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OPERATOR FOR HORIZONTALLY SLIDING WAREHOUSE DOORS

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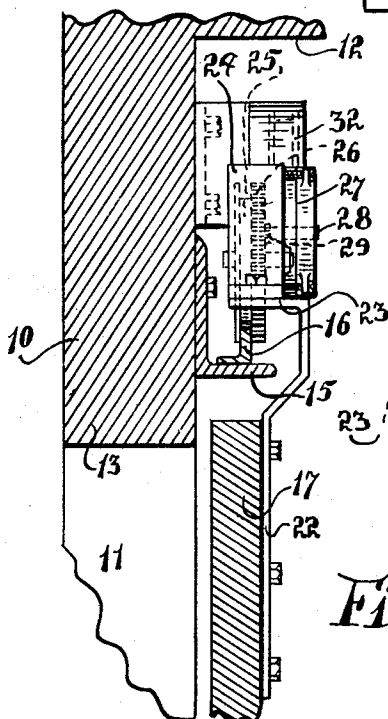
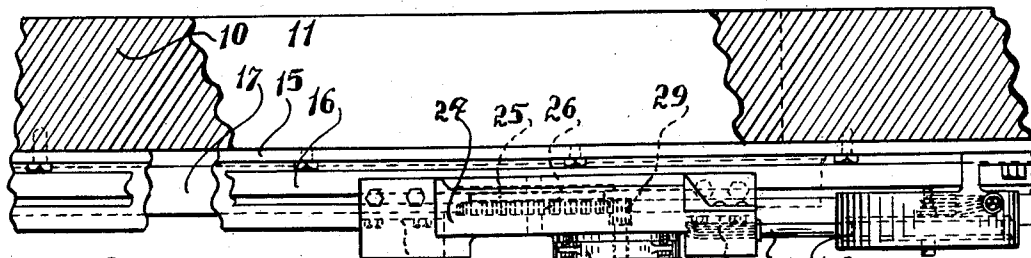
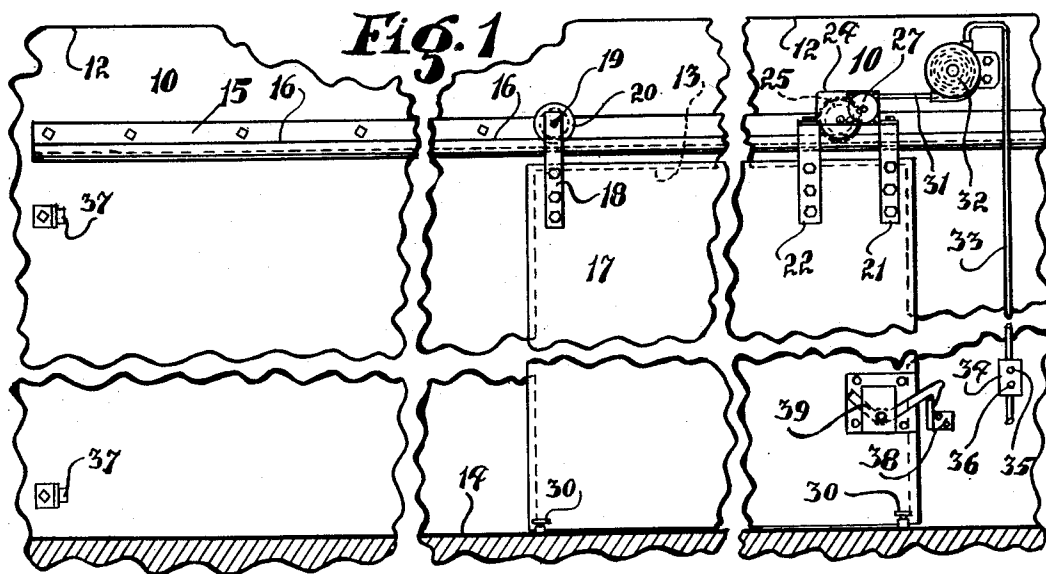
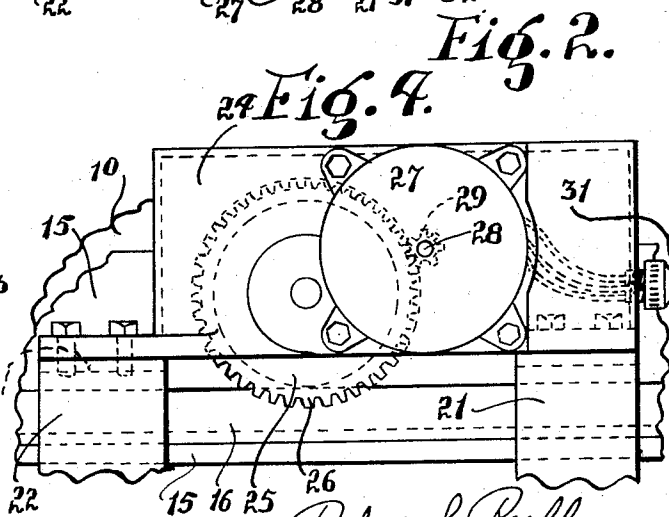


Fig. 3.



