

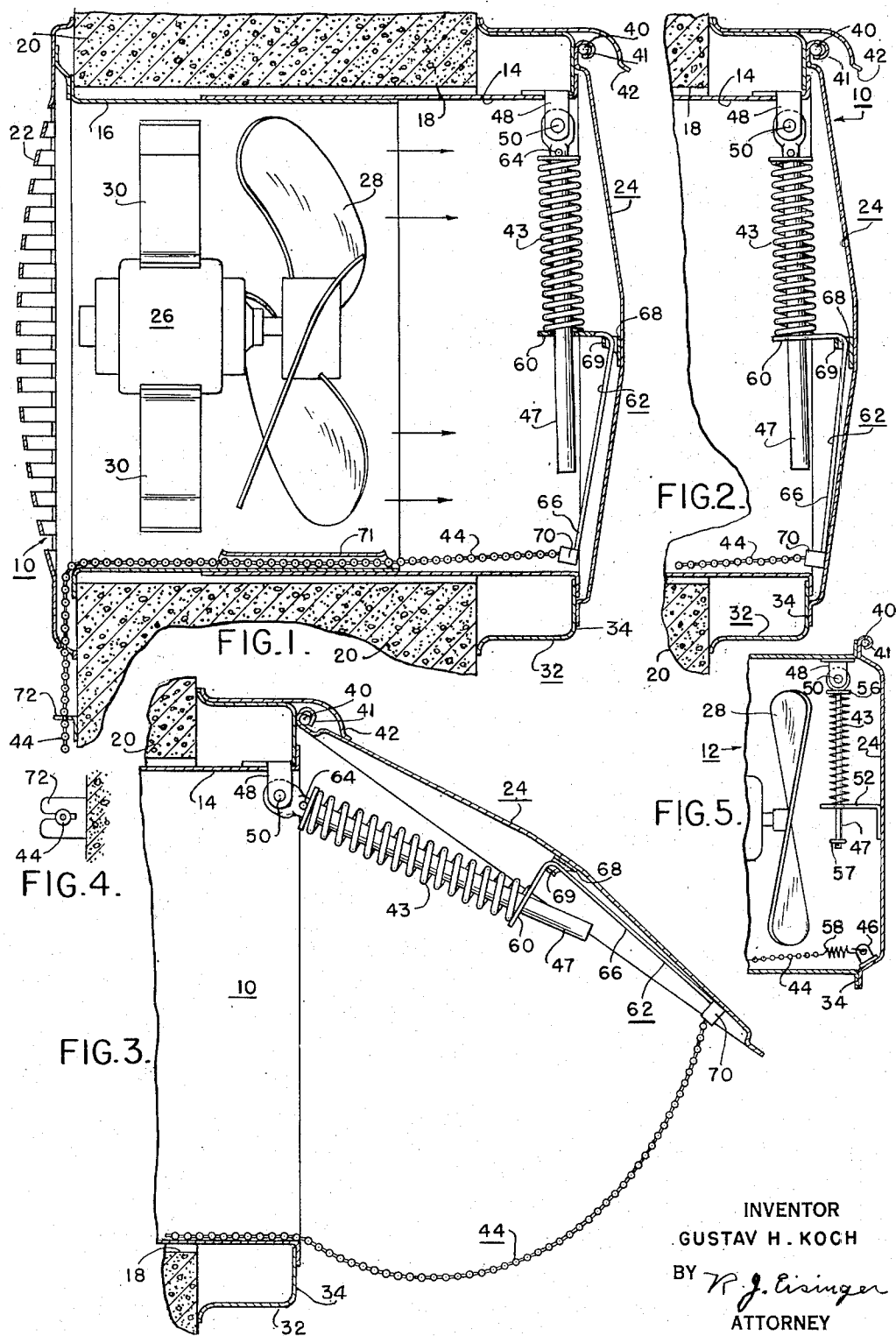
Aug. 27, 1957

G. H. KOCH

2,804,008

FAN APPARATUS

Filed Jan. 19, 1954



INVENTOR
GUSTAV H. KOCH
BY *R. J. Lisinger*
ATTORNEY

1

2,804,008

FAN APPARATUS

Gustav H. Koch, Springfield, Mass.

