DOOR OPERATOR

Filed Jan. 3, 1957 4 Sheets-Sheet 1

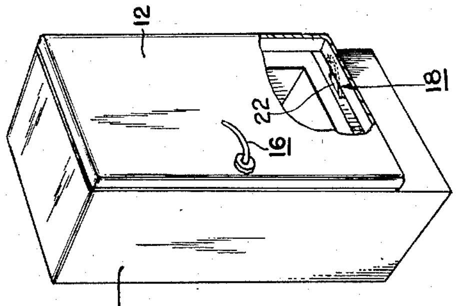

FIG.1.

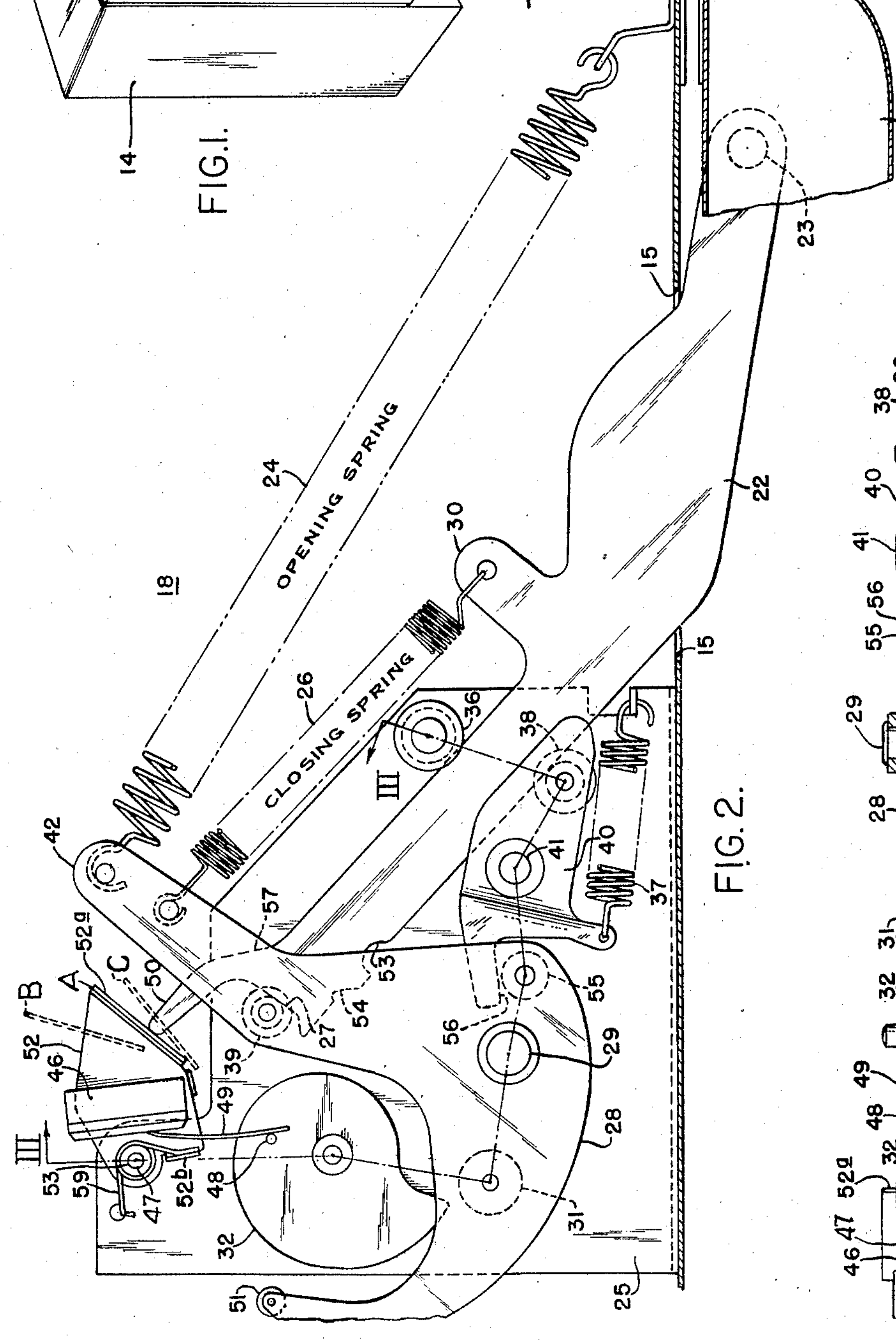

FIG.2.

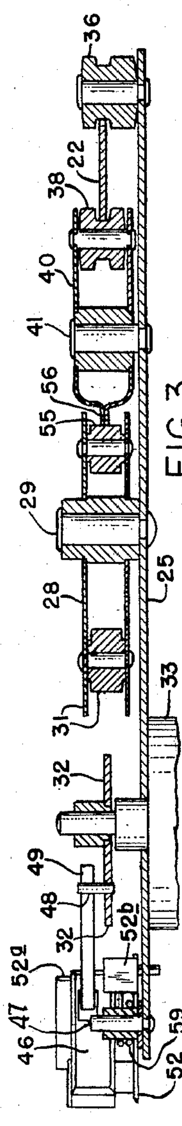

FIG.3.

