Aug. 15, 1961 G. OLEXSON ET AL 2,996,152

MAGNETIC RETRACTABLE DOOR ROLLER FOR AUTOMATIC ELEVATORS

Filed April 6, 1960 4 Sheets-Sheet 1

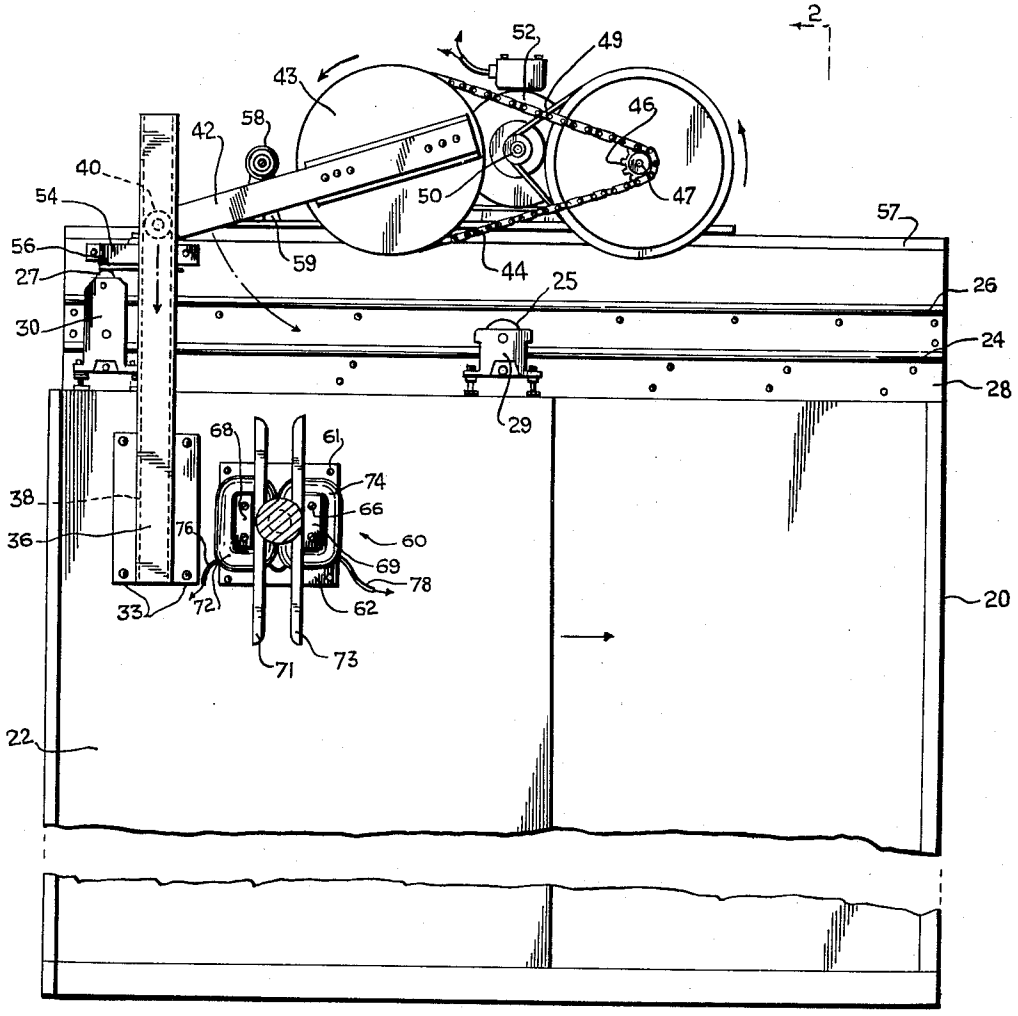

Fig. 1.

