the opposite direction. If, however, the starting windings are reversed while the motor is running the motor will continue to run in the same direction in which it was started since centrifugal mechanism, commonly employed in such motors, maintains the starting windings in deenergized condition during the running of the motor. Since the motor was started immediately upon the energization of the solenoid 86 the starting windings were likewise energized in the manner and in the direction as now described. Current from the lead 92 passes through conductors 116, 104, switch 105, contact point 106, conductor 107, through the starting winding of the motor M back through the conductor 108, contact point 109, switch 110, conductor 100, switch 90, conductor 101, safety micro switch 71, conductors 102, 103, and back to lead 93.

As the motor continues to run traveler plate 61 will likewise continue to run proportionally in a direction to the left as shown in Fig. 5 and the roller element 74 of the light and reverse conditioning micro switch 75 will be closed when the roller 74 drops from the raised cam portion 69 to the lower level of plate 61. This occurs when the door has attained a distance in an upward direction of a few inches above the floor of the garage. When the micro switch 75 closes a circuit is established from lead 93 through conductor 103, switch 75, conductor 111, light bulb 112, and back to lead 92. At the same time a circuit is established from lead 93 through conductor 103, micro switch 75, conductor 113, solenoid 114, conductors 115, 116 and back to lead 92. When the solenoid 114 is thus energized the double pole double-throw switch 105—110 breaks contact between contact points 106 and 109 and establishes contact with the points 117 and 118. When this new contact has been established the starting windings of the motor M will be reversed with respect to the leads 92 and 93, although the windings themselves will not be energized at this point because of the centrifugal throw out which maintains the starting windings deenergized as long as the motor M continues to run. The new circuit, however, is preconditioned so that when it is established within the motor, current will flow from leads 92 and 93 in the opposite manner to that which was established at the beginning of the starting operation when the door was closed. This new circuit is established as follows:

Connection is made from lead 93, through conductors 103, 102, 101, switch 90 (always closed when motor is running) conductor 100, switch 110, contact point 118 and conductor 107 to the starting winding coil. The other connection from the starting winding coil to the opposite lead is back through conductor 108, contact point 117, switch 105, conductors 104, 116 and to lead 92. As the motor continues to run the traveler 60 goes to the left in Fig. 5 until roller 72 of the limit micro switch 73 engages raised cam portion 68 which opens the switch 73, thus deenergizing the solenoid 86 and allowing the double pole single-throw switch 89—90 to return to open position under the tension of spring 91. Since the switch 90 is also opened the main line current to the run windings of the motor M is interrupted and the motor will stop. Momentum of the motor while stopping will position roller 72 slightly farther than the front edge of raised cam portion 68 so that several seconds may be required on the return movement before roller 72 again drops back to the lower portion of traveler plate 61. There is no raised cam portion on the right side of the traveler plate 61 for roller 74 to engage. As a consequence, the reverse conditioning of the starting windings remain preconditioned as previously explained and the light 112 remains on as long as the door is in open position. As before stated the roller 70 of switch 71 in normal operation does not engage either of the raised cam portions 65 or 66 since it is merely a safety switch will not become opened except under extraordinary circumstances such as maintenance of the starting switch 80 in closed condition while the limit switch 73 is being opened. If this condition occurs the safety switch 71 will be positioned over the raised cam portion 66 until the roller 70 thereof opens it. This will deenergize the run windings of the motor even though the solenoid 86 is energized since the main circuit is broken whether or not the switch 90 is closed or open. This, of course, is an exception to the statement that the motor is always energized when the solenoid 86 is energized since the condition is an abnormal one. In order to reestablish energization of the motor in a reverse direction when the safety switch has been reached it becomes necessary to manually close emergency switch 120 which by-passes the safety micro switch 71 and while thus being held closed the starting switch 80 is again closed. Since the starting windings are preconditioned for reversal as be-