Application January 19, 1954, Serial No. 404,954

7 Claims. (Cl. 98—118)

This invention relates to a wall box fan, more particularly to the door operating mechanism thereof. Such a fan is commonly mounted in an opening in a wall of a building for exhausting air therefrom.

It is an object of the invention to provide an improved mechanism for retaining the door of a wall box fan in the closed position.

It is another object of the invention to provide a door operating mechanism which will minimize warping of a light gauge sheet material door when in the closed position, thereby causing the door to seal properly.

It is a further object to provide a door operating mechanism which will distribute evenly the forces acting on the door in closing direction when the door is in the closed position.

A more specific object is to provide a door operating mechanism in which the spring for biasing the door to the open position is further utilized to bias the door shut when it is in the closed position.

Still another object of the invention is to provide a door operating mechanism in which the spring for biasing the door to the open position is further utilized to provide a range of adjustment of the beaded chain when the door is in the closed position, so that the beaded chain may be pulled until one of its beads is engaged with a latch.

These 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 longitudinal section, taken on a vertical plane, of a wall box fan having a door operating mechanism in accordance with my invention, the door being shown in the closed and latched position;

Fig. 2 is a fragmentary view taken on the same plane as Fig. 1, the door being shown in the closed position and unlatched;

Fig. 3 is a fragmentary view similar to Fig. 2 but showing the door in the fully open position;

Fig. 4 is a fragmentary plan showing the latch for the pull chain; and

Fig. 5 is a fragmentary view, on a smaller scale, showing a prior arrangement of door operating mechanism.

Referring to Figs. 1, 2, and 3 in detail, there is shown a wall box fan 10 having my improved door operating mechanism incorporated therein. As best shown in Fig. 1, the wall box fan comprises the usual casing structure having an outer tubular sleeve 14 telescopically engaging an inner sleeve 16 to form an air duct. The sleeves 14 and 16 are fitted into an opening 18 provided in a building wall 20 and may be held therein in any desired manner (fastening not shown). The inlet opening in the sleeve 16 may be covered by a grill 22 adapted to engage the vertical surface of the wall 20, while the outlet opening in the sleeve 14 may be closed and opened by a movable door 24.

A motor 26 having a fan 28 mounted thereon is supported in a central position within the sleeve 16 by means of metal straps 30. As well understood in the art, the

2

fan 28 is operable when the door is in the open position to exhaust air through the duct formed by the casing, in the direction indicated by the arrows, from the interior of a building, for ventilation purposes. When the fan is not operating, it is desirable to close the outlet opening in the casing by means of the door 24, thereby preventing rain, dust, insects and other foreign matter from entering the building interior through the duct.

A flanged member 32 is attached to the outer sleeve 14 and serves to seal the annular gap between the sleeve 14 and the wall 20. The member 32 has a vertical face portion 34 adapted to be abutted by the door 20 in the closed position and is further provided with a hinge pin 40 for hingably supporting the door. The door 24 is made of relatively light sheet metal and has its upper edge portion rolled into a sleeve 41 in which the hinge pin 40 is received. A sheet metal shield 42 is attached to the upper portion of the flanged member 32 and extends outwardly beyond the hinge sleeve 41.

Heretofore, such a door has commonly been actuated by a door actuating mechanism similar to that shown in Fig. 5, in which the door 24 is biased to the open position by a spring 43. The door is movable to the closed position, against the action of the spring 43, by means of a pull chain 44 attached to a bracket 46 mounted on the door. Because of the location of the fan 28, the chain 44 and the bracket 46 are located adjacent the lower edge of the door, so that the pull exerted by the operator on the chain 44 is transmitted substantially only to the lower edge of the door, and is not effective to produce a seal along the upper edge of the door.

The spring 43 is received upon a guide pin 47 pivotally connected to a bracket 48, mounted on the sleeve 14, by a pivot pin 50 disposed parallel to and adjacent the door hinge pin 40 and slightly to the left and below the latter, so that the spring always biases the door in opening direction. The spring 43 is confined on the guide pin in compression between a washer 56 carried by the guide pin and a bracket 52 mounted on the central portion of the door 24. The guide pin 47 extends through an opening provided in the bracket 52 and is freely slidable therein.

