June 9, 1964 P. M. WHITFIELD 3,136,537

DOOR OPENING MECHANISM

Filed Oct. 3, 1961 2 Sheets-Sheet 1

Fig. 1

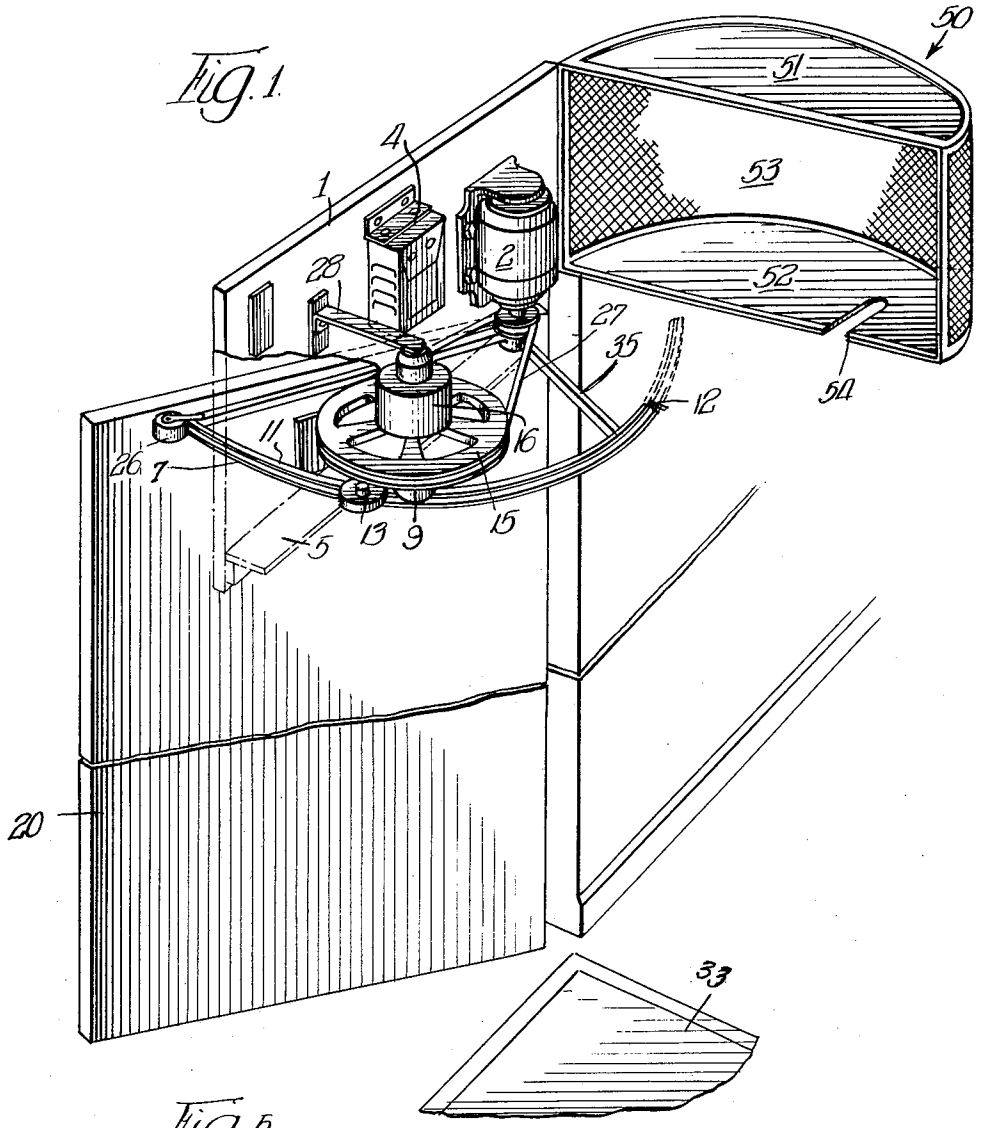
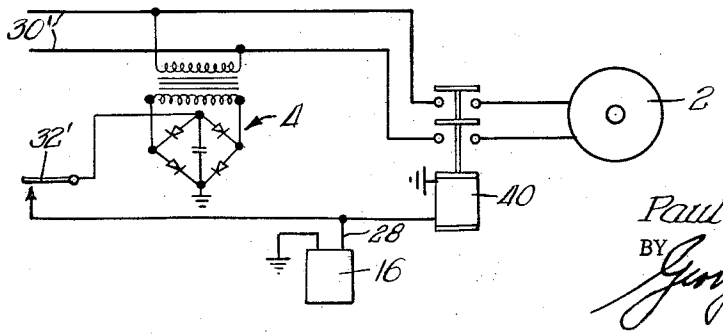



