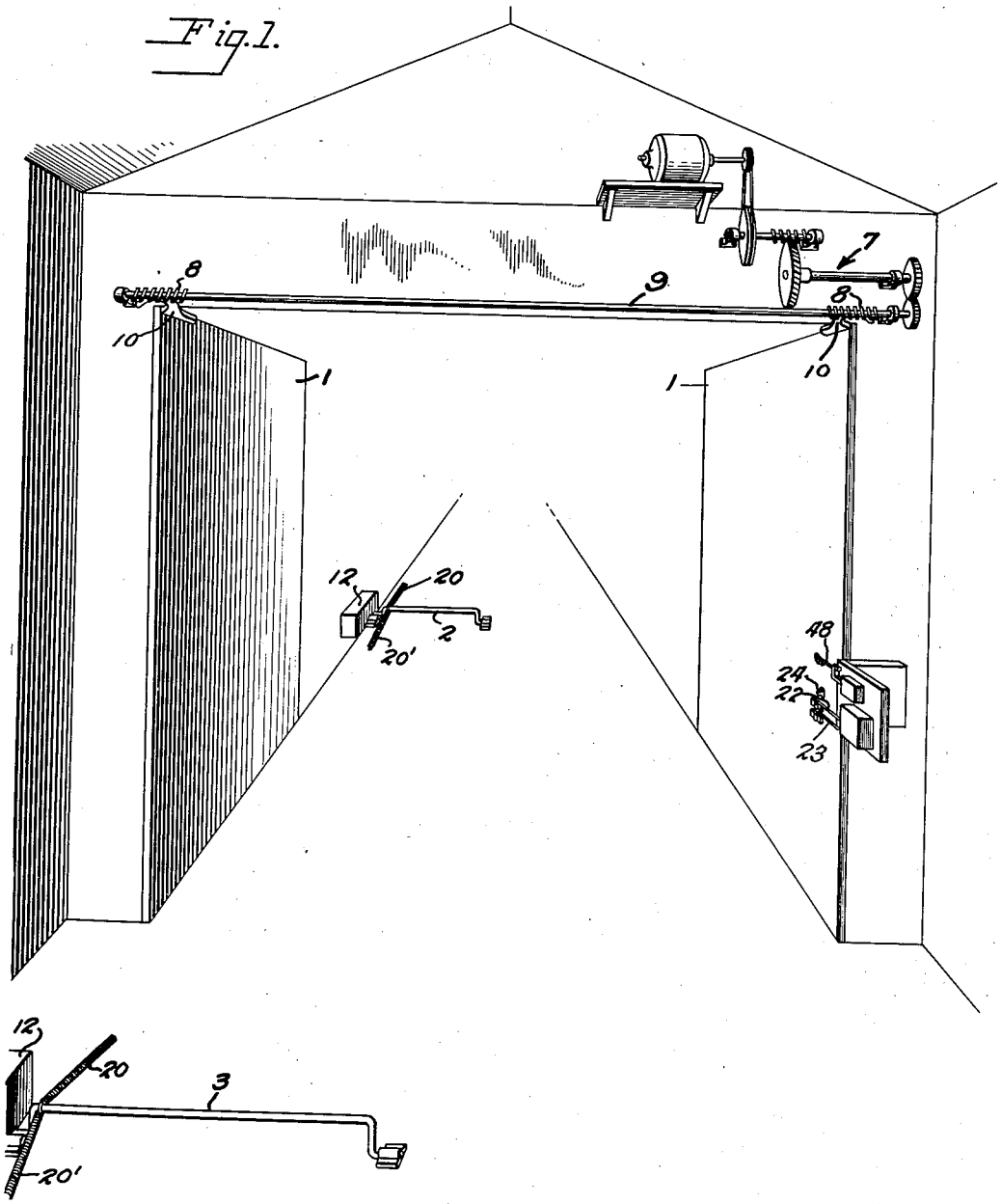
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AUTOMATIC DOOR CONTROL

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Fig. 1.



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Fig. 2.

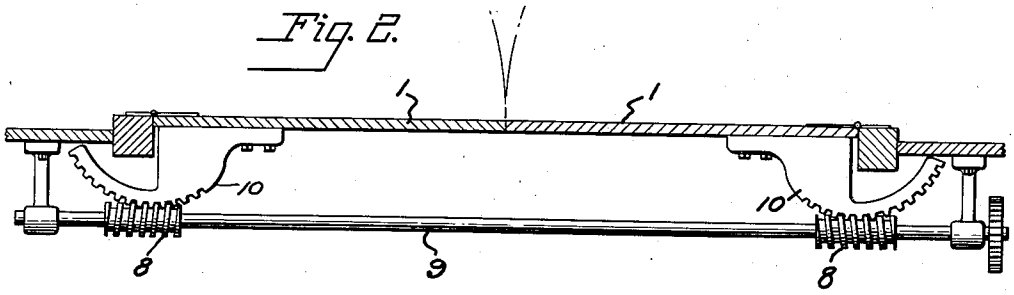


Fig. 3.