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DOOR OPERATOR

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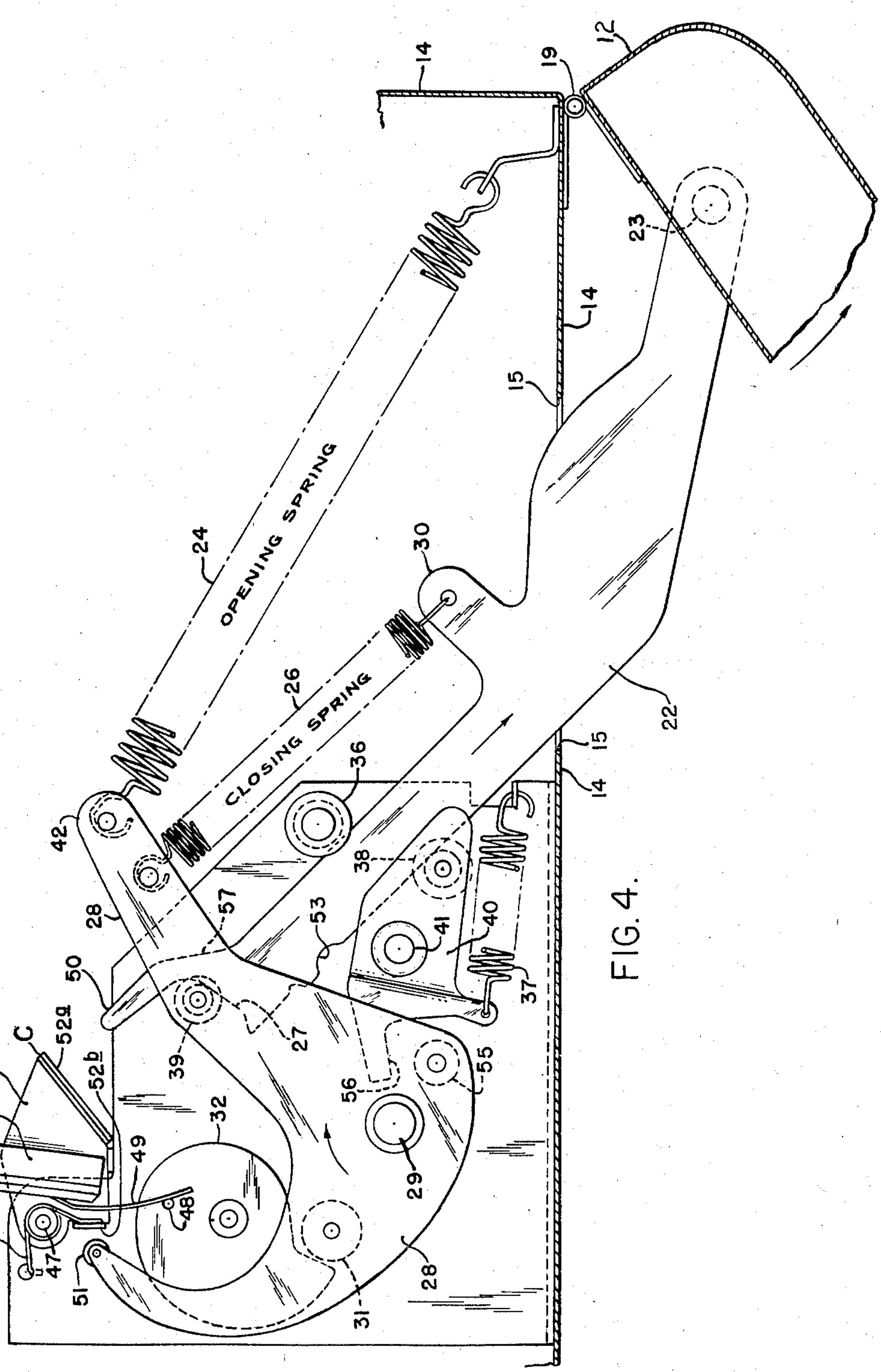

FIG. 4.