fore noted the motor will begin to run in the opposite direction. In several seconds the roller 70 of the safety switch will have dropped back to the lower portion of the traveler plate 61 thus reestablishing the circuit through the switch 71 so that emergency switch 120 may be released. If the starting switch 80 is now released before the roller 72 causes limit switch 73 to become closed the entire mechanism will be in exactly the same condition as normally occurs when the door is open and the motor is deenergized. Thus to initiate the door closing operation, the starting switch 80 is closed and the solenoid 86 is again energized with the run windings of the motor energized as in the first instance. It will be noted, however, that since there is no raised portion to open the light circuit and reverse conditioning micro switch 75, the solenoid 114 remains energized as long as the current from the electrical source through leads 92 and 93 is established and as a consequence the starting windings of the motor are always preconditioned for the reverse starting and running of the motor M when the door is in open position. If the current through leads 92 and 93 should be interrupted the solenoid 114 will become deenergized and will move back to the position shown in the diagram of Fig. 7 under tension of spring 121. This position has no significance because the entire system is deenergized. If the circuit through leads 92 and 93 is again established the solenoid 114 will automatically become energizing and the reverse windings will again be preconditioned as before noted. Because of the overrun caused by the momentum of the motor it is necessary as before to maintain the starting switch 80 in closed condition until the limit switch 73 is closed by the dropping of roller 72 from the edge of raised cam portion 68 to the lower surface of traveler plate 61. At this point the starting switch 80 may be released and the motor will continue to run in its reverse condition to close the door, the illuminating bulb 112 remaining lit during this period. The traveler plate 61 will, of course, be traveling in a direction to the right as shown in Fig. 5 and as the door closes the first switch to be actuated will be the light and reverse conditioning micro switch 75 which will be opened when the roller 74 engages the raised cam portion 69 on the traveler plate 61. When the switch 75 opens the solenoid 114 will be deenergized and the double pole double-throw switch 105—110 will snap back under the tension of spring 121 so as to reestablish contact with points 106 and 109. This latter movement preconditions the motor starting windings again for reversal so as to be ready to start in the original direction when the door is again opened. As previously noted the reverse preconditioning does not presently affect the operation of the motor since the centrifugal throw out mechanism maintains the starting windings deenergized and they will not be capable of operation until the motor comes to a stop. The motor thus continues to run in the door closing operation until limit switch 73 is opened by contact of roller 72 with the cam portion 67. This movement will again deenergize the solenoid 86 so as to stop the operation of the motor. Since the light and reverse conditioning switch 75 now remains in open position the solenoid 114 will also remain deenergized regardless of whether the current from the source through leads 92 and 93 is interrupted or remains constant. The light 112 will, of course, have gone out when the switch 75 first contacted the raised cam portion 69 slightly above the completely closed condition of the door.

Assuming that an unusual condition existed where an obstruction prevents the door from closing, such as where the hood of an automobile is in the doorway of the garage, the door in its downward movement will strike the top of the automobile hood but since the door is not traveling at a high rate of speed it will not have sufficient momentum to injure the finish thereof. The preferred rate of speed in an ordinary situation is eight to

ten seconds for the entire period during which the door travels from one position to the other and the motor runs at from eighteen to twenty seconds during this same period, having started simultaneously with the movement of the door but continuing to run for a short period after the door has reached either its closed or open position. The sleeve 49 will, of course, be rotating at all times when the motor M is rotating. If the door has reached an obstruction such as the hood of the car or when it has reached its lower closed position or its upper open position the motor will continue to run but the slip clutch F will turn in frictional engagement so that rotation will be imparted to shaft 45 only if the restraining force thereon is less than that selected for the clutch by adjustment of the nut 54. Since the door used is counterbalanced, this force may be selected so as to be in the neighborhood of ten pounds when applied at the pressure point at the bottom of the door in its contact with an obstruction, or at its stop position when closed or when opened. If the friction clutch is set for a ten pound force the door will exert only ten pounds upon the hood of the car, which of course will not be sufficient to injure it. Under this condition the motor will be running in the direction reverse to its original direction (for opening the door) and will continue to run with the traveler plate 61 moving in a direction to the left until limit switch 73 is opened by contact with the raised cam portion 68. When this occurs the motor will stop but the entire control mechanism will have been preestablished for reverse running even though the door has been retained in an intermediate position. In other words, my device has behaved in a manner the same as though the door had closed all the way. Now since the device is preconditioned for opening the door and since the door immediately responds whenever the motor is energized it will begin to raise from the obstruction as soon as the starting switch 80 is again closed. However, since the door was not in intermediate position and the control mechanism was in the condition normally coincident with the closed position of the door at the floor of the garage, the door will consequently reach its uppermost position before the control device will have reached the opposite limit controlled by the opening of limit switch 73 as roller 72 contacts the raised cam portion 68. While this situation exists the slip clutch will again frictionally rotate without imparting movement to the shaft 45 and the same light force will be exerted by the door in its upward stopped position until the motor and the limit switch has run out its distance. It may thus be seen that device has automatically compensated for the unusual circumstance without more than the ordinary manual closing of the starting switch 80. The door has been completely compensated and again is in condition to be closed in a normal operation by merely reestablishing the closing of starting switch 80, and all without special adjustment and without danger to persons or objects nor to the equipment itself.