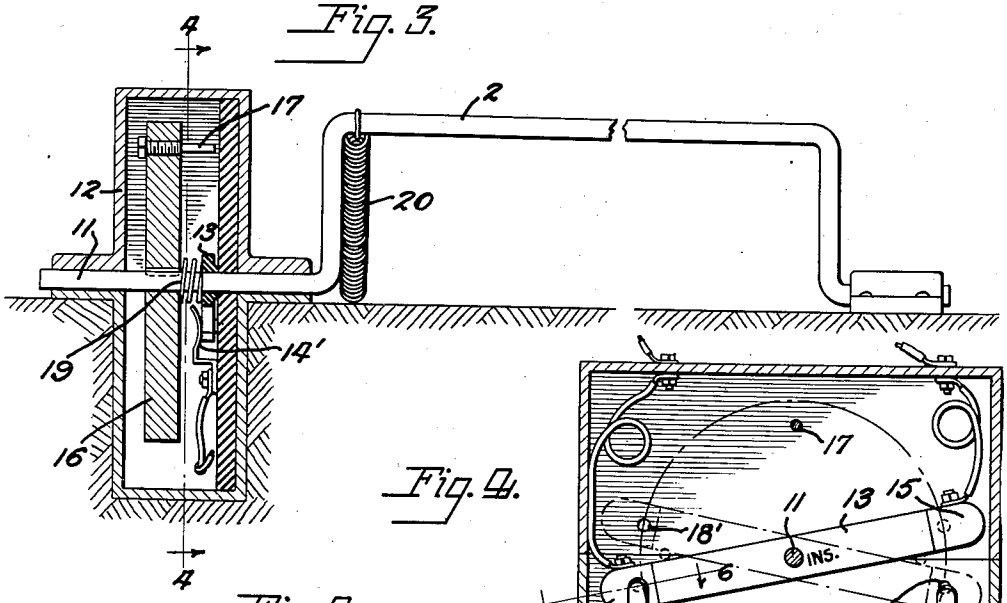


Fig. 4.

Fig. 6.

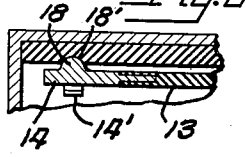
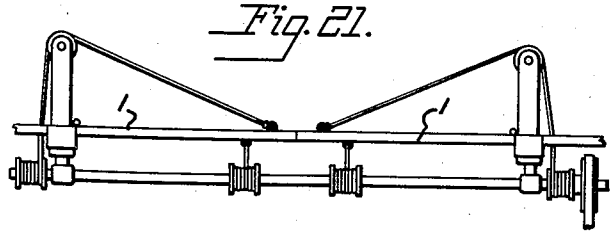


Fig. 21.



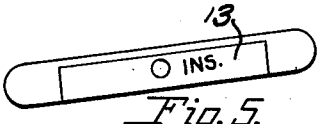


Fig. 5.

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Fig. 7.

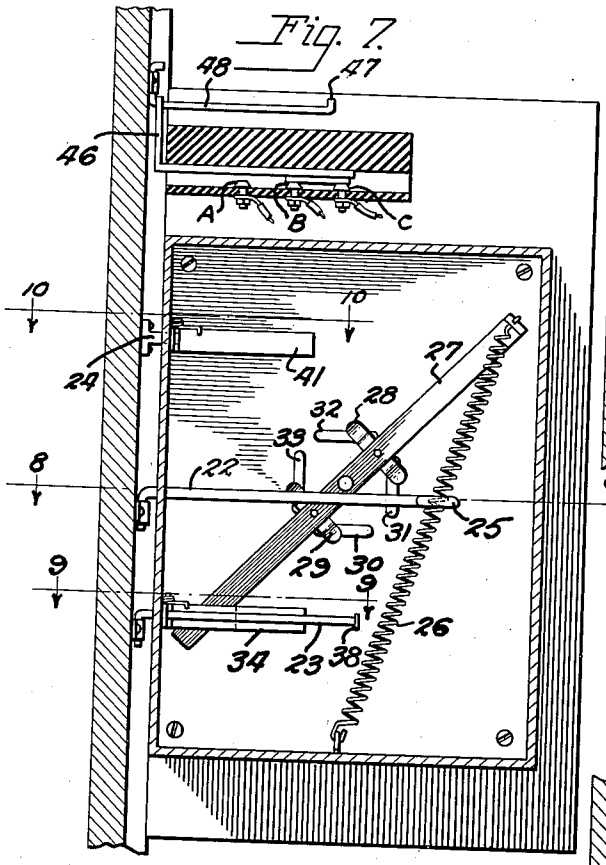


Fig. 9.

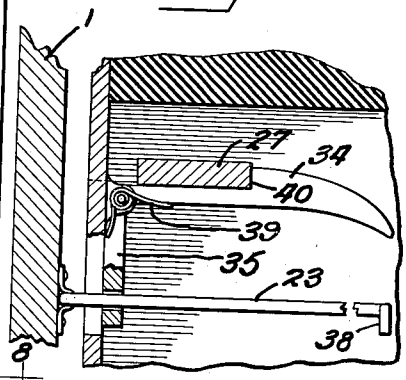


Fig. 8.