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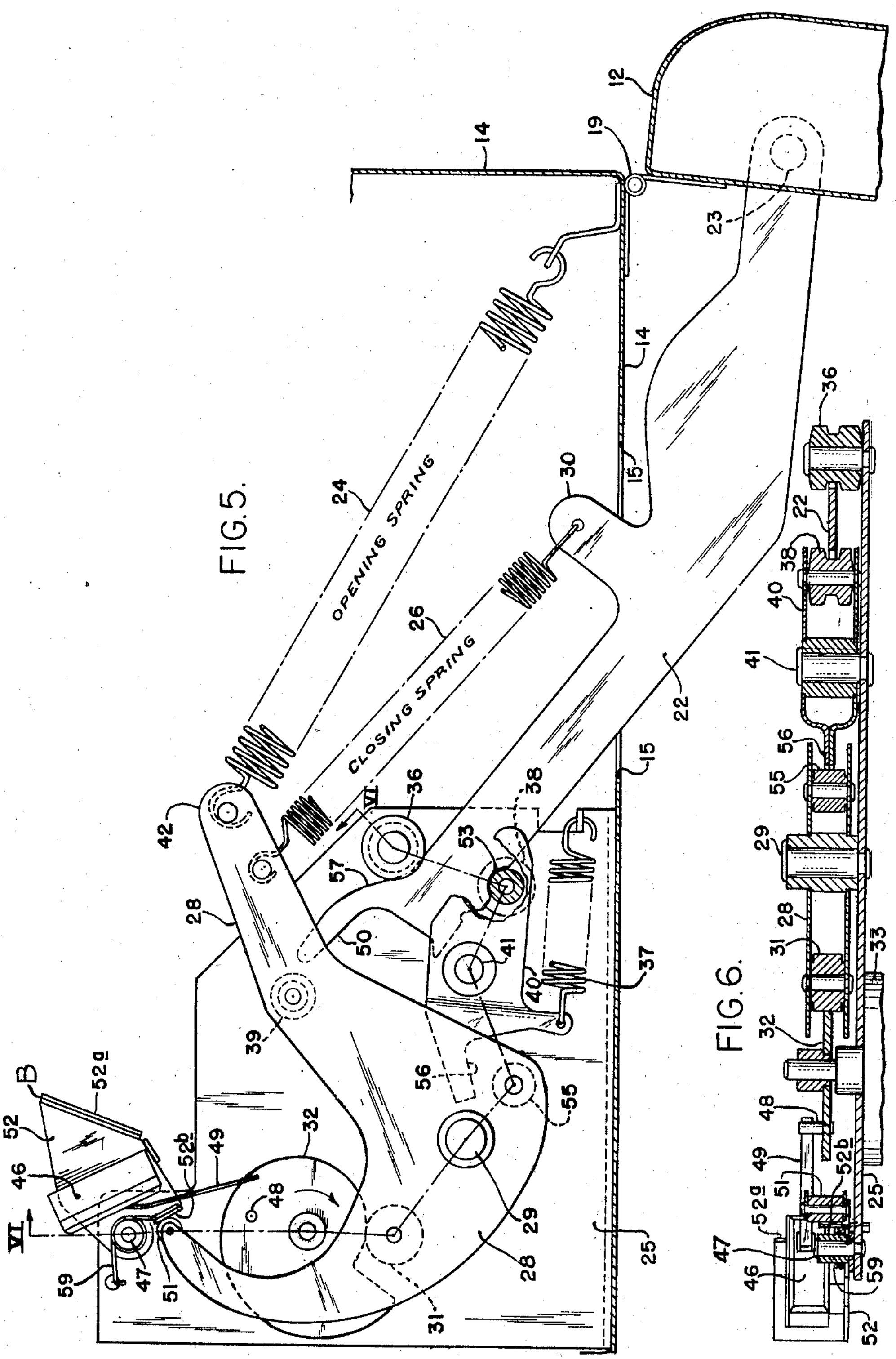
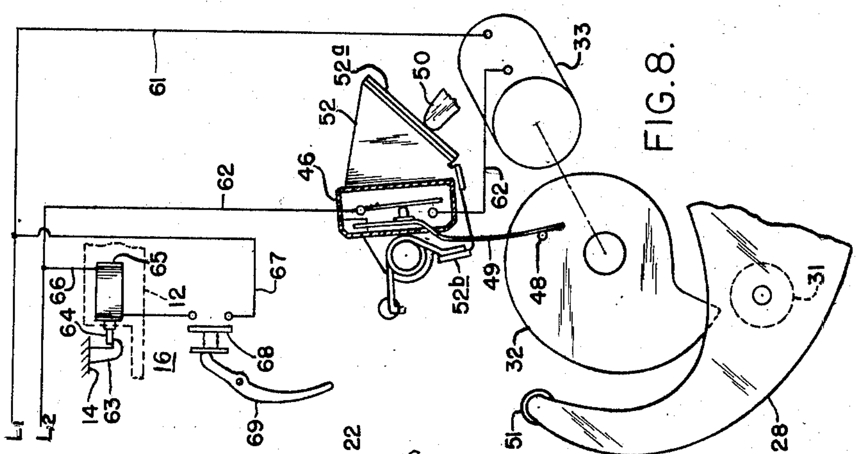


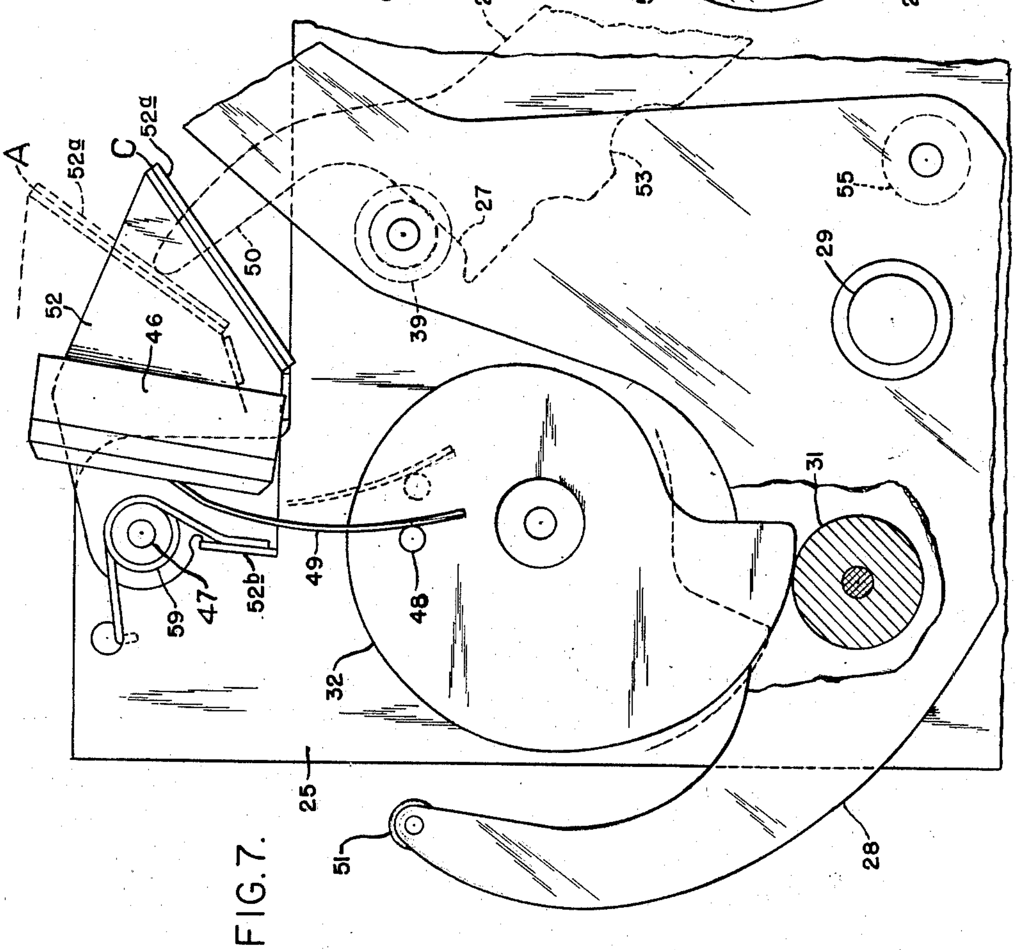
FIG. 5.