The door operating mechanism shown in Fig. 5 operates in the following manner. The spring 43 exerts a downward force on the bracket 52, which force is effective to move the door to the right in opening direction when the pull chain 44 is released. Movement of the door to the right may be limited, in any suitable manner; for example, by a collar 57 mounted on the free end of the guide pin 47 and adapted to engage the bracket 52, or by the shield 42 of Figs. 1, 2 and 3.

To move the door to the closed position, the pull chain 44 is pulled to the left, exerting a force on the door in the vicinity of the bracket 46 against the force of the spring 43, which is thereby compressed, causing the door to move into engagement with the flange face 34, after which the pull chain 44 may be anchored upon a latch, such as the latch 72 shown in Fig. 4, which serves to engage one of the beads of the chain.

A small tension spring 58 may be provided between the chain 44 and the bracket 46 to permit anchoring the chain 44 in the proper position upon the latch for holding the door tightly closed. The spring 58 serves to bias the door to the closed position, even though there is some variation in the extent to which the pull chain is pulled in before latching, as well known in the art.

It will be noted that in this construction, when the door is in the closed position, the downward force of the spring 43 is effective at the center of the door as a force tending to move the door in opening direction, while the force of the pull chain 44 on the door is effective at the lower portion of the door as a horizontal force to the left which serves to hold the door in closed position,

3

Since the bracket 52 is rigidly mounted on the door in the center thereof, the spring force and the opposing force of the pull chain are transmitted through the lower part of the door and induce strains in this portion of the door. Since the door is made of light sheet metal, the induced strains in the door cause it to warp, so that a tight seal between the door 24 and the flange face 34 is difficult to maintain.

Most of the closing force is applied in the lower part of the door, so that in the upper part of the door little, if any, force is exerted on the door to maintain it in contact with the flange face 34. With such an arrangement, it is essential that the hinge sleeve 41 be snugly fitted to the hinge pin 40 to minimize side play therebetween, since the force in closing direction in this area is inadequate to take up looseness in the hinge. Should looseness between the hinge sleeve 41 and the hinge pin 40 develop in service or result from variations in the parts during manufacture, there is a tendency to create a gap between the door and the flange face 34 in the area adjacent the hinge.

In accordance with my invention, I provide a door operating mechanism as shown in Figs. 1, 2 and 3, wherein an L-shaped lever 62 is employed to transmit pull on the chain 44 to a central portion of the door, thereby distributing the closing force evenly around the periphery of the door. Thus, the hinge sleeve 41 need not be accurately fitted to the hinge pin 40, but may be loosely fitted therein without impairing the seal when the door is closed, as will subsequently be described. The spring 43 serves to bias the door in opening direction when the door is open and also to bias the door in closing direction when the door is closed.

The bias of the spring 43 is imposed on the L-shaped lever 62, which is pivotally mounted on a central portion of the door by a fulcrum member 68. The latter has a pivot portion 69 spaced slightly from the door and disposed parallel to the axes of the door hinge pin 40 and the pivot 50. The lever 62 includes an upper leg 60 which extends horizontally inwardly from the door and rests on the pivot portion 69 and a lower leg 66 which is inserted between the pivot portion 69 and the door and extends downwardly from the pivot portion. Thus, the L-shaped lever 62 pivots about the pivot portion 69. The spring 43 is disposed on the guide pin 47 and is confined in compression thereon between a pin 64 fixed to the guide pin 47 and the upper leg 60 of the L-shaped lever 62.

The pull chain 44 has one end attached to the lower leg 66 of the lever, the lever having a bent end portion 70 for attachment of the pull chain thereto. The pull chain 44 extends to the left along the lower portion of the sleeves 14 and 16, preferably through a guide tube 71 therein, and is then directed downwardly through an opening provided in the grill member 22. A slotted latch member 72, as shown in Figs. 1 and 4, is attached to the wall 20 below the grill for receiving and latching the pull chain in any desired position.