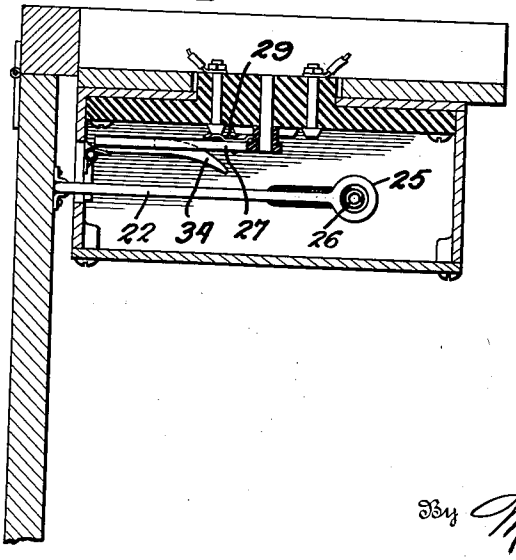
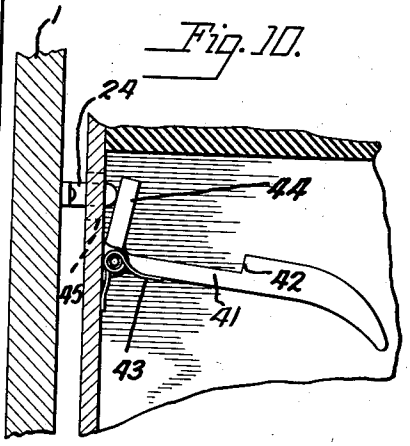


Fig. 10.



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AUTOMATIC DOOR CONTROL

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Fig. 11.

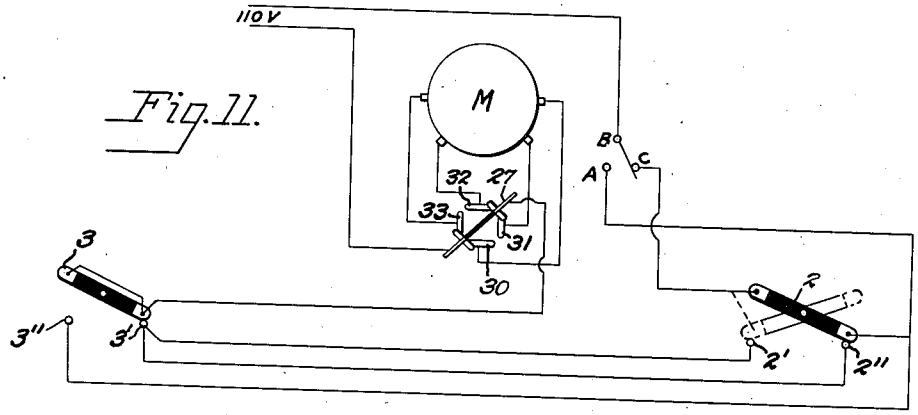


Fig. 12.

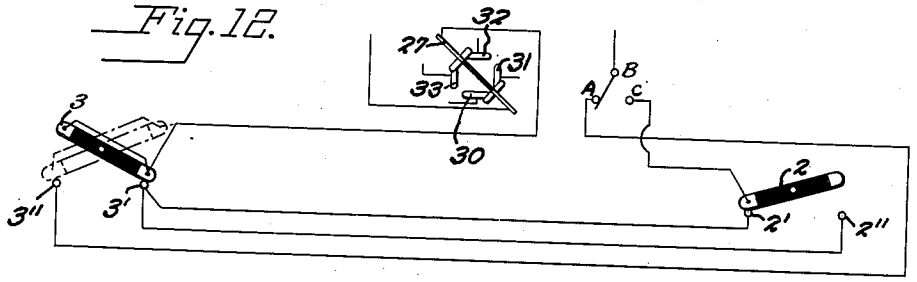


Fig. 13.

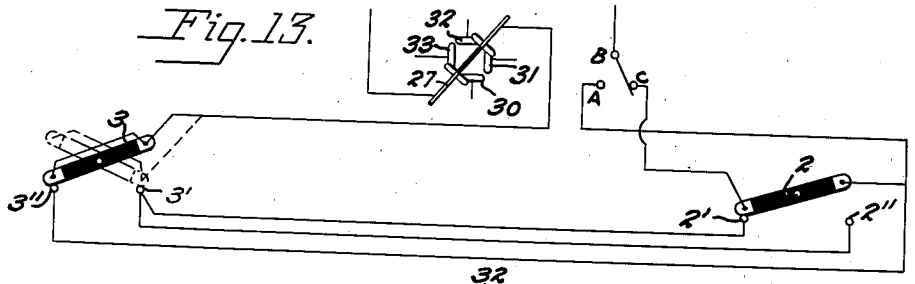
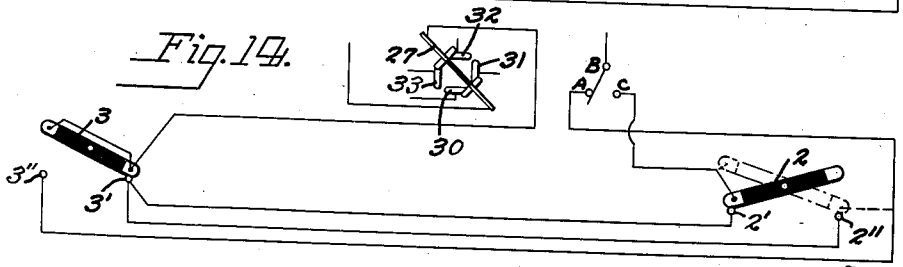


Fig. 14.