FIG. 6.



61
33
52a
50
52
46
62
62
65
66
64
12
67
16
14
63
68
69
49
52b
48
32
31
51
28
L1
L2

FIG. 8.



A
C
52a
52a
52
46
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53
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52b
31
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FIG. 7.

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DOOR OPERATOR

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Application January 3, 1957, Serial No. 632,340

8 Claims. (Cl. 268—65)

This invention relates to apparatus for automatically opening and closing doors and in particular to a device which will open, hold open and close the door and which requires a minimum amount of effort by the operator.

It is an object of the present invention to provide an automatic device to open a door, hold the door open for a predetermined period of time, and to automatically close the door.

It is a further object of the invention to provide an automatic door opening and closing mechanism which may be easily actuated by the operator.

In many instances where an automatic door opening and closing mechanism is used it may be desirable to interrupt the normal cycle or to prolong or curtail the open period. Therefore, it is a further object of this invention to provide an automatic door operating device, the normal opening and closing cycle of which may be interrupted by the operator without damage to the operating mechanism.

Another object is to provide an automatic door opening and closing mechanism which, after the normal operating cycle has been interrupted, may be easily restored to the initial position for automatic operation.

In the automatic door opening and closing mechanism of this invention, a pair of springs are employed to store energy and impart opening and closing movement to the door. A first or opening spring is adapted to be maintained in stressed condition while the door is closed, and upon the door becoming unlatched, the energy stored in this opening spring is transmitted through a linkage mechanism to the door, moving the door to its open position. The second or closing spring is arranged in such a manner as to bias the door toward its closed position and is partially stressed as the door is moved to its open position under the action of the opening spring.

This invention also contemplates the use of a source of motive power, such as an electric motor, which is adapted to be energized when the door is in its open position to act on the linkage mechanism to stress both the opening and closing springs; in other words, the electric motor provides energy which is stored in the closing spring and subsequently dissipated when the door is permitted to close, and also provides energy which is stored in the opening spring for subsequent use in the next door opening operation. Suitable control circuits are provided for energizing and deenergizing the electric motor to store energy in the springs during periods when the door is open.

A further feature of the invention is the employment of the electric motor as a timing means to release the door from its open position and permit it to close after the lapse of a predetermined period of time following opening of the door.

The foregoing and other objects are effected by the invention as will be apparent from the following description taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a view, in perspective, of a typical refrigerator cabinet showing schematically a door latch and a door operating mechanism, the latter being constructed in accordance with the present invention;

Fig. 2 is a plan view of the door operating mechanism when the door is in the closed position;

Fig. 3 is a sectional view, taken along the line III—III of Fig. 2, looking in the direction indicated by the arrows;

Fig. 4 is a plan view, similar to Fig. 2 but showing the door operating mechanism when the door is being opened and is intermediate the closed position and the open position;

Fig. 5 is a plan view, similar to Figs. 2 and 4, but showing the door operating mechanism when the door is in the open position;

Fig. 6 is a sectional view taken along line VI—VI of Fig. 5 looking in the direction indicated by the arrows;

Fig. 7 is a fragmentary plan view showing the position and operation of a portion of the mechanism as the door is being closed; and

Fig. 8 is a schematic wiring diagram of the apparatus.

Referring to the drawings and in particular to Fig. 1, there is illustrated a domestic refrigerator having a door **12** and a cabinet **14**. The door **12** is provided with a suitable latch **16** and a door operating device **18** which are shown only schematically in Fig. 1 and will be described subsequently. Generally, the door operating device **18** serves to open, maintain open and close the door **12** without any manual effort by the operator except to release the latch **16**, which may be either of the mechanical or magnetic type, both types being well known in the art and, therefore, not illustrated in detail. An embodiment of the present invention has been constructed to open the door in approximately two seconds, hold the door open for approximately eight to ten seconds, and then close the door in approximately three more seconds. As will become apparent as the detailed description proceeds, these time periods can be varied.