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OPERATOR FOR HORIZONTALLY SLIDING
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4 Claims. (Cl. 268—53)

My invention relates to operators for horizontally sliding warehouse doors, and more particularly to an electric motor actuated operator.

Warehouse doors of the type to which the operator of my invention is adaptable are usually large heavy thick doors, closing exterior openings of a building. They are of fireproof or fire retardant construction, and are suspended from an overhead track structure in a manner to allow them to have no contact with the floor or walls of a building.

Prior to my invention such doors were opened and closed by hand. Because of the weight of the doors such operation was difficult and troublesome, notwithstanding that roller bearings were used for the sheaves in the hangers by means of which the door was suspended from the overhead track. By reason of the size of the doors and the length of their run when opening and closing same, the application of power for operating such doors would have required the use of mechanical means complicate in its nature and unreliable in its action, so much so that the practice with both manufacturers and users was to avoid power operators in connection with such doors, and the expense and difficulties of upkeep and possible interference with the free operation of the door. Manufacturers and users preferred to forego the advantages of the power operation of such doors rather than attempt to apply thereto power operating mechanisms.

The foregoing applies only to heavy horizontally sliding warehouse doors, since the openings to passenger elevator shafts in modern equipment, are all power operated. The mechanism used in the operation of passenger elevator doors is not adaptable, however, for warehouse doors of the type to which the operator of my invention is applied.

With the above conditions in mind, I have provided an electric motor driven operator, all of the operative parts of which are carried by, and movable with, the door itself, power being conducted to the electric motor through conductor wires which are also movable with the door. In the operator of my invention the weight of the door itself is relied upon to develop sufficient tractive force to ensure reliability in the opening and closing movement of the door by electric motor power. The construction and manner of application of the operator to the door is such as to permit the operation of the door by hand at any time in the event of a failure of the electrical power.

In a door equipped with an operator of the in-

vention, the overhead rail may extend upon a true horizontal plane, thus avoiding liability of accidental closing movement of the door and a necessity for the use of any latches or other stop devices for holding the door in the open position.

The operator of the invention is very simple as to the number and combination of parts; requires no modification of the door or rail structure, and is not subject to disarrangement even after long continued use.

The invention consists primarily in the combination with an overhead track structure adjacent a wall opening, a door closing said opening carrying a plurality of hangers at the top thereof, and a sheave mounted in one of said hangers, of a motor carried by and movable with said door section, a second sheave mounted adjacent said motor, intermeshing gears carried by the shaft of said motor and by said last named sheave, an electrical conductor movable with and supplying power to said motor, and a switch mechanism controlling the circuit to said motor; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawing,

Fig. 1 is a view in elevation, vertically and horizontally condensed, of a horizontally sliding warehouse door equipped with an operator embodying the invention;

Fig. 2 is a plan view thereof, upon a larger scale, with a portion of the wall above the opening broken away;

Fig. 3 is a view from the right of Fig. 2; and

Fig. 4 is a detail view of the motor housing, the power sheave and the gearing between the motor in said housing and said sheave.

Like numerals refer to like parts throughout the several views.

In the embodiment of the invention shown in the drawing, the wall 10 of the building has a door opening 11 therein. The line of the ceiling is indicated at 12. The lintel of the door opening is shown at 13 and the floor line is shown at 14. Above the lintel 13, the wall 10 has secured thereto a heavy angle bar 15 which extends to one side of the opening a distance sufficient to admit of a full opening movement of the door. Mounted upon this angle bar is a smaller angle bar 16 having an upwardly directed flange parallel with the wall of the building and near the edge of the flange of the angle bar 15 which projects inwardly from the wall.

The door proper is shown at 17 and may be of

any desired construction, the details of construction not being shown in the drawing as such are immaterial to the present invention. A common form of such door consists of a wooden core having a sheet metal sheathing, but wooden doors without such sheathing, or properly reinforced sheet metal doors may be used.

Secured to the top of the door, adjacent one vertical edge thereof, is a hanger bracket 18 having journaled, upon a bearing stud 19 adjacent the top thereof, a sheave 20 having shrouds or flanges at the opposite edges thereof. This sheave is of a width to receive the upwardly extending flange of the angle bar 16. The hanger bracket 18 extends beyond the top of the door and is offset to pass about the track structure, composed of the angle bars 15 and 16, so as to properly position the sheave 20 in relation to said track structure.