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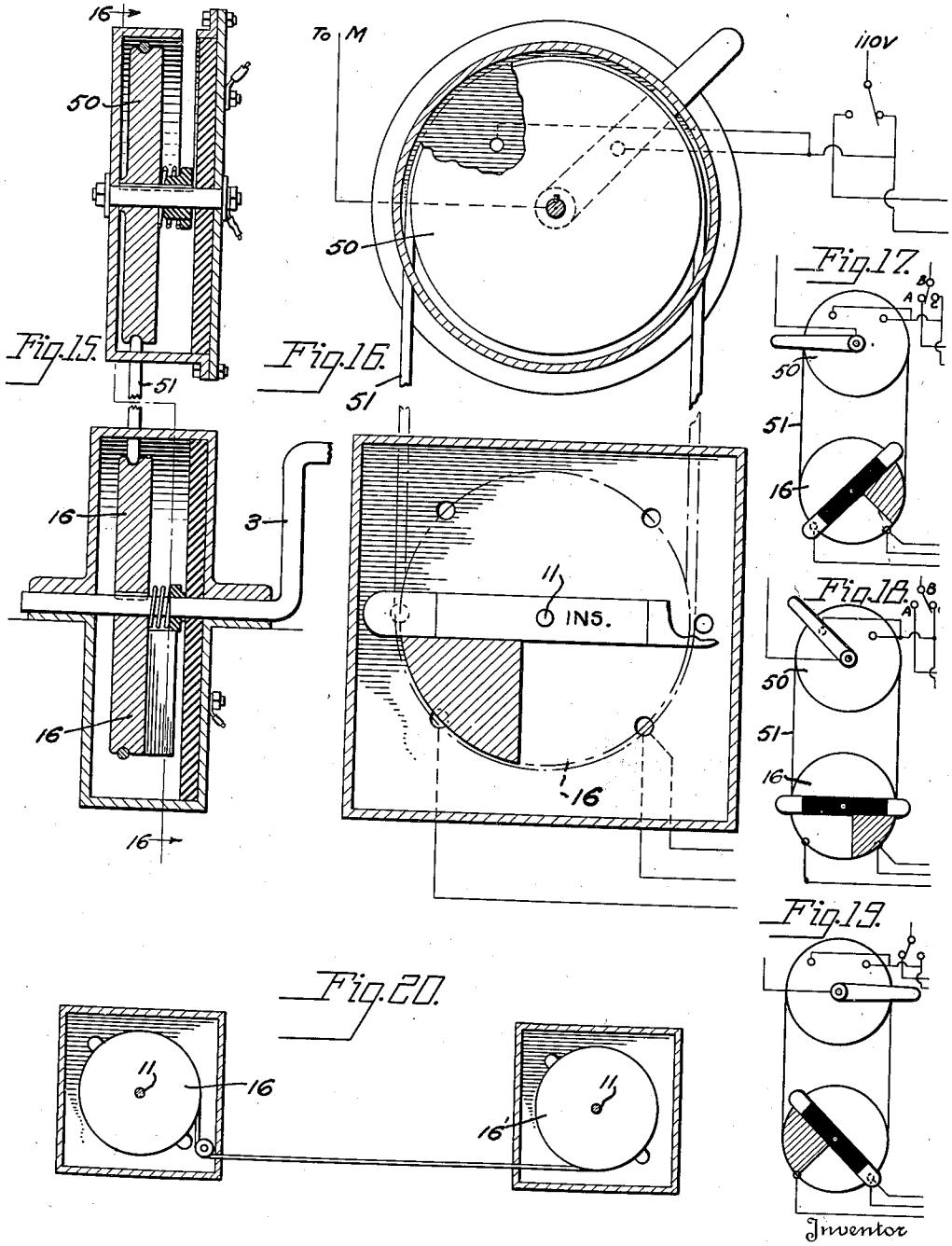


Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

Fig. 19.

Fig. 20.

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Patented May 20, 1941 2,242,706

UNITED STATES PATENT OFFICE

2,242,706

AUTOMATIC DOOR CONTROL

Charles S. Hanson, Wellington, Kans.

Application March 16, 1939, Serial No. 262,297

1 Claim. (Cl. 268—63)

This invention relates to automatic controls for garage doors, particularly automatic arrangements to open or to close motor-operated doors with switch elements alternately actuated as a car moves in or out.

An object of the present invention is to provide an electric motor to open and close a garage door, with switch arrangements to operate the motor to automatically open the door upon approach of a vehicle from one side thereof, and to automatically close the door upon the vehicle passing beyond the other side of the door.

Pursuant to this object the invention comprises a motor reversible to respectively open and close the door, and a reversing switch, with vehicle actuated operating switches on each side of the door. Included in this switch arrangement is a distributing switch to set the circuit of the reversing switch preparatory to the next normal operation of the vehicle, whereby the position of the vehicle on one or the other side of the door is coordinated with its direction of movement towards or away from the door to close the door when the vehicle retreats from it on either side, and to open the door when the vehicle approaches it from either side.

The invention includes a mechanical operation of the reversible switch, and of the distributing switch, responsive to the opening and closing of the door, in addition to mechanism to delay the operation of the reversing switch until the door has attained fully opened or closed position. The delayed throw of the reversing switch is accomplished by mechanism employing the door movement to set the switch throwing mechanism ready for operation, together with trip means responsive to the door attaining its extreme open or closed position to release the switch throwing mechanism to operate to throw the reversing switch.