Referring to Figs. 2 and 3, there is shown in detail the door closing mechanism as it appears when the door has been in the closed position for a period of time. The mechanism **18** is preferably mounted within the cabinet **14** and, when applied to a refrigerator, can be located within the unrefrigerated machinery compartment in the lower portion of the cabinet. The door **12** is provided, on the right-hand side as viewed in Fig. 2, with a hinge **19** which is secured to the cabinet **14** for pivoting the door about a vertical axis. The door is connected to the operating mechanism by a suitable link **22**, hereinafter referred to as an actuating arm. The actuating arm **22** projects through an opening **15** in the front of the cabinet **14** and transmits to the door **12** the forces required for opening and closing the door. The actuating arm **22** is pivotally connected to a bottom panel **21** of the door **12** by a pin **23**.

The forces for opening and closing the door are provided, respectively, by a pair of springs **24** and **26**, which, in all positions of the device, are in tension. One end of each spring is connected to a J-shaped link **28**, hereinafter referred to as a pivot arm. The pivot arm **28** pivots about a pin **29** mounted on a stationary supporting plate **25** of the door actuating mechanism. The supporting plate **25** is secured to the cabinet **14** by any suitable fastening means (not shown). The opening spring **24** has one end attached to one end **42** of the pivot arm **28** and the other end to a portion of the cabinet **14** near the vertical axis of the hinge **19**. The closing spring **26** is also attached at one end to the pivot arm **28** adjacent the point of attachment for the opening spring **24**. The other end of the closing spring **26** is attached to a projection **30** extending from the actuating arm **22**.

When the door **12** is closed the actuating arm **22** is in its innermost position as shown in Fig. 2. The actuating arm **22** is positioned between a plurality of rollers **36** and **38** and has an end portion **27**, farthest removed from the pin **23**, in contact with a push roller **39** pivotally mounted on the pivot arm **28**. Roller **36** is carried by a fixed pivot pin on the supporting plate **25** and roller **38** is mounted on a plate member **40** pivotally mounted at **41** and biased against the actuating arm **22** by means of a spring **37** for a purpose which will hereinafter be described. The push roller **39** is preferably mounted on the pivot arm **28** in a position midway between pivot pin **29** and the end portion **42** to which the springs **24** and **26** are attached.

The pivot arm **28** is provided with a follower **31** which cooperates as hereinafter described with a cam **32**, driven by a motor **33**, for the purpose of storing the required energy in the closing and opening springs. In the closed position, (Fig. 2) the follower is displaced from the center of the cam a distance approximately equal to the maximum cam rise. The cam **32** is mounted on the shaft of motor **33** for clockwise rotation therewith as indicated by the arrow in Fig. 5. The cam **32** preferably possesses a single rise, spiral peripheral surface with the high and low portions of the cam surface joined by a radial peripheral portion. In the static door closed position shown in Fig. 2, the cam **32** rests in a position in which the low point of its peripheral surface is opposite the cam follower **31** on the pivot arm **28**. The follower **31** is out of contact with the cam **32** by virtue of the door **12** being closed and latched and the pivot arm **28** being held in the position shown by the actuating arm **22**.

The cam motor is controlled by a switch **46** of the normally closed type and which is mounted on a plate **52**. The plate **52** pivots about a pin **47** secured to the plate **25** and is biased clockwise by a spring **59**. In the door closed position, a finger portion **50** of the actuating arm **22** engages a bumper **52*a*** on the support plate **52**, holding plate **52** and switch **46** thereon against the bias of spring **59** in the position illustrated in Fig. 2, which is hereinafter identified as position A. In position A, a leaf **49** extending from the switch **46** is biased to the right by a pin **48** provided on the cam **32** in such a manner that the switch is open, and the motor **33** which drives the cam is deenergized.

When the door **12** is in the closed position, the pivot arm **28** occupies the extreme counterclockwise position of its range of movement about pivot pin **29**. In this position the opening spring **24** is stretched beyond its normal length, i.e., it is stressed and it applies a bias to pivot arm **28**, tending to rotate arm **28** clockwise. Consequently, in the closed position the push roller **39** attached to the pivot arm **28** is in contact with the end portion **27** of the actuating arm **22** and transmits the bias of spring **24** through the actuating arm **22** to the door **12**. A counterclockwise moment exists about the vertical axis of the hinge **19**, and the door will open when the latch **16** is released.

When it is desired to open the door **12** the operator releases the latch **16**. Since the door **12** has been under a force tending to open it, the door immediately starts to pivot about its hinge axis. Fig. 4 illustrates the position of the device when the door is in a position intermediate the fully closed and fully open position and shows the door while it is still being pushed by the action of the push roller **39** bearing against the end portion **27** of the actuating arm **22** and before it reaches its maximum velocity.

Upon release of the latch **16** and the movement outwardly of the actuating arm **22** so that the finger portion **50** thereof no longer contacts the switch support **52**, the latter rotates clockwise under the influence of the biasing spring **59**, until the switch support **52** assumes position C, shown in Fig. 4 and indicated by dotted lines in Fig. 2. The edge of support plate **25** acts as a stop for the switch support plate **52**. Just before the cam follower **31** contacts the cam **32** a roller projection **51** on the actuating arm **28** engages another bumper **52*b*** on support plate **52** and rotates the switch support plate counterclockwise about pin **53** to position B (shown in Fig. 5 and indicated by dotted lines in Fig. 2).

Pressure of the cam pin **48** on the switch leaf **49** is relieved and the switch closes, energizing the cam motor **33**. Thus, the cam **32** starts rotating while the door is moving from approximately its half open position to its fully open position.

When the cam follower **31** comes in contact with a portion of the cam **32** near the minimum diameter of the cam the door has reached a point of maximum velocity. The point of maximum velocity occurs at approximately the midpoint between fully open and fully closed positions and thereafter the door glides or decelerates to the fully open position.