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4 Sheets-Sheet 2

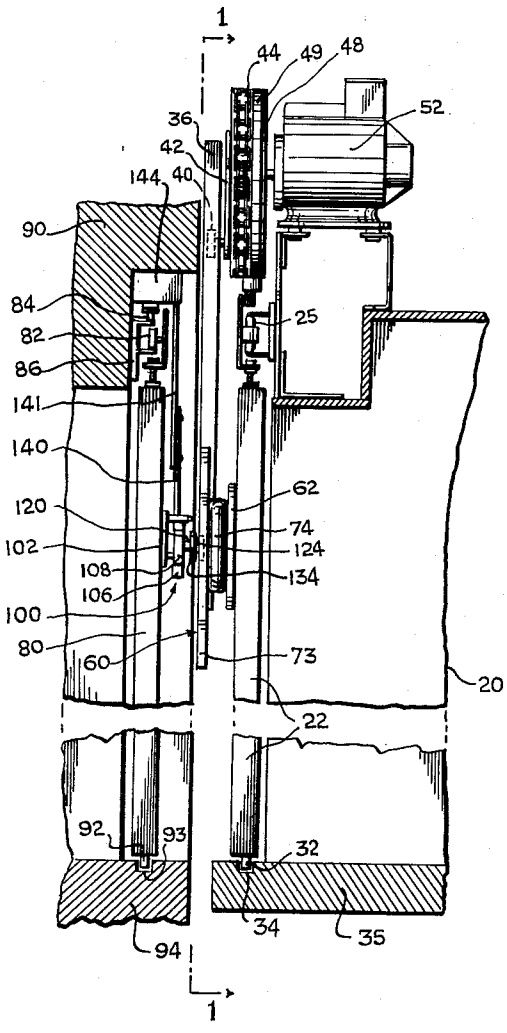

Fig. 2.

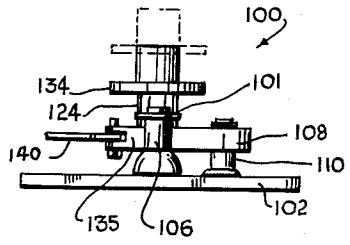

Fig. 8.

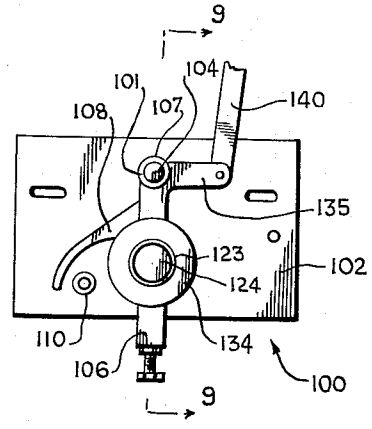

Fig. 7.

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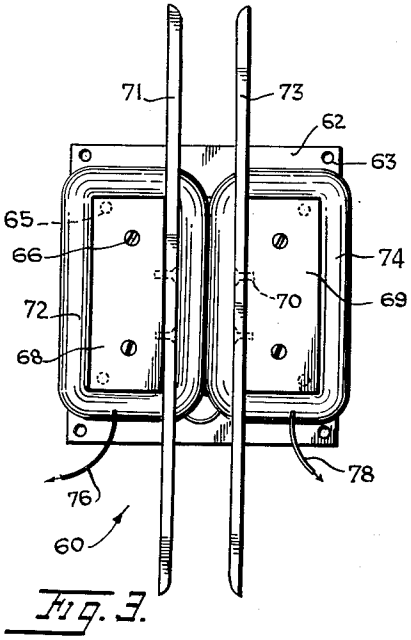

Fig. 3.

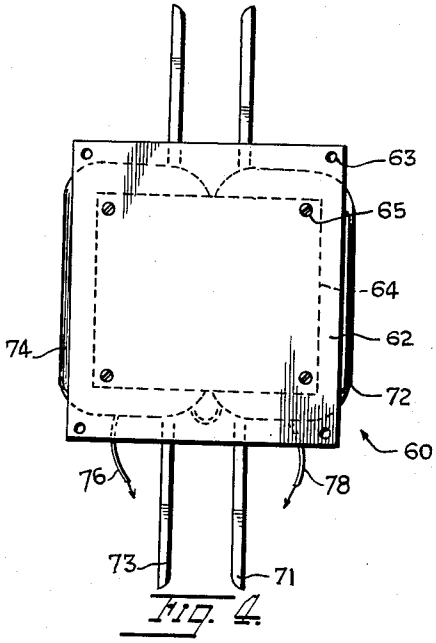

Fig. 4.