These and other objects will appear from the following illustrative description of this invention taken with the accompanying drawings and more fully pointed out in the appended claim.

In the drawings:

Figure 1 represents in general assembly a garage door with motor connections to open and close the door in combination with switches actuated by the door and with switches placed inside and outside the garage to be tripped by a passing car;

Figure 2 is a plan view, with the doors in section, showing a gear arrangement to move the doors;

Figure 3 is a vertical section through one of the car-operated control switches associated with a car-operated trip;

Figure 4 is a vertical section taken along the line 4—4 of Figure 3 showing the assembly of switch mechanism within a control box;

Figure 5 is a side view of one form of car-tripped switch arm;

Figure 6 is a detail in cross section of a switch arm within a control box along the line 6—6 of Figure 4;

Figure 7 is a side elevation of a reversing switch and distributing switch mechanism operated by the door, with a portion of the door and of the switch boxes in section;

Figure 8 is a horizontal section along the line 8—8 of Figure 7 showing the disposition of a door-operated reversing switch mechanism;

Figure 9 is a horizontal section along the line 9—9 of Figure 7 showing a reversing switch latch and door-operating releasing means therefor;

Figure 10 is a horizontal section along the line 10—10 of Figure 7 showing a corresponding switch latch and actuation means therefor to open the latch when the door is closed;

Figure 11 is a diagrammatic representation of switch combinations to enter a garage as a car opens the door.

Figure 12 is a diagrammatic representation of switch controls arranged to close the door after a car enters a garage;

Figure 13 is a diagrammatic representation of switch combinations to open a door for a car to leave a garage;

Figure 14 is a diagrammatic representation of switch combinations to close a door after a car has left a garage;

Figure 15 is a vertical section through a pair of control switches for manually opening the door after a car has entered and has acted on the switch controls set forth in the preceding figures;

Figure 16 is a vertical section along the line 16—16 of Figure 15;

Figure 17 is a diagrammatic representation of the manual switch and circuit operation of Figures 15 and 16 to close the door after a car has entered a garage;

Figure 18 is a diagrammatic representation of the circuit and switch arrangements actuated by the manual control of Figures 15 and 16 to open a door for a car outside the garage;

Figure 19 is a diagrammatic representation of manual control and switch arrangements as shown in Figures 15 and 16 when in position to close a door with a car outside the garage;

Figure 20 is a schematic plan view showing a correlated arrangement between a pair of trip controls positioned respectively inside and outside a garage having the automatic controls described in the preceding figures;

Figure 21 is a modification, in plan view, of alternative motor-operated means to open or close a pair of garage doors.

Referring more particularly to the illustrative embodiment of this invention shown in the drawings, Figure 1 presents a pair of garage doors 1 combined with a pair of inner and outer switch control members 2 and 3 for contact by a car, and distributing switch actuating element 48 and reversing switch operating elements 22, 23, and 24 carried by one of the doors.

The reversing switch operating elements 22, 23 and 24 function to operate the reversing switch 61 mounted on the door jamb 63, Figure 1, the mechanism of which reversing switch is more clearly illustrated in Figures 7 to 10 and will be described more fully in connection with those figures. The distributing switch 62, operated by the actuating element 48, is also mounted on the door jamb 63, Figure 1. It will be described more fully in connection with the description of Figures 7 to 10. The distributing switch 62 and reversing switch 61 are in circuit with the motor M through the operating switches 2 and 3.

As illustrated in Figure 1, the motor drives the worms 8 on the shaft 9 through the reduction gear train 7, Figures 1 and 2. The worms 8 drive the worm gear segments 10, one for each door, in opposite directions to swing the doors 1 towards or away from each other, as illustrated in Figure 2, to close or open the door. Thus as worm gears 8 are rotated, the doors swing open or closed. It will be seen from Figure 21 that in lieu of this gear and hinged door arrangement, the present invention is applicable as well to a pulley type drive.

Figures 3, 4 and 5 show details of reversing switch trips 2 and 3 to be actuated by a car. For these trips 2 and 3 a single description will suffice.

In Figure 3 is shown a trip bar 2 having generally the form of an inverted U and mounted horizontally at the ground level to rock in supports. At one side the trip arm 2 is extended as a horizontal shaft 11 through a switch box 12 partly buried in the ground. Mounted loosely upon shaft 11 near one face of the switch box 12 is a bi-polar switch arm 13 bearing conducting terminals 14 and 15. These are rotated vertically into contact with one or the other of a pair of conductor clips 14' and 15' which are parts of the control circuit more fully to be described hereinafter. Also, within switch box 12 but keyed to shaft 11 is a vertically disposed disk 16 through which penetrates a horizontal pin 17 positioned to swing with U-shaped trip arm 2 through an arc of about 90° each side of normal vertical position and at one extreme or the other to depress conductor terminal 14 or opposite terminal 15 into engagement with corresponding conductor clip 14' or 15'.