For the purpose of locking the garage door in any position which it has assumed at the time the motor M stops I have provided a solenoid 122 which may be mounted upon the inner wall of case 35 and which lies in parallel with the electrical circuit through solenoid 86 as shown in the diagram Fig. 7. Retractable within the solenoid 122 is a bolt or pin 123 which is adapted to cooperate pivotally with an arm 125 which is in turn pivoted to bracket 124. The bolt 123 is normally spring pressed to an outer position by spring 126 so as to engage a tooth on sprocket 31. Thus when the motor M is deenergized it will be impossible for anyone to raise the door or lower the door because the pin or bolt 123 will have dropped between two of the teeth on the periphery of sprocket 31. When the motor M is energized the solenoid 122 will likewise be energized and will retract the pin 123 against the compression of spring 126 so as to allow the sprocket 31 to rotate freely.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention.

What I claim is:

1. Apparatus for automatically opening and closing a counterbalanced door actuatable by a single manually operated starting switch comprising, mechanism for connection to said door to urge it to an open position and to urge it to a closed position, a reversible motor mounted adjacent said mechanism and responsive to said starting switch for electrical energization thereof, a friction clutch connection interposed between said motor and said mechanism for driving connection therewith below a predetermined resisting torque, an electrical circuit to said motor and including a limit switch and also including said starting switch, a second circuit including a reversing switch for conditioning said motor for reverse starting, a control traveler, mechanical linkage positively connecting the traveler to the motor and proportionately moving the traveler in response to the rotation of said motor in each direction of rotation to precondition said second circuit to the motor for reverse running upon the next succeeding operation of said starting switch and said traveler having a pair of spaced limit switch-operating abutments each for interrupting said first mentioned circuit to the motor substantially at the limit of the normal movement of the said control traveler, and reversing abutment means mounted in fixed relation to said pair of abutments to operate the reversing switch to condition the motor for reverse travel.

2. In combination, a vertical roll-up door, a reversible motor, an output shaft, means positively and permanently connecting said motor and said output shaft, a controller positively driven by said shaft for limiting the movement of said motor, and friction clutch means connecting said output shaft with said door whereby when the movement of the door in either direction is interrupted the motor will continue to operate said controller in synchronism therewith irrespective of the position of the door.

3. In combination, a vertical roll-up door; a reversible motor; an output shaft; means positively connecting said motor and said output shaft; a motor control mechanism including movable means operating to stop the motor; a driving member to move the door and to stop when the door is stopped; means positively connecting the driving member to the door; and transmission mechanism connecting the output shaft with the control mechanism and with said driving member and including a rotary element, means positively connecting the shaft with said rotary element for continuously transmitting torque thereto, means positively connecting the rotary element to the movable means of said control mechanism for moving the movable means and stopping the motor, and said mechanism also including clutch means bearing against a surface of said rotary element and normally causing torque transmission through said rotary element and to said driving member for moving the door, said clutch means slipping when the door and driving member are stopped to permit continued transmission of torque through said rotary element for rotating the same and causing operation of said movable means to thereby stop the motor.

4. In combination, a vertical roll-up door; a reversible motor; an output shaft; means positively connecting said motor and said output shaft; a motor control mechanism including a switch connected in controlling relation with the motor for stopping the motor when operated and a movable switch-operating arm, driving mechanism to move the door and to stop when the door is stopped and including a driving member and movable apparatus positively connecting the driving member and the door; and transmission mechanism connecting the output shaft with the control mechanism and with said driving mem-

ber and including a rotary element, means positively connecting the shaft with said rotary element for continuously transmitting torque thereto, means positively connecting the rotary element to the movable switch-operating arm for operating the switch when the rotary element is rotated and including a rotary cam connected to the rotary element and a cam follower, said transmission mechanism also including clutch means normally bearing against a surface of said rotary element in non-slipping relation relative to the rotary element and normally causing torque transmission through said rotary element and to said driving mechanism and for moving the door, said clutch means slipping on the rotary element when the door and driving member are stopped to permit continued transmission of torque through said rotary element for rotating the same and causing operation of the cam and cam follower to move the switch-operating arm and operate the switch for stopping the motor.