Operation

The compression spring 43 biases the lever leg 60 downwardly relative to the pivot portion 69, thereby applying a turning moment on the lever 62 which tends to rotate the same in counterclockwise direction as seen on the drawings. In all open positions of the door, this turning moment causes the lower end of the lower leg 66 to be biased into abutment with the door and the upper end thereof to be biased to the left or in door closing direction against the pivot 69.

In the full open position of the door shown in Fig. 3, the door is held in abutment against the shield 42 by the force of the spring 43 transmitted through the L-shaped lever 62, which now acts similarly to the rigid bracket 52 of Fig. 5. The chain 44 is in a slack position.

To move the door to closed position, the pull chain is

4

pulled to the left as shown on the drawing, with sufficient force to overcome the force of the spring 43. The lever 62 remains in the same position relative to the door, that is, with its lower leg 66 in abutment with the door, throughout the closing operation of the door from the full open position of Fig. 3 until the door strikes the face 34 as shown in Fig. 2. As the lower end of the lever leg 66 is pulled from the full open position, it is not separated from the door, because the door closing force imposed on the pivot portion 69, as well as the weight of the door, maintains the door in biased engagement with the lower end of the lever leg 66. However, after the door strikes the face 34, as shown in Fig. 2, further pull on the chain 44 separates the lever leg 66 from the door, whereupon the door closing force imposed on the door at the pivot portion 69 is no longer applied against the lower end of the lever leg 66 but is now applied and distributed to the periphery of the door to bias it against the face 34 of the member 32. The chain 44 is engaged with the latch member 72 after being pulled a sufficient distance to insure that, after latching, the leg 66 will still be separated from the door. The spring 43 is sufficiently resilient to be further compressed after the door is closed and to permit yielding movement of the lower end of the leg 66 greater than the spacing between the centers of adjacent heads. Thus, the spring provides a reasonable range or latitude in which the chain may be latched.

The forces acting on the door when the chain is latched to hold the door in the closed position shown in Fig. 1 will now be reviewed. The spring 43 exerts a downward force which is transmitted through the lever leg 60 and imposed on the pivot portion 69. Since the latter is disposed outwardly of the pivot pin 40, there is thus produced a small component of force tending to close the door. The force of the spring 43 on the lever leg 60 also tends to rotate the lever 62 counterclockwise about the pivot portion 69, thereby imposing a turning moment on the lever 62 tending to rotate the lever counterclockwise. Since the lower end of the lever leg 66 is held by the chain 44, this turning moment imposes a force to the left on the pivot portion 69, thereby imposing an additional closing force on the door. Since the pivot portion 69 is attached to the central portion of the door, the closing forces are distributed uniformly about the peripheral portions of the door, thereby providing a uniform seal around the edges of the door.

With this arrangement, even though the hinge sleeve 41 is larger than the diameter of the pivot pin 40 in horizontal direction, the sealing effect of the door is not impaired, since the forces acting on the door through the pivot portion 69 take up the lost motion between the pivot pin 40 and the hinge sleeve 41 in door closing direction.

When it is desired to operate the fan 28 to exhaust air to the outside atmosphere, the door 24 is moved to an open position, for example, the fully open position shown in Fig. 3. To do this, the pull chain 44 is disengaged from the latch member 72 and gradually released, whereupon the spring 43 rotates the lever 62 in counterclockwise direction and draws the chain through the guide tube 71 to the right. During the first part of its movement, the lever 62 rotates in counterclockwise direction relative to the door until the leg 66 again abuts the door as shown in Fig. 2. Subsequent movement of the chain to the right in response to the force of the spring 43 results in movement of the door in opening direction, the lever 62 acting on the door as a rigidly mounted lever and the spring force being exerted on the door through the lever in opening direction.

The door may be retained in any partially open position between the fully open position shown in Fig. 3 and the closed position shown in Fig. 2 by engaging the pull chain 44 with the latch 72 after the door has been moved to such partially open position. In such position, the chain 44 is held taut by the force of the spring 43 biasing the lever 62 in door-opening direction, and the

5

counterclockwise turning moment on the lever 62 maintains the lever leg 66 and the door in biased engagement with each other.