Movement of the door **12** to the position shown in Fig. 5 (the fully open position) is due to the inertia of the door and results from the energy stored in the door **12** by the opening spring **24**. The latter portion of door opening movement is dampened by the closing spring **26** which is stressed or stretched slightly as the actuating arm **22** is pulled out of contact with the pivot arm roller **39**. It will be noted that, whereas the pivot arm **28** and the actuating arm **22** moved in the manner of a connected linkage assembly during the initial portion of the door opening movement when the pivot arm **28** was pushing against the actuating arm **22** through the roller **39**, during the latter portion of opening movement of the door **12**, motion of the actuating arm **22** becomes independent of the pivot arm **28** as movement of the pivot arm **28** is stopped by virtue of the pivot arm follower **31** contacting cam **32**. There is then, in effect, a lost motion connection between the actuating arm **22** and the pivoted arm **28** which allows the door **12** to swing out to its fully open position, separating the actuating arm **22** from the pivot arm **28** and partially stressing the closing spring **26** connected between the arm **22** and the arm **28**. The damping or braking action of the closing spring **26** on the door **12** brings the door **12** to a gentle halt in its fully open position.

Referring to Fig. 5, the door **12** is shown in its fully open position in which the actuating arm has been pulled outwardly by the door **12** until a holding notch **53** near the free end of the actuating arm **22** moves opposite the arm guide roller **38**. The roller **38**, being biased toward the actuating arm **22** by the spring **37**, moves into the holding notch **53** and acts as a detent to releasably lock the actuating arm **22** against further movement. The door **12** is thereby held in its open position.

In accordance with this invention, the motor **33**, cam **32**, and the pivot arm **28** driven thereby are employed as a timing mechanism to determine the period of time the door **12** is held in its open position before being automatically closed. As mentioned previously, the motor **33** is energized to impart clockwise rotation to the cam **32** upon the pivot arm **28** reaching its extreme clockwise position. As cam **32** rotates, it drives pivot arm **28** counterclockwise about pivot pin **29**, stressing or stretching both the opening spring **24** and the closing spring **26**. Stressing of closing spring **26** increasingly biases the actuating arm **22** inwardly of the cabinet. Movement of the actuating arm **22** in the direction to close the door **12** is, however, resisted by engagement of roller **38** in the holding notch **53** until near the end of the counterclockwise rotation of the pivot arm **28**, when a stop roller **55**, which is carried by the pivot arm **28**, comes in contact with a projection **56** on the hold-open plate **40**. The hold-open plate **40** is rotated clockwise until the roller **38** moves out of the notch **53** releasing the actuating arm **22**. The closing spring **26**, which was stretched to more than its normal length by movement of the pivot arm **28**, then pulls the actuating arm **22**, and, hence, the door **12** toward closed position.

Prior to the door 12 being returned to its fully closed position, the bias applied to pivot arm 28 by the springs 24 and 26 is opposed solely by virtue of follower 31 bearing on the cam 32. It is necessary that the pivot arm 28 be held in its extreme counterclockwise position until such time as the actuating arm 22 is moved inwardly and contacts the pivot arm roller 39 to hold the arm 28 in such position. Means are provided for stopping rotation of the cam 32 just prior to the position at which it would release the follower 31. Stated differently, the cam 32 is prevented from continuing its clockwise rotation to the point where the follower 31 would ride off the high point of the cam and allow the pivot arm 28 to slam around clockwise in an unrestrained manner under the action of springs 24 and 26.

This stopping of the rotation of cam 32 with its high point still adjacent the follower 31 is accomplished by means of the switch 46 controlling energization of the motor 33 and illustrated in Fig. 7 of the drawings. The full line showing of the elements of the mechanism depicts the positions of these elements just as the motor driving cam 32 is deenergized and while the door is still open. It will be noted that the pivoted switch support 52 is biased to its extreme clockwise position (position C). This locates the switch blade 49 in a position to be engaged by the cam pin 48 to open the switch 46 when the cam 32 reaches the full line position shown in Fig. 7.

As the door 12 closes, the finger portion 50 of the actuating arm 22 comes in contact with the bumper 52*a* of the switch support 52 and rotates the switch counterclockwise, to position A. This is shown in dotted lines in Fig. 7. In this manner the leaf 49 is moved away from or out of the way of the pin 48 and the switch is again closed. Thereupon, the cam 32 rotates and the cam follower 31 moves off the high part of the cam and assumes a position opposite the low part of the cam so that it is ready for the next opening. Simultaneously with the switch closing, the door latch 16 secures the door 12 in the closed position. The cam motor 33 is then deenergized, by the cam pin 48 contacting the switch blade 49 (see dotted line positions), after the cam 32 has rotated through the small angle necessary to clear follower 31.

An electrical wiring diagram for the automatic door opener and closer of this invention is shown in Fig. 8 of the drawings. In this figure, portions of the operating mechanism are illustrated in diagrammatic fashion and the reference numerals applied thereto are the same as those previously used in the detailed description of the mechanism. Electrical energy is supplied to the drive motor 33 from a pair of supply lines identified as L1 and L2 by means of one line 61 connected directly to the motor 33 and another line 62 connected to the motor 33 through the switch 46 previously described. Switch 46 is normally closed and is actuated to its open position by switch blade 49 when engaged by cam pin 48. Supply lines L1 and L2 also supply current for the actuation of the latch mechanism 16 which is shown schematically in Fig. 8 as a simple solenoid actuated device. The latch 16 consists of a strike 63 carried by the cabinet 14 in a position to be engaged by a bolt 64 carried by the door 12. The bolt 64 is retracted from the strike 63 to unlatch the door 12 from the cabinet 14 by means of a solenoid 65. Electric current from supply lines L1 and L2 is supplied to the solenoid 65 by means of lines 66 and 67, the line 67 being wired through a normally open switch 68 adapted to be closed by a handle 69 for the latch mechanism.