To hold switch arm 13 in dependable contact in its closed position, each end of the switch arm, as shown in Figure 6, carries protuberance 18 which when depressed engages a corresponding depression 18' in the insulated wall of the switch box 12. Such firm engagement is assured by a coil spring 19 which encircles shaft 11 between disk 17 and switch arm 13 so as to push switch 13 firmly against the wall of box 12. Once an end of switch 13 is depressed, that end remains in contact with its engaging conductor clip until an oppositely moving vehicle depresses the opposite end. Meanwhile, the depressed pin 17 returns to a neutral position under the influence of a pair of horizontal coil springs 20 and 20' mounted in opposition to each other at the top of the trip arm 2. Cooperating switch mechanism actuated by the door is illustrated in general arrangement in Figure 1 and in greater detail in Figures 7, 8, 9 and 10.

The switch arm 13, in Figure 4, is the one outside the garage door, operated by the actuating trip 2. It differs from the switch arm 13', illustrated in Figure 5, the switch arm 13' being located inside the garage door under operation of the trip arm 3. The switch arm 13' comprises the terminal contacts 14'', 15'' connected electrically by the conductor 64 which is insulated from the pivot shaft 11' of the trip arm 3 by means of the bar of insulating material 65'. The terminal contacts 14 and 15 of the switch arm 13, Figure 4, are insulated from each other, and from the pivot shaft 11 by means of the insulation bar 65.

Figure 7 shows a vertical section through door 1 from which projects inwardly a vertical series of switch operating elements designated as 22, 23, 24 and 48. Figures 7 and 8 show the projecting arm 22 swivelly attached to door 1 and terminating inwardly in a guide ring 25. A coil spring 26 therethrough is secured at its bottom to the door frame and at its upper end to one end of a vertically disposed switch arm 27. Switch arm 27 is pivoted about a center above the lower end of coil spring 26 for rotation in a vertical plane to snap selectively to one side and then the other. This is effective by movement of door 1 to pull or to push the horizontal rod 22 and springs 26. Switch arm 27 bridges either one pair or the other of two double contacts in the electric motor circuit more fully to be described hereinafter. This bridging of selected circuits utilizes a pair of conducting bridge arms 28 and 29 fastened to the switch arm 27 at opposite sides of its center of rotation. Two pairs of cooperating conducting bars 30, 31, 32 and 33 are arranged as in Figure 7, generally in the form of a disjointed square, and are contacted in pairs respectively by the contact arms 28 and 29, different pairs of contacts being made by the respective two positions of the switch arm 27. By this means door 1 at open or closed position distributes control of the motor circuit. This distribution is more fully shown in Figures 11, 12, 13 and 14, and is more fully discussed hereinafter.

Switch arm 27 is held in its respective two positions by the latches 34 and 41.

The latch 34 retains switch arm 27 in the position shown in Figure 7, while the door 1 is closed and during the opening of the door until it has reached its extreme open position. The latch 34, Figure 9, pivots in bracket 66, which is attached to the housing 67 of the reversing switch 61, the housing being attached to the door jamb 63. The coil spring 39 operates, as most clearly illustrated in Figure 9, to hold the shoulder 40 of the latch 34 in engagement with the arm 27. Latch 34 comprises one arm of a bell crank lever, the other arm 35 of which is provided with an eye 69 which receives the draw pin 23. The draw pin 23 pivots on a bracket 68 attached to the door 1, and terminates with an abutment head 38. The length of the draw pin 23 is such that it slides freely in the eye in the

arm 35 while the door is opening and swinging away from the jamb 63. The abutment head 38 is so positioned that when the door attains its fully opened position it engages the arm 35 and actuates the bell crank lever 34, 35 against the tension of the spring 39 to release the shoulder 40 from the switch arm 27. The arm 35 is free to swing into the slotted opening 70 in the housing 67 under action of the abutment head 38.

While the door opens, the draw pin 22, the eye 25 of which encircles the spring 26, acts to deflect the spring 26 from the straight line position illustrated in Figure 7. When the door reaches fully opened position, the eye 25 has passed the pivot pin 71 of the switch arm 27. The spring 26 is thus in position to actuate the switch arm 27 in the counterclockwise direction in Figure 7 when the door is opened, and it does so upon the abutment member 38 actuating the arm 35 to release the latch shoulder 40 from the switch arm 27. By this means the switch arm is snapped to break the contacts of the bridge arms 28, 29, Figure 7, and to close new contacts. When the switch arm 27 is in the position of Figure 7, the bridge arm 28 closes contact between conducting bars 31 and 32; and bridge arm 29 closes contact between conducting bars 30 and 33. When the door attains its fully opened position, and the switch arm 27 is snapped in the counterclockwise direction, Figure 7, the circuit through conducting bars 31, 32 and conducting bars 30 and 33 is broken, and new circuits are closed between conducting bars 32, 33 by bridge arm 28, and between conducting bars 30 and 31 by bridge arm 29.

When the door approaches fully opened position the distributing switch 62, Figures 7, and 11 to 14, is actuated. The draw pin 48 is pivoted in a bracket 72 attached to the door 1, and passes throuhg an eye 73 in the arm 46 terminating with the shoulder 47 which is positioned to engage the arm 46 immediately before the door attains its fully opened position. Disposed at an angle to the arm 46 is the longitudinally movable contact supporting arm 74 which carries the jumper bar 75 which closes contact selectively between the terminals B, C and the terminals B, A, Figure 7. Thus, as the door attains fully opened position contact through terminals B, C has been broken and contact through terminals A, B is closed.