It will now be seen that I have provided an improved door operating mechanism for a wall box fan which is of simple construction and which may be easily and cheaply manufactured.

It will also be seen that with my invention a more positive seal between the door and the face portion 34 may be effected, even though the play between the hinge pin 40 and the sleeve 42 is large, and even though the door 24 may be made of relatively light and yieldable material.

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 changes and modifications without departing from the spirit thereof.

What is claimed is:

1. A closure structure for a member having an opening, comprising a door for closing the opening, said door being pivoted to said member on an axis disposed adjacent to one edge of said door and one edge of said opening and extending substantially parallel to the plane of contact between said door and said member, a spring for biasing said door to an open position, means including a pull chain and a latch for holding said door in the closed position, a lever having two legs disposed at an angle to each other, means connecting said lever to a central portion of said door for angular movement about an axis parallel to the pivotal axis of said door, and means for supporting said spring on said member for pivotal movement about an axis parallel to but spaced from the pivotal axis of said door, one leg of said lever extending from the connection to the door away from the door axis and substantially parallel to the door and connected to said pull chain and the other leg extending transversely of the door and being engaged by said spring, whereby said spring acts through said other leg to bias said one leg toward said door in door opening direction, said pull chain being adapted to move said lever against the bias of said spring when said door is in the closed position, whereby said lever imparts a force at the central portion of said door in door closing direction.

2. A closure structure for a member having an opening, comprising a door for closing said opening, said door being pivoted to said member on an axis disposed adjacent to one edge of said door and one edge of said opening and extending substantially parallel to the plane of contact between said door and said member, a spring for biasing said door to an open position, means including a pull chain and a latch for holding said door in the closed position, a member for guiding said spring, said guiding member being connected at one end to said first member for pivotal movement about an axis parallel to but spaced from the pivotal axis of said door, a lever having two legs disposed at an angle to each other, means for pivotally connecting said lever to a central portion of said door for movement about an axis parallel to the pivotal axis of said guide member, one leg of said lever extending from the pivotal connection away from the door axis and along the door and being connected to said pull chain and the other leg extending transversely of the door and slidably receiving said guide member, said spring acting on said other leg and biasing said one leg toward said door, whereby said spring is effective to bias said door in opening direction through said lever, said pull chain being manually movable to rotate the lever against the bias of said spring when said door is in the closed position, whereby said lever imparts a force at the central portion of said door in door closing direction.

3. In a wall box fan, a casing structure having an opening, a door pivotally mounted on said casing structure adjacent the opening for closing the same, the axis of the door pivot being disposed adjacent one edge of the door and one edge of said opening and parallel to said door, a

6

spring for biasing said door to an open position, means including a pull chain and a latch for holding said door in the closed position, a guide member connected to said casing structure for pivotal movement about an axis parallel to but spaced from the pivoted axis of said door, said spring being carried by said guide member, an L-shaped lever having two legs disposed at an angle to each other, means for connecting said lever to a central portion of said door for pivotal movement about an axis parallel to the pivotal axis of said guide member, one leg extending from the connection away from the door axis and along said door and being connected to said pull chain and the other leg extending transversely of the door and having an opening slidably receiving said guide member, said spring being restrained by said other leg and being effective to impart a force on said door, in opening direction, through said lever, said lever being movable against the bias of said spring by said pull chain when said door is in the closed position, whereby a force is exerted on the central portion of said door through said one leg in door closing direction.

4. A closure structure of a member having an opening, comprising a door pivotally mounted on said member for closing said opening, the axis of the door pivot being disposed adjacent one edge of the door and one edge of said opening and parallel to said door, a spring for biasing said door to an open position when the door is in an open position, means including a pull chain and a latch for holding said door in the closed position, a member for guiding said spring, said guide member being connected to said member for pivotal movement about an axis parallel to but spaced from the pivotal axis of said door, a lever having two legs disposed at an angle to each other, means for connecting said lever adjacent the junction of said legs to a central portion of said door, one of said lever legs extending transversely of the door and being abutted by said spring and having an opening for slidably receiving said guide member, the other leg extending from the connection in the direction away from the door axis and being in abutment with said door when said door is in an open position, said pull chain comprising a string of spaced beads and said latch having a notch for selectively receiving one of said beads to anchor said pull chain, said pull chain being connected to the other of said lever legs and being manually movable into engagement with said latch to close said door, said other leg being arranged to yield to the pull exerted by said chain and to move out of abutment with said door in door closing direction, whereby a force is exerted on the central portion of said door through said other leg in door closing direction.