Fig. 5




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Filed Oct. 3, 1961 2 Sheets-Sheet 2

Fig. 2

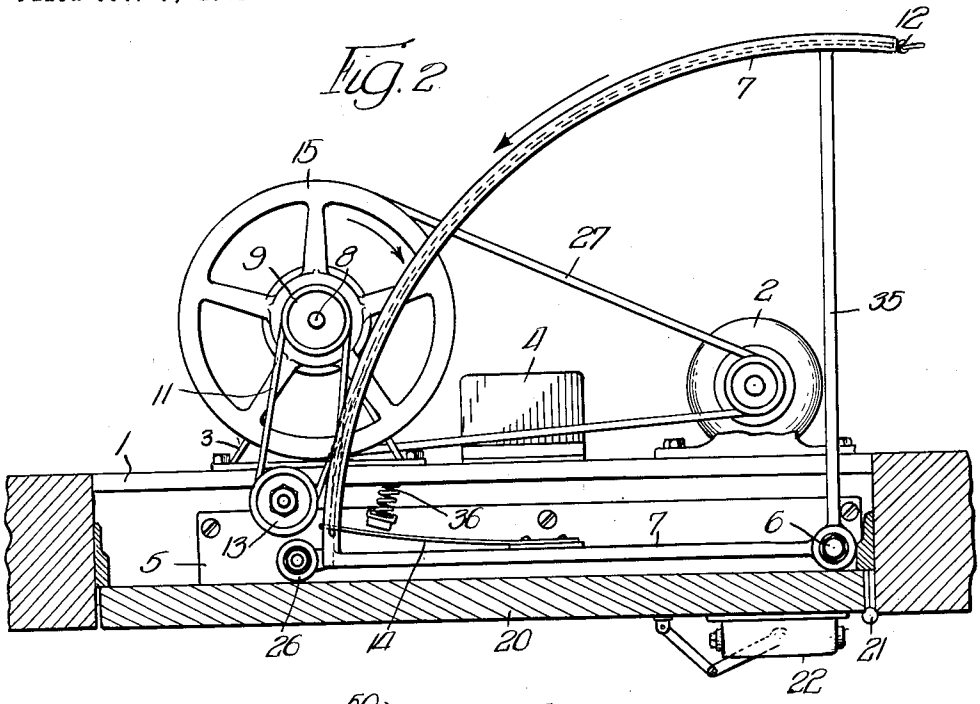



Fig. 3

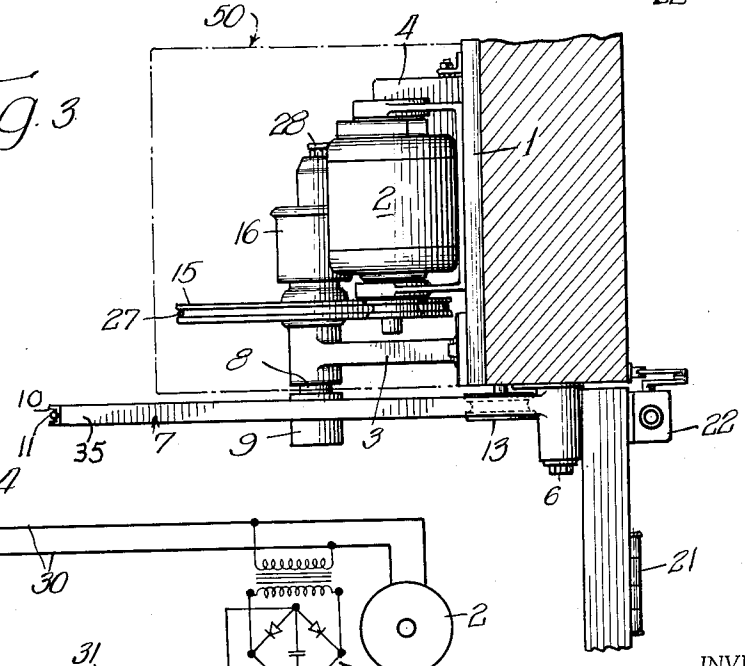
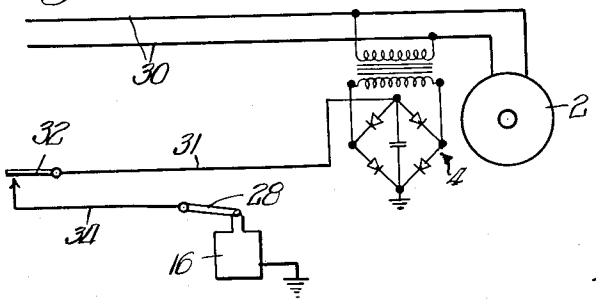



Fig. 4




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3,136,537

# DOOR OPENING MECHANISM

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7 Claims. (Cl. 268—33)

This invention relates to door openers and has for its principal object the provision of a new and improved device of this kind.