In addition when the switch arm 27 snaps in the counterclockwise direction in Figure 7 it assumes latching engagement with the latch 41. The latch 41, Figure 10, is mounted to pivot in a pivot bracket 76 fixed to the door jamb 63, and comprises the bell crank lever 41, 44. The bell crank lever 41, 44 is spring actuated by the coil spring 43 to urge the lever in latching position, the shoulders 42, Figure 10, engaging the switch arm 27 in its extreme counterclockwise position while the door is open and while the door is closing until it attains fully closed position. Attached to the door 1 is the abutment member 24, Figure 10, which projects through the opening 45 in the reversing switch housing 67 when the door approaches fully closed position. Abutment 24 engages the arm 44 of the bell crank lever 41, 44 to swing the lever in the clockwise direction in Figure 10, against the tension of the spring 43.

While the door is closing the rod 22 with the eye 25 encircling the spring 26, operates to deflect the spring 26 from its straight line position, and to extend its tensioning terminus to the right of the pivot pin 71 of switch arm 27. In this position the spring 26 tends to rotate the switch arm 27 in the clockwise direction in Figure 7. Immediately upon the release of the switch arm 27 by the latch shoulder 42, resulting from the abutment member 24 actuating the lever arm 44, the spring 26 is enabled to snap the switch arm 27 in the clockwise direction. This breaks contact of the contact arm 28 across the terminals 32, 33 and contact of the contact arm 29 across the terminals 30, 31; and closes new contacts of the contact arm 28 across the terminals 30, 33. The reversing switch has thus reverted to its position illustrated in Figure 7.

As the door 1 is closing, and immediately before the door attains its fully closed position, it actuates the arm 46 to switch the jumper bar 75 from contact across the terminals A, B, to contact across the terminals B, C. The arm 34 is cam shaped for yieldable engagement when switch 27 snaps into latched position in a recess 40 of the arm 34. This latching occurs as the door is fully closed and is retained until at the extreme open position of door 1, latch release arm 38 functions for quick release of switch arm 27.

Reversing switch arm 27 is latched also when its upper end has been snapped toward the door at the extreme open position of the door. This latching is accomplished by a cam-faced arm 41 containing a recess 42 similarly to the lower latch arm and mounted to swing by spring 43 about a vertical pintle, as shown in Figure 10.

A bell-crank arm 44 integral with the latch arm 41 extends horizontally past an opening 45 in the frame. This arm 44 may be pushed by a pin 24 mounted on the door 1 to project through the opening 45 and swing the latch arms 44, 41 against the force of spring 43 to unlatched position. As will be seen from Figure 10, this unlatching occurs when door 1 reaches its innermost closing position. When the door is closed, the openings through which the several latch release arms extend from the door are covered and protected by the door itself.

Attached also to the door frame similarly to snap switch 27 and its latches 34 and 41 is a sliding distribution switch 46 comprising three terminals designated A, B, C with an actuating arm 48 pivotally mounted on the door, as shown in Figure 7. The three terminals A, B, C are aligned to be contacted successively by contact plate 46 as the door closes or opens. Plate 46 contact face is sufficiently long to bridge the middle terminal B simultaneously with either extreme terminal C or A. When the door is wide open, the terminals A, B are joined. Horizontal control arm 48 at its inner extremity contains an upwardly extending burr 47 to pull plate 46 but at its outer extremity is turned upwardly to swivel on door 1 and as the door closes to push contact arm 48 inwardly. When the door is at its closed position, the contacts B, C are closed.

The electrical connections involved in these distributing and reversing switches in cooperation with the vehicle tripped arms 2 and 3 are shown diagrammatically in Figures 11, 12, 13 and 14.

Figure 11 shows the circuit when the door is closed preparatory to the approach of a vehicle from the outside. It shows the motor M in circuit with the reversing switch 61, the switch arm 27 being turned in its clockwise position, which

is the position it occupies in Figure 7. Contact is closed across the terminals 31, 32 and the terminals 30, 33. The distributing switch 62 connects with the line through terminals B, C. The arm 13 of the vehicle actuated switch 2 being insulated between its end terminals, as illustrated in Figures 4 and 11, and the motor circuit being open at terminal 2', the motor M is inoperative. As the vehicle approaches the door of the garage and deflects the switch 2 into dotted line position in Figure 11, the line circuit through the distributing switch contacts B, C is closed through terminals 2', 3' and through the motor M. The motor M now operates in the direction to open the door. Immediately before the door attains fully opened position the distributing switch 62 opens contact across terminals B, C and closes contact across terminals A, B. This breaks the motor circuit, but the motor and the door override until the door attains fully opened position at which time the switch arm 27 is snapped in the counterclockwise direction, as described, in connection with the latching mechanism 34 illustrated in Figure 9.

The several switches and contact members are now in the position illustrated in Figure 12. The door is open and ready for the vehicle to pass through and beyond it. In this position the circuit through contacts A, B, it will be noted, is broken at the switch 3. As the vehicle advances through the door it deflects the switch arm 13' of switch 3 into the dotted line position of Figure 12, and contact is closed through the terminal 3''. This closes the motor circuit with the reversing switch 61 in position to drive the motor in the reverse direction. The motor M, therefore, operates to close the door, and as it approaches complete closed position it operates to break contact across the terminals A, B and to close contact across the terminals B, C. This functions to open the motor circuit at the terminal 3' of the switch 3, the circuit through 3'' being open at the distributing switch 62. The motor M overrides until the door attains fully closed position at which time, by means of the latching mechanism 24, 41, illustrated in Figure 10, the reversing switch is enabled to snap back in the clockwise direction to reverse circuit of the motor. The motor circuit is now open at the distributing switch 62 and the reversing switch 61 is in position to operate the motor M to open the door when the motor circuit is closed at terminal 3'.