5. In combination, a vertical roll-up door, a source of rotary power having a reversible power take off, an output shaft, means positively connecting said power take-off and said output shaft, a controller connected with the power source for limiting movement of the power source and said controller being movable to power source movement-limiting position, transmission mechanism connecting the output shaft with the controller and also with the door, said mechanism including means positively connecting the shaft with the controller in continuous driving relation and said mechanism also including clutch means normally maintaining a power transmitting relation between the output shaft and the door and said clutch means slipping in response to stoppage of the door to permit movement of the controller to said power source movement-limiting position.

6. In combination, a vertical roll-up door, a reversible motor, an electric switch connected in controlling and motor-stopping relation with the motor, a rotary driving member, means positively connecting said driving member in driven rotary relation with said motor, a driven rotary member, means positively connecting the driven member with the door, a torque-responsive releasable drive mechanism drivably connecting said rotary driven member in driven relation with said rotary driving member and at least a portion of said mechanism rotating upon release of said mechanism, and switch actuating mechanism connected with said drive mechanism in controlling relation with said switch and rotating with said portion of said drive mechanism upon release of the latter to actuate the switch.

7. In combination, a vertical roll-up door, a reversible motor, a driving member, means positively connecting said driving member in driven relation with said motor, an electric switch connected with said motor in controlling relation, a driven member, means connecting the driven member in driving relation with the door, a torque-responsive releasable drive mechanism drivably connecting said driven member in driven relation with said driving member, and switch actuating mechanism operably connected with said drive mechanism in controlling relation with said switch, said releasable drive mechanism, during released condition thereof, being drivably connected with said switch actuating mechanism to cause the latter to actuate said switch.

8. In combination, a vertical roll-up door, a reversible motor, an output shaft, means positively and permanently connecting said motor and said output shaft, a controller for limiting movement of the motor and being movable to a motor-movement-limiting position, means responsive to movement of the controller and preconditioning the motor for reverse running when the motor is again operated, transmission mechanism connecting the output shaft with the controller and also with the door, said mechanism including means positively connecting the shaft with the controller in continuous driving rela-

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tion and said mechanism also including clutch means normally maintaining a driving relation between the output shaft and the door and said clutch means slipping in response to stoppage of the door to permit movement of the controller to said motor-movement-limiting position.

9. In combination, a vertical roll-up door, a source of rotary power having a reversible power take-off mechanism, a frame, an output shaft journaled on the frame, means positively and permanently connecting said take-off mechanism and said output shaft, a traveler drivably connected with the shaft to be moved thereby as the shaft is rotated, a limit switch means and a switch-operating means, one on the frame and the other on the traveler, the limit switch means connected in controlling relation with the power source, and the switch-operating means including apparatus operating the limit switch means as the traveler moves with the shaft and thereby limiting the movement of said motor, and clutch means connecting said output shaft with said door whereby when the movement of the door in either direction is interrupted the motor will continue to operate said traveler in synchronism therewith regardless of the position of the door until the limit switch means is operated.

10. In combination, a vertical roll-up door, a reversible motor, an output shaft, means positively and permanently connecting said motor and said output shaft, a controller positively driven by said shaft and including motor-operating means for limiting the movement of said motor, the controller also including switch means preconditioning the motor for reverse running when the motor is subsequently operated again, and friction clutch means connecting said output shaft with said door whereby when the movement of the door in either direction is interrupted, the motor will continue to operate said controller in synchronism therewith regardless of the position of the door and the motor and door are preconditioned for reverse movement when the motor is subsequently operated.

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11. In combination, a vertical roll-up door, a reversible motor, a frame, an output shaft journaled on the frame, means positively and permanently connecting said motor and said output shaft, a traveler drivably connected with the shaft to be moved thereby as the shaft is rotated, a limit switch means and a limit switch-operating means, one on the frame and the other on the traveler, the limit switch means connected in controlling relation with the motor, and the limit switch operating means including apparatus operating the limit switch means as the traveler moves with the shaft in either direction and thereby limiting the movement of said motor, a reversing switch means and a reversing switch-operating means, one on the frame and the other on the traveler, the reversing switch means being connected in controlling relation with the motor to precondition the motor for reverse running after the motor is stopped and operated again, and the reversing switch-operating means being positioned for operating the reversing switch as the traveller moves between the limits of movement thereof, and clutch means connecting said output shaft with said door, whereby when the movement of the door in either direction is interrupted the motor will continue to move said traveler in synchronism therewith regardless of the position of the door and the motor will be preconditioned for reverse running in the next successive operation thereof.

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