It is a main object of the invention to provide a simple inexpensive opener, for automatically opening a vertically hinged door, that can be installed in operating position adjacent an existing door without requiring alteration of the door frame, wall or floor adjacent the door.

Another object of the invention is to provide an electrically operated door opener which engages but is not fastened to the door, thereby to permit manual opening of the door in case of failure of the electric power.

Another object of the invention is to provide a mechanism, for automatically opening a door, which is mounted at the top of and above the door, in which position the mechanism is readily accessible for cleaning and servicing as required.

Another object of the invention is to provide a door opening mechanism for use with a hinged door that is equipped with a pneumatic or hydraulic door check, which mechanism moves the door from closed to open position, holds it open while the mechanism is operating, and in which the door check returns the door to closed position and the mechanism to its normal position.

Another object of the invention is to provide a door opening mechanism which can be manufactured, installed and maintained at low cost without sacrificing reliability.

Further objects of the invention not specifically mentioned here will be apparent from the detailed description and claims which follow, reference being had to the accompanying drawings in which a preferred embodiment of the invention is shown by way of example and in which:

FIG. 1 is a perspective view showing a preferred embodiment of the invention with the door in partially open position;

FIG. 2 is a bottom side plan view showing the door closed and the mechanism in its normal position;

FIG. 3 is a side elevational view of the mechanism as seen from the hinged side of the door;

FIG. 4 is a circuit diagram for one embodiment of the invention; and

FIG. 5 is a circuit diagram for another embodiment of the invention.

It is tremendously advantageous to have doors, such as, for example, doors between the kitchen and dining room of a restaurant, opened automatically. In the absence of a door so equipped, a waitress approaching the door with a loaded tray must either balance the tray on one hand and keep the other hand free to open the door, or, if both hands are required on the tray, to either kick the door open or turn around and back against it while taking the tray through the door opening. In such instances spilling of the dishes on the tray occurs all too frequently.

Prior art automatic door openers of which I am aware have usually consisted of a mechanism embedded within or mounted below the floor adjacent the door opening. Installation of these mechanisms has been expensive by reason of the fact that modification of the floor structure is necessary to permit installation of the operating mechanism. Furthermore such mechanisms have been permanently attached to the door and in case of failure, such as, for example, power failure to an electrically operated mechanism, manual operation of the door has been rendered much more difficult, if not impossible.



The automatic door opening mechanism of the present invention seeks to overcome the difficulties by providing a mechanism which can be installed without modification of the floor or wall adjacent the door opening. The mechanism is designed for use with a door that is equipped with the customary pneumatic or hydraulic door check which returns the door to closed position when the force moving the door to open position is removed. The present invention provides an opener that is not connected in any way to the door, but rather merely bears thereagainst so that in case of power failure manual operation of the door is no more difficult than if the operating mechanism were not associated with it.

In its preferred form the device of the present invention consists of a quadrant pivotally mounted on the door frame at the top thereof and bearing against the door on the side thereof away from the hinges and near the top of the door. An electric motor is operated to rotate the quadrant on its pivot, there being a clutch in the drive between the motor and quadrant. When the door is in fully opened position, the quadrant engages a stop and the clutch slips to hold the door open until release of the clutch permits the door check to close the door and move the quadrant back into its normal position.

The invention will best be understood by reference to the accompanying drawings where it will be seen that in its preferred form the device of the present invention comprises a mounting base 1 upon which an electric motor 2, a journal bracket 3, and a rectifier 4 are secured by suitable means. Mounted upon the top member of the door frame is a mounting plate 5 from which a pivot 6 projects downwardly and serves to mount a quadrant 7 on the door frame. Journaled in the journal bracket 3 is a shaft 8 which carries at its lower end a drum 9. The arcuate edge of the quadrant 7 carries flanges forming an outwardly opening groove 10 in which a cable 11 is disposed, the cable being fastened to the end of the quadrant adjacent the hinged edge of the door, as indicated at 12.