In operating the latch 16 the operator pulls on the handle 69, closing the switch 68 and energizing the solenoid 65 which retracts the bolt 64. It will be obvious to those skilled in the art that the handle 69 and the switch 68 may be replaced by a push button (not illustrated) located either on the cabniet 14, the door 12 or a remote location. The door 12 is thus released from the cabinet 14 and permits the door to swing open under the bias of the opening spring 24. Thereafter the automatic opening and closing mechanism commences to operate in the manner previously described with energization of the motor 33 being controlled by the switch 46.

The automatic door opening and closing mechanism of this invention is so constructed that either or both the door opening movement and the door closing movement of the door 12 may be manually accelerated by the operator or the door may be closed prior to the end of the automatically timed open period without injury to the drive mechanism. If the operator, upon releasing the latch 16, accelerates the door opening movement by manually pulling on the door 12, the mechanism will function normally with the opening spring 24 causing the pivot arm 28 to follow the actuating arm 22 as it moves out of the cabinet 14. With an extreme manual door opening movement, the door is prevented from opening too far by the arm 22 butting a portion of the cabinet 14 adjacent the opening 15 through which the arm 22 extends. The remainder of the mechanism functions normally to rotate the pivot arm 28 in the direction to stress the opening spring 24 and closing spring 26 for subsequent automatic operation. If, during the course of an automatic closing movement of the door, the door is manually pushed toward its closed position, the actuating arm 22 will merely slide between its guide rollers 36 and 38 until it engages the push roller 39 on the pivot arm 28. The door 12 may also be manually closed prior to the time that it would otherwise automatically close. If the motor driven cam 32 has not returned the pivot arm 28 to its extreme clockwise position, a manual closing force applied to the door 12 is transmitted through the actuating arm 22, causing the pivot arm 28 to override, so to speak, the cam 32, and movement of the pivot arm 28 to its extreme counterclockwise position is accelerated. With the door 12 thus manually closed and latched the cam 32 will continue to be driven without load until it reaches the position shown in Fig. 2, where its drive motor 33 becomes deenergized.

If it is desired to keep the door open for a greater period of time than provided by the revolution of the cam 52, it is only necessary to manually move the door beyond the fully open position shown in Fig. 5 a distance sufficient to cause roller 38 to ride out of holding notch 53 and engage a second notch 54. This additional movement of the actuating arm 22 brings an offset portion 57 of the actuating arm 22 into contact with the guide roller 36, shifting this end of the arm 22 in the direction of roller 38 and causing the spring biased plate assembly 40 to rotate clockwise sufficiently to clear the projection 56 from the path of the release roll 55 on the pivot arm 28. Arm 22 will remain in this position, even though pivot arm 28 is driven to its counterclockwise stopped position (full line position of Fig. 7), until the door 12 is manually nudged toward its closed position to move roller 38 out of notch 54.

It should be apparent that the period of time required for a complete door opening, hold open, and door closing cycle of the mechanism of this invention is determined by a number of factors which, for any given application, may be adjusted to provide a predetermined door open period. These factors are: (*a*) the period of time required for the opening spring 24 to move the pivot arm 28 to its extreme clockwise position. This time period is determined by the strength of the spring 24 with respect to the inertia mass of the door 12; (*b*) the time period required for the cam 32 to make substantially a complete revolution to move the pivot arm 28 from its extreme clockwise position to its extreme counterclockwise position to release the roller 38; and (*c*) the strength of the closing spring 26 with respect to the inertia mass of the door 12, which factor determines the period of time required to actually close the door. By increasing the speed of rotation of motor 33, the time required for the cam 32 to make one revolution can be reduced and the period that the door is automatically held open can be decreased. Conversely, decreasing the speed of the motor 33 increases the period of time required for the cam 32 to make one revolution and the door open period can thus be increased. The mass of the door 12, for most applications, will remain substantially constant and changes in the rate at which the door is opened and closed may be adjusted by varying the strength of the opening and closing springs 24 and 26.

From the foregoing it will be apparent that this invention provides an improved mechanism for opening, holding open and closing entirely automatically, virtually any type door for which automatic actuation is desired.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. In an operating mechanism for a door that is movable between open and closed positions, a spring for opening said door, means restraining one end of said spring, means for connecting the other end of said spring to said door, said last-named means including a member mounted for movement between first and second positions, the other end of said spring being connected to said member whereby said spring is adapted to move said member from its first to its second position, and lost motion structure for transmitting movement of said member to said door to cause said door to move from its closed position to its open position when said member moves from its first position to its second position, said lost motion structure permitting mvement of said member from its second position to its first position independently of said door, motor means for returning said member from its second position to its first position and for holding said member in its first position, means actuated by said member upon reaching its second position for energizing said motor means to effect return of said member to its first position, means responsive to closing of said door for rendering said motor means ineffective to hold said member in its first position, whereby said member transmits the force of said spring to said door to bias said door toward its open position, and releasable latch means for holding said door closed against the bias of said spring.