Adjacent the opposite vertical edge of the door are two hanger brackets 21 and 22, which are attached to the door and extend beyond the top of the door and are offset to pass the rail structure 15 and 16. Each bracket has a support as 23 extending over the top of the door. Secured to said supports 23, is a housing 24 in which is mounted a sheave 25, similar to the sheave 20, excepting that one of the shrouds thereof is widened and provided with teeth 26 to form a spur gear. The sheaves 20 and 25 are alined one with the other so as to track upon the bar 16 of the track structure.

Carried by the housing 24 is a small electric motor 27 of special construction. This motor is of the polyphase, inductive type and its armature is provided with a shaft 28 carrying, or having formed thereon, a pinion 29 enmeshed with the gear teeth 26. The housing 24 and motor 27 are only between three or four inches in width, so that they may be contained within the available space above the door, particularly as the motor must be positioned inwardly of the wall in relation to the sheave 25 in order to ensure a proper enmeshment of the pinion 29 with the gear teeth 26. In the accompanying drawing, the door is substantially two inches in thickness so that the small dimensions of the housing 24 and motor 27 are apparent by a comparison of the relative dimension of parts as shown in the drawing.

Special construction, both as to its electrical and its mechanical features, of the motor 27, is made possible because of the run of the motor required to effect a complete opening or closing movement of the door. This construction of motor is also highly desirable since it is capable of developing a high torque.

The entire weight of the door is suspended from the track structure by the sheaves 20 and 25, the housing 24 and the brackets 18, 21 and 22. The sheaves are positioned above the approximate center line of the door thus minimizing any tendency of the door to tilt toward or from the wall. The door in its entirety is maintained in a substantially vertical plane with the bottom of the door spaced slightly from the floor of the building.

In order to prevent the door being forced inwardly toward the bottom thereof, I provide spaced roller stops 30 in a position to confine the door in close proximity to the wall when the door is in the closed position.

It will be noted that the upwardly directed flange of the bar 16 forming a part of the track structure, affords a straight line surface along

which the sheaves 20 and 25 may roll during opening or closing movement of the door, and that this surface is on a substantially horizontal plane. Hence there is no tendency of the door to have movement by gravity along the track in either direction.

The housing 24 is provided with suitable outlet openings through which an electric cable 31 may be run to the motor 27. A flexible cable is used. Because the motor 27 is carried by and has movement with the door it is essential, to avoid a complicated structure involving electrified rails and shoes co-operating therewith, to provide for the movement of the cable 31 with the door. Various expedients may be resorted to to permit this movement of the cable according to the space available. Where, as in the embodiment of the invention shown in the drawing, but small space is afforded between the top of the door and the ceiling, I provide an automatically acting spring reel 32 to which the cable is electrically connected, and upon which it is wound, suitable means (not shown) being provided to secure the desired electrical connection of the lines of the cable with an electrical source.

Arranged in the length of the electrical mains indicated at 33 is a switch mechanism 34. This switch mechanism includes two constant pressure switches 35 and 36, by means of which the polarity of the field of the motor 27 may be reversed so as to control the direction of rotation of the motor according to whether it is required to open or to close the door.

Means limiting the opening movement of the door are provided, such as the stops 37 secured to the wall 10, as shown at the left of Fig. 1.

Projecting from the jamb of the opening 11 is a striker member 38 with which the edge of the door is adapted to contact. This striker member projects inwardly of the wall to a distance greater than the thickness of the door, and is engageable by a pivoted latch member 39 carried by and movable with the door.

The operation of the herein described mechanism is substantially as follows:—

The entire weight thereof, which may amount to a thousand pounds or more, is applied to the sheaves 20 and 25, and is supported solely from the upwardly directed flange of the angle bar 16. The sheaves preferably are furnished with ball bearings to permit free turning thereof in relation to their supports.

When the opening of the door is required, it is merely necessary to raise the latch member 39 out of engagement with the striker 38 and push the opening buttons as 35, holding this button depressed until the opening movement of the door is finished. With the closing of the circuit, by means of the opening switch 35, power is applied to the motor to give a clockwise movement to the armature thereof, and to the pinion 29 carried by the armature shaft 28. This will impart contra-clockwise movement to the sheave 25 through the gear 26.

The traction of the sheave, by reason of the weight of the door applied thereto, is sufficient to impart an initial and a continuing movement of the sheave 25 and the sheave 20 along the track 16. In fact, the weight of the door is sufficiently great to preclude possibility, under normal conditions, of any slippage of the sheave upon said track. Not only is the small motor used capable of imparting the desired movement to the door, but this movement is a fairly rapid movement since the sheave may be six to

nine inches in diameter and the motor may have eight hundred to a thousand revolutions per minute.