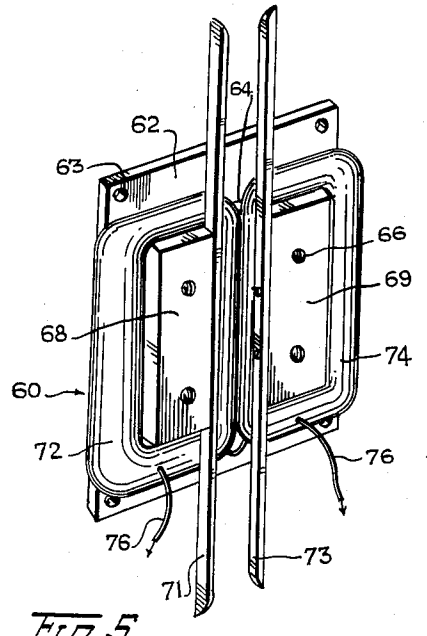

Fig. 5.

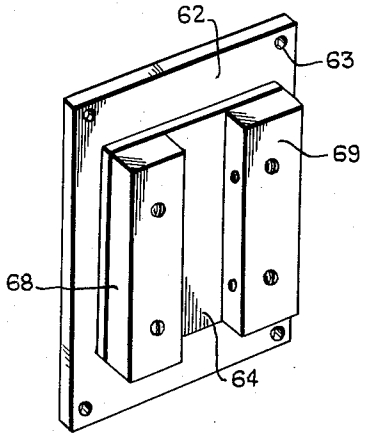

Fig. 6.

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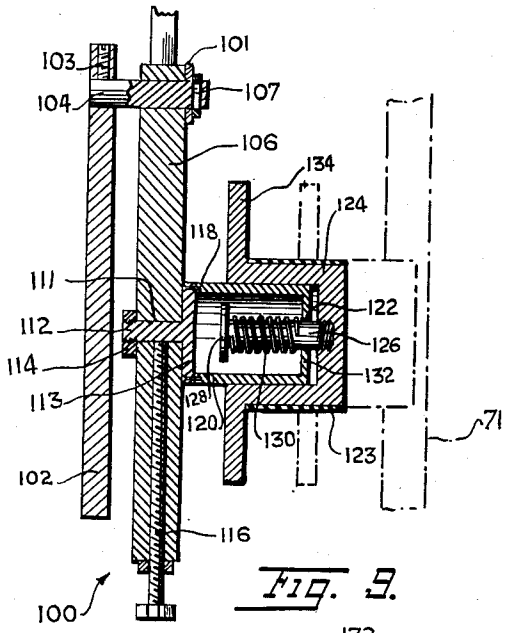

Fig. 9.

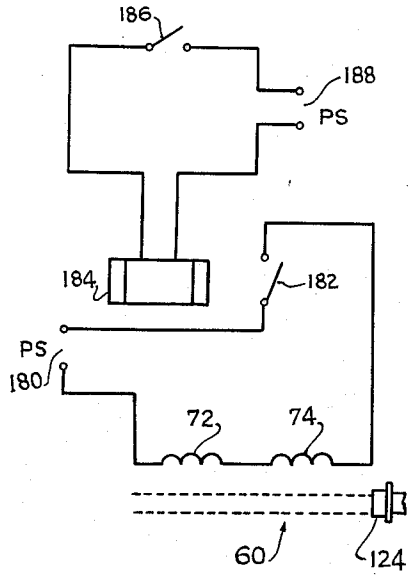

Fig. 11.