Also mounted upon the mounting plate 5 is an idler pulley 13 around which the cable is extended and thence around the drum 9, there being several turns of the cable engaging the drum. From the drum the cable extends to a spring 14 carried by the quadrant and to which the end of the cable is fixed.

Above the journal bracket 3 the shaft 8 carries a pulley wheel 15 loosely mounted thereon and above this pulley wheel 15 is a clutch 16, preferably a magnetic fluid clutch of the type disclosed in U.S. Patent 2,575,360, issued November 20, 1951.

As will be seen best in FIG. 2, the door 20 is hinged to its frame by hinges 21 and carries adjacent its upper edge a door check mechanism 22 of known design. The quadrant is positioned near the top edge of the door and carries a roller 26 that bears against the door.

A belt 27 encircles the pulley 15 and the pulley on the motor shaft serves to rotate the pulley 15 as the motor operates.

Since direct current of voltage lower than that of commercial current is required to operate the magnetic fluid clutch of the above invention, the rectifier 4 is provided and the circuit of the clutch extended through a commutator 28 that is mounted on the mounting base 1 and engaged with the end of the clutch mechanism. The particular type of rectifier used is not of the essence of this invention as there are several forms of rectifiers readily available on the open market that can be used. So long as the rectifier produces direct current of voltage and wattage required by the magnetic clutch, the requirements of the invention are met.

In the case of a door between the kitchen and dining room of a restaurant, it is advantageous to have the

motor of the device running continuously, since during rush periods of the restaurant the door may be required to be opened several times a minute. Under these circumstances the electrical circuit diagrammatically illustrated in FIG. 4 is advantageous.

The rectifier 4 and the motor are connected together in parallel to leads 30 that extend to a source of commercial alternating current through a suitable plug or switch, not shown, over which circuit the motor operates and the rectifier 4 is energized. The low voltage output of the rectifier is connected at one of its terminals to the frame of the mechanism and the other terminal is extended over conductor 31 to normally open switch contacts 32 which may conveniently be contacts of a mat switch 33 illustrated in FIG. 1. Conductor 34 connects the make contact of this switch mechanism through the commutator 28 to the magnetic clutch 16, the other terminal of which is connected to the frame of the mechanism. When switch 32 is closed, as it will be by a person stepping on the mat 33, the clutch 16 is operated and a driving connection established thereby from a pulley wheel 15 to the drum 9 operating that drum clockwise, as seen in FIG. 2, thereby pulling the cable 11 to cause the quadrant 7 to be rotated counterclockwise, as seen in this figure, thereby to push the door 20 counterclockwise around the axis of its hinges 21 from closed to open position, tension being built up in the door check 22 by this movement.

When the door is in fully open position, that is at right angles to the door frame, the trailing arm 35 of the quadrant moves into engagement with a spring 36 mounted upon the mounting plate 5 and further rotation of the quadrant is thus prevented.

Magnetic fluid clutches of the type disclosed in the above mentioned patent are capable of transmitting a definite amount of torque from a driving to a driven member, and when the load on the driven member exceeds this torque the clutch slips without reducing the torque. Thus when the door moves into fully open position and further movement of the quadrant is prevented, the door will be maintained in open position and against the tension built up in the door check 22 so long as the circuit of the clutch is maintained closed. When this circuit is opened, torque developed in the clutch is reduced to zero and the tension built up in the door check comes into play to close the door which on moving from fully open to closed position pushes the quadrant clockwise, as seen in FIG. 2, into its normal position.

In installations where a door is required to be opened only occasionally, with substantial periods of time intervening between successive openings of the door, it is advantageous to have the motor disconnected from the source of power during these intervals. In an installation of this kind the circuit arrangement shown in FIG. 5 is advantageous. From this figure it will be seen that the power leads 30' are connected to the rectifier 4 as before, but rather than being connected to the motor 2 are connected to the contacts in a switch mechanism 40. The low voltage output of the rectifier is connected to normally open contacts 32' as before, and upon closing of these contacts the magnetic clutch 16 is energized and also the switch mechanism 40 is energized parallel with the clutch. Operation of the switch mechanism closes the obvious circuit of the motor 2 thereby to connect the motor across the line to initiate its operation. So long as the contacts 32' remain closed, the motor will operate and the clutch 16 will be energized to effect operation of the mechanism in the hereinbefore explained manner.