The ratio of the pinion 29 and the gear 26, and the high torque of the motor ensures certainty and ease in the starting of the door. But even with this reducing gearing, the opening movement of a door of from fifteen to twenty feet in width may be accomplished in a very few seconds.

No particular timing of the duration of the application of the electric current to the motor is required. When movement of the door is arrested by engagement with the stops 37, if power is still being applied to the motor, the only result will be slippage between the sheave 25 and the track 16. Ordinarily, however, the current is interrupted before the door has attained its full opening so that the moving inertia of the door will complete such movement without necessitating the application of power thereto throughout the full movement of the door.

The procedure in closing the door, is a reversal of that heretofore described, the closing switch 36 being used instead of the opening switch 35. While there is possibility of a slight rebound of the door upon engagement with the stops 37, the latch member 39, by engagement with the striker 38, will prevent such a rebound upon the closing of the door.

One great advantage of the construction herein described is that the door may be operated either by the motor 27 or by hand, so that in the event of the loss of power, or a burning out of the motor, the doors may still be opened or closed. If manual power be applied to the door lengthwise of its direction of travel, when either opening or closing it, without application of power to the motor, the armature thereof turns freely so as to permit a free turning of both sheaves 20 and 25.

Another important advantage in the operator of the invention, is, that in the event of an obstruction being accidentally placed in the path of movement of the door no damage will result to the operator, since such stoppage of the door will merely result in slippage between the sheave 25 and the track 16.

An operator embodying the invention is composed of the minimum number of parts, so combined as to avoid possibility of a failure of the operator through a disarrangement of such parts.

The weight of the housing 24, the sheave 25 and the motor 27 carried thereby is insufficient to have any effect, so far as developing the desired traction of the sheave 25 is concerned. It will be noted that the housing and the motor move with the door and that the manner of associating the driving sheave and the motor is such as to avoid any possibility of the breakage or disarrangement of these parts.

This movement of the motor with the door necessitates the employment of the movable electrical connections above described. As the door opens, the flexible cable 31 is drawn from the reel 32, and with the closing of the door, is automatically rewound upon this reel. This is solely for the purpose of avoiding such slack in the cable as might interfere with the movement of the door, or result in the breakage of the cable by the door during its movement. Other means for taking care of this slack in the cable may be employed however.

The use of an overhead motor is, from a prac-

tical standpoint, highly desirable since it avoids tampering with the motor. This arrangement of the motor is made possible because with the special construction used there are no parts which require replacement from time to time, and no oiling of the motor is necessary for long periods of use.

By using a housing 24, no dust or dirt is permitted to accumulate upon the working parts of the motor, the driving sheave or the gear train connecting the sheave with the motor.

It is not my intention to limit the invention to the precise details of construction shown in the drawing, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. The combination with an overhead track structure adjacent a wall opening, a door closing said opening carrying a plurality of hangers at the top thereof, and a sheave mounted in one of said hangers, of a reversible electric motor carried by and movable with said door section, a second sheave mounted adjacent said motor, intermeshing gears carried by the shaft of said motor and by said last named sheave, an electrical conductor movable with and supplying power to said motor, and a switch mechanism controlling the circuit to said motor.

2. The combination with an overhead track structure adjacent a wall opening, a door closing said opening carrying a plurality of hangers at the top thereof, and a sheave mounted in one of said hangers, of a housing supported from said other hangers, a reversible electric motor within said housing, a sheave having gear teeth upon one of the shrouds thereof also mounted in said housing, a pinion upon the shaft of said motor enmeshed with the gear teeth upon said sheave, an electrical conductor movable with and supplying power to said motor, and a switch mechanism controlling the circuit to said motor.

3. The combination with an overhead track structure adjacent a wall opening, a door closing said opening carrying a plurality of hangers at the top thereof, and a sheave mounted in one of said hangers, of a reversible electric motor carried by and movable with said door section, a second sheave mounted adjacent said motor, intermeshing gears carried by the shaft of said motor and by said last named sheave, an electrical conductor movable with and supplying power to said motor, stops limiting the movement of said door in one direction, and a switch mechanism controlling the circuit to said motor.

4. The combination with an overhead track structure adjacent a wall opening, a door closing said opening carrying a plurality of hangers at the top thereof, and a sheave mounted in one of said hangers, of a housing supported from said other hangers, a reversible electric motor within said housing, a sheave having gear teeth upon one of the shrouds thereof also mounted in said housing, a pinion upon the shaft of said motor enmeshed with the gear teeth upon said sheave, an electrical conductor movable with and supplying power to said motor, stops limiting the movement of said door in one direction, and a switch mechanism controlling the circuit to said motor.

ROBERT S. PEELE.