5. A closure structure for a casing member having an opening, comprising a door pivotally mounted on said casing member and movable into engagement therewith to close said opening, the axis of the door pivot being disposed adjacent one edge of the door and one edge of said opening and parallel to said door, a spring for biasing said door to an open position, a member for guiding said spring, said guide member being connected to said casing member for pivotal movement about an axis parallel to the pivotal axis of said door, a lever, means for supporting said lever on a central portion of said door for pivotal movement about an axis parallel to the pivotal axis of said guide member, said lever having a first leg extending transversely of the door and abutted by said spring and having an opening for slidably receiving said guide member, said lever having a second leg extending from the central portion of the door away from the door axis and being biased into engagement with said door in door opening direction by said spring when said door is in an open position, means including a pull chain and a latch for holding said door in the closed position, said pull chain comprising a string of spaced beads and said latch being provided with a notch for selectively receiving one of said beads to anchor said pull chain, said pull chain

being connected to said second leg and being manually movable into engagement with said latch to close said door against the action of said spring bias, said spring being sufficiently resilient to be further compressed after said door is closed and permitted yielding movement of said second leg at least as great as the spacing between the centers of a pair of said beads.

6. A door closure mechanism for a casing member having an opening and adapted to be mounted with said opening in a substantially vertical plane, comprising a door for closing the opening, a pivot pin for supporting said door at the top for rotation about a horizontal axis and disposed adjacent and parallel to said vertical plane, a lever extending substantially normal to said door pivot and supported below the door pivot for angular movement about an axis parallel to said door pivot, a fulcrum member attached to said door at a central portion thereof and in spaced relation thereto, said lever having a portion intermediate its ends disposed in the space between said fulcrum member and said door and having its lower end portion disposed substantially parallel to said door and terminating adjacent the lower edge of said door, means connected to the casing member and the lever for biasing said lever toward said door to bias said door in opening direction and for imposing a turning moment on said lever biasing its lower end towards said door and its intermediate portion toward said fulcrum member, a pull chain extending through said opening and having one end attached to the lower end portion of said lever, said pull chain being manually movable in door-closing direction to impose an opposing force on said lever in door-closing direction, said turning moment on said lever causing it to bias said fulcrum member in door closing direction when the lower end of the lever is moved

in door closing direction away from said door, and a latch for holding said pull chain in any one of a plurality of positions.

7. A closure structure for a member having an opening, comprising a door for closing the opening, said door being pivoted to said member on an axis disposed adjacent to one edge of said door and one edge of said opening and extending substantially parallel to the plane of contact between said door and said member, means forming a fulcrum carried by said door, said fulcrum being spaced from said door in a central region of the door, a lever disposed between said fulcrum and said door, said lever having a region intermediate its ends, adapted to engage said fulcrum and being adapted to pivot on said fulcrum about an axis substantially parallel to the pivotal axis of said door, one end of said lever terminating adjacent the edge of the door opposite the pivotal axis of the door, a spring having opposite ends engaging respectively said member and the other end of said lever, said spring being constructed and arranged to bias said lever against said door in a direction to open said door and to yieldingly resist pivotal movement of said lever on said fulcrum, and a pull chain extending through the opening in said member and connected to the said one end of the lever, said pull chain being adapted to apply a closing force to said door through said lever, the construction and arrangement being such that said spring yieldingly resist pivotal movement of said lever on said fulcrum when a closing force is applied to said one end of the lever by means of the pull chain.

References Cited in the file of this patent

UNITED STATES PATENTS

2,225,349 Morse ----- Dec. 17, 1940