2. In an operating mechanism for a door that is movable between open and closed positions, a releasable latch for holding said door in its closed position, a spring for opening said door, means restraining one end of said spring, means for connecting the other end of said spring to said door, said last-named means including a member mounted for movement between first and second positions, the other end of said spring being connected to said member whereby said spring is adapted to move said member from its first to its second position, and lost motion structure for transmitting movement of said member to said door to cause said door to move from its closed position to its open position when said member moves from its first position to its second position, said lost motion structure permitting movement of said member from its second position to its first position independently of said door, means including a source of motive power for returning said member from its second position to its first position and for holding said member in its first position, means actuated by said member upon reaching its second position for energizing said motive power means to effect return of said member to its first position, and means responsive to closing of said door for rendering said motive power means ineffective to hold said member in its first position, whereby said member transmits the force of said spring to said door to bias said door toward its open position while said door is held closed by said latch.

3. In an operating mechanism for a door that is movable between open and closed positions, a spring for opening said door, means restraining one end of said spring, means for transmitting the force of said spring to said door and including a member mounted for movement between said first and second positions, said spring having the other end thereof connected to said member whereby said spring biases said member toward its second position, and lost motion structure for transmitting movement of said member to said door to cause said door to move from its closed position to its open position when said member is moved from its first position to its second position under the action of said spring, said lost motion structure permitting movement of said member from its second position to its first position independently of said door, a motor, a cam driven by said motor and engageable with said member for moving said member from its second position to its first position, means actuated by said member upon reaching its second position for energizing said motor, means responsive to return of said member to its first position for deenergizing said motor with said cam in position to hold said member in its first position, and means responsive to closing of said door for energizing said motor to drive said cam out of engagement with said member to release said member and permit said spring to bias said door toward its open position.

4. In an operating mechanism for a door that is movable between open and closed positions, a latch for holding said door in its closed position, a spring for opening said door when said latch is released, means restraining one end of said spring, means for transmitting the force of said spring to said door and including a member mounted for movement between said first and second positions, said spring having the other end thereof connected to said member whereby said spring biases said member toward its second position, and lost motion structure for transmitting movement of said member to said door to cause said door to move from its closed position to its open position when said member is moved from its first position to its second position, said lost motion structure permitting movement of said member from its second position to its first position independently of said door, a motor, a cam driven by said motor and engageable with said member for moving said member from its second position to its first position, means actuated by said member upon reaching its second position for energizing said motor, means responsive to return of said member to its first position for deenergizing said motor with said cam in position to hold said member in its first position, and means responsive to closing of said door for energizing said motor to drive said cam out of engagement with said member to release said member and permit said spring to bias said door toward its open position.

5. In a mechanism for opening and closing a door, the combination of a member mounted for movement between first and second positions, a first spring for moving said member from its first position to its second position, motive means for moving said member from its second position to its first position against the action of said spring, means including lost motion structure for transmitting motion of said member to said door for causing said door to move from its closed position to its open position when said member is moved from its first position to its second position by said spring, said lost motion structure permitting movement of said member from its second position to its first position independently of movement of said door, means actuated by said member upon reaching its second position for initiating operation of said motive means to return said member to its first position, a second spring, and means connecting said second spring to said member and to said door whereby said second spring is stressed in a manner to bias said door toward its closed position when

said member is moved from its second position to its first position.

6. In a mechanism for opening and closing a door for a cabinet, the combination of a member mounted for movement between first and second positions, a first spring for moving said member from its first position to its second position, motive means for moving said member from its second position to its first position against the action of said spring, means including lost motion structure for transmitting motion of said member to said door for causing said door to move from its closed position to its open position when said member is moved from its first position to its second position by said spring, said lost motion structure permitting movement of said member from its second position to its first position independently of movement of said door, means actuated by said member upon reaching its second position for initiating operation of said motive means to return said member to its first position, a second spring, means connecting said second spring to said member and to said door whereby said second spring is stressed in a manner to bias said door toward its closed position when said member is moved from its second position to its first position, means for holding said door in its open position against the bias of said second spring, and means for rendering said holding means ineffective when said member is returned to its first position.

7. In an operating mechanism for a door movable between open and closed positions, an arm connected to said door for moving the door between its open and closed positions, a member mounted for reciprocating movement between first and second positions, said member being engageable with said arm while moving from its first position to its second position to effect movement of said door to its open position, a door opening spring having one end thereof connected to said member, means restraining the other end of said spring whereby said spring biases said member toward its second position for opening said door, a closing spring connected to said member and said arm and adapted to be stressed by movement of said member from its second position to

its first position when said door is in its open position, releasable means for holding said door in its open position against the bias of said closing spring, means functioning over a predetermined period of time for returning said member from its second position to its first position, and means for releasing said holding means when said member is returned to its first position.

8. In an operating mechanism for a door movable between open and closed positions, an arm connected to said door for moving the door between its open and closed positions, a member mounted for reciprocating movement between first and second positions, said member being engageable with said arm while moving from its first position to its second position to effect movement of said door to its open position, a door opening spring having one end thereof connected to said member, means restraining the other end of said spring whereby said spring biases said member toward its second position for opening said door, a closing spring connected to said member and said arm and adapted to be stressed by movement of said member from its second position to its first position when said door is in its open position, releasable means for holding said door in its open position against the bias of said closing spring, motor means for returning said member from its second position to its first position, means for activating said motor means when said member reaches its second position, and means for releasing said holding means when said member is returned to its first position.

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