The various switches and contacts are now in the position illustrated in Figure 13, and it will be noted that the switch 2 is rendered completely ineffectual because of the condition of the distributing switch 62, as illustrated in Figure 13. If the switch arm 13 were to be actuated to close contact across the terminal 2'' this would not close the motor circuit because of the insulation 65, illustrated in Figure 4.

The parts are now in position for the door to be opened when it is desired to move a vehicle through the door from inside to outside the garage. As the vehicle advances from the inside of the garage toward the door, the switch arm 13' is deflected to close contact across the terminal 3' and to close the motor circuit now set by the reversing switch 61 to drive the motor M in the direction to open the door. As the door approaches fully opened position it operates the distributing switch to break contact across terminals B, C, and to close contact across terminals A, B. The motor circuit is now open at the terminal 3'', which is in circuit with the contact C, and this takes place immediately before the door attains fully opened position. The motor and door override and the door continues to open to fully opened position at which time the latch mechanism 23, 24, Figure 9, again operates to release the reversing switch arm 27 to be thrown in the counterclockwise direction in Figure 13. The door is now open ready for the vehicle to advance through and beyond it out of the garage.

The several switches and contacts are now in the positions illustrated in Figure 14. As the motor vehicle advances out of the garage it trips the switch 2 to close the circuit across terminal 2'' and through the terminal 3' into the motor M. The reversing switch 61 is set to drive the motor M in the direction to close the door, and immediately before attaining fully closed position the door operates to open contact across the terminals A, B and to close contact across the terminals B, C. This opens the motor circuit across the terminal 2', but the motor and door override, and the door continues to close until it attains fully closed position. The latch mechanism, 24, 41, of Figure 10, thereupon operates to release the reversing switch arm 27 to snap in the clockwise direction in Figure 14 and to assume the position illustrated in Figure 7. The several switches and contacts have now reassumed the positions illustrated in Figure 11 and the cycle has been completed.

It will be noted that the distributing switch 62 is enclosed in the housing 77 separate and apart from the housing 67 for the reversing switch 61. This enables independent adjustment of the distributing switch relative to the door 1 which will not effect the position of adjustment of the reversing switch 61. The motor circuit is broken by the distributing switch 62 before the reversing switch operates, each time the motor circuit is reversed, and this eliminates all arcing in the reversing switch 61. The mounting of the distributing switch 62 and of the reversing switch 61 in the respective housings 77 and 67 on the door jamb 63 inside of the garage door places them in position where they are not apt to be tampered with.

It will be observed that the distribution switch ABC is placed in the line separately from the reversing switch 27. This permits simple adjustment by adjustment of the length of actuating arm 46 to alter the contacts ABC at such time with respect to the operation of reversing switch 27 as to place the minimum of arcing in the entire circuit. Further, it will be observed that the various actuating arms 48 and 22, 23 and 24 are carried horizontally by the door. They thus are supported in position during the entire cycle of use. Moreover, the latches 34 and 41 serve to assure positive operation of the reversing switch 27. Further, the described positioning of the various horizontal actuating arms carried by the door assures that these arms are substantially sealed against inadvertent use when the door is closed and provides means for placing these operating elements within a garage.

Figures 15 and 16 show means connected to the trip switch 3 for manual operation thereof to open the garage door from inside. This comprises a pulley 50 connected by element 51 about the disk 16 of the trip switch. In this arrange-

ment extensions from terminals ABC may be operatively connected to manually operated disk 50 for correlation with trip switch disk 16, as shown in Figures 16, 17, 18 and 19.

Figure 20 shows an extension from manually operated trip disk 16 to a companion trip disk 16' placed outside the garage so that the door may be operated manually also from outside.

In accordance with the patent statutes, I have fully described and illustrated the best means now contemplated for operation of this invention. However, within the terms of the appended claims modifications will now occur to those skilled in this art.

What I claim is:

An automatic door operating device comprising, a motor operable reversibly to respectively open and close the door, a reversing switch for the motor, operating switches on opposite sides of the door, a distributing switch, each operating switch comprising two-way throw contacts disposed in opposite directions towards and away from the door, the contacts of the several switches disposed in opposite directions respectively toward and away from each other being in common circuit with the reversing switch, the distributing switch comprising two-way throw contacts for opening the operating switch simultaneously with closing the reverse circuit through the open contact of the other operating switch, the reversing switch comprising a switch arm positionable alternatively to two positions for closing the respective circuits of the motor, a reversing switch arm actuating spring, means operable by the respective opening and closing of the door to position the spring to throw the arm for reversing the operation of the motor, means for holding the arm against actuation by the spring, means responsive to the door approaching either fully opened or closed position to operate the distributing switch to open the operating circuit of one operating switch and to close contact through the inoperative circuit of the other operating switch, and means operable responsive to the door attaining either fully opened or closed position to release the holding means for the reversing switch arm actuating spring to operate the throw of the arm.

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