As will be seen in FIG. 1, the mechanisms carried upon the mounting base 1 may be enclosed in a suitable cover, generally indicated at 50. Preferably this cover consists of a solid metallic top 51 and a solid metallic bottom 52 with mesh or louvered side wall 53 disposed therebetween. The bottom contains a slot 54 through which the shaft 8 of the mechanism projects to position the drum 9 outside of the casing and in proper alignment with the quadrant.

As will be seen in FIG. 2, the axis 6 around which the quadrant rotates is offset from the axis of the hinges 21, and as a result as the quadrant is rotated there will be relative movement between it and the door 20 and as a result it is preferable to equip the quadrant with a roller, such as 26, which when composed of a suitable material such as rubber is capable of rolling over the surface of the door without marring that surface. The use of a roller, however, is not mandatory as the use of other devices capable of causing the quadrant to push the door is contemplated. If desired, the mounting for the quadrant can be arranged so that the axis around which the quadrant rotates is aligned with the axis around which the door rotates; however, such modification complicates the mounting unnecessarily.

From the foregoing it will be apparent that the door opening device of my invention can be installed above the door opening with a minimum of damage to the wall and door frame. The device is of simple construction and when mounted in such position, access to the mechanisms thereof is easily achieved simply by removing the cover 50, and cleaning and servicing of these mechanisms is therefore much easier to accomplish than in installations where the operating mechanism is disposed beneath the floor or inclosed in the wall of the building.

While I have chosen to illustrate my invention by showing and describing a preferred embodiment of it, I have done so by way of example only, as there are many modifications and adaptations which can be made by one skilled in the art within the teachings of the invention.

Having thus complied with the statutes and shown and described a preferred embodiment of my invention, what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What I claim is:

1. Mechanism for opening a door that is hinged for rotation around a vertical axis and is equipped with a hydraulic door check, comprising

(1) a quadrant mounted for rotation around an axis that is parallel to the axis of the door hinges and spaced therefrom, said quadrant engaging the door at a point near the top thereof and remote from the hinges;

(2) a drum journaled for rotation around an axis that is parallel to the quadrant axis;

(3) an idler pulley mounted adjacent the door engaging end of the quadrant for rotation around an axis that is parallel to the axis of the drum;

(4) a spring fixed upon the quadrant near the door engaging end thereof;

(5) a cable fixed to the end of the quadrant remote from the door engaging end thereof, engaged with the arcuate portion of the quadrant, engaged with said pulley, extended around said drum a plurality of times, thence to said spring to which it is fastened, said spring being tensioned to snub the cable around the drum;

(6) a motor driven wheel journaled for rotation around the axis of the drum;

(7) an electromagnetic clutch for connecting said drum to said wheel;

(8) and means for operating the clutch thereby connecting the drum to said wheel to rotate the drum and move the quadrant and door from door closed to door open position.

2. A door opening mechanism as specified in claim 1 in which a second spring mounted adjacent the quadrant is engaged by the quadrant when the door is in open position to limit the movement of the quadrant.

3. A door opening mechanism as specified in claim 1 in which the spring reduces tension on the cable as the

door check functions to close the door thereby permitting the cable to slip on the drum.

4. A door opening mechanism as specified in claim 2 in which the clutch slips when the quadrant engages said second spring to maintain the door open so long as said means maintains said clutch operated.

5. Mechanism for opening a door that is hinged for rotation around a vertical axis and is equipped with a hydraulic door check comprising:

(1) a quadrant mounted for rotation around an axis that is parallel to the axis of the door hinges and spaced therefrom, said quadrant engaging the door at a point near the top thereof and remote from the hinges;

(2) a drum journaled for rotation around an axis that is parallel to the quadrant axis;

(3) a spring fixed upon the quadrant near the door engaging end thereof;

(4) a cable fixed to the end of the quadrant remote from the door engaging end thereof, engaged with the arcuate portion of the quadrant, extended around said drum a plurality of times thence to said spring to which it is fastened, said spring being tensioned to snub the cable around the drum;



(5) a motor driven wheel journaled for rotation around the axis of the drum;

(6) an electromagnetic clutch for connecting said drum to said wheel;

(7) and means for operating the clutch thereby connecting the drum to said wheel to rotate the drum and move the quadrant and door from door closed to door open position.

6. A door opening mechanism as specified in claim 5, in which a stop mounted adjacent the quadrant is engaged by the quadrant when the door is in open position to limit the movement of the quadrant.

7. A door opening mechanism as specified in claim 5, in which the spring is tensioned to maintain the cable snubbed on the drum and in which the drum is rotated by the cable as the door is being closed by the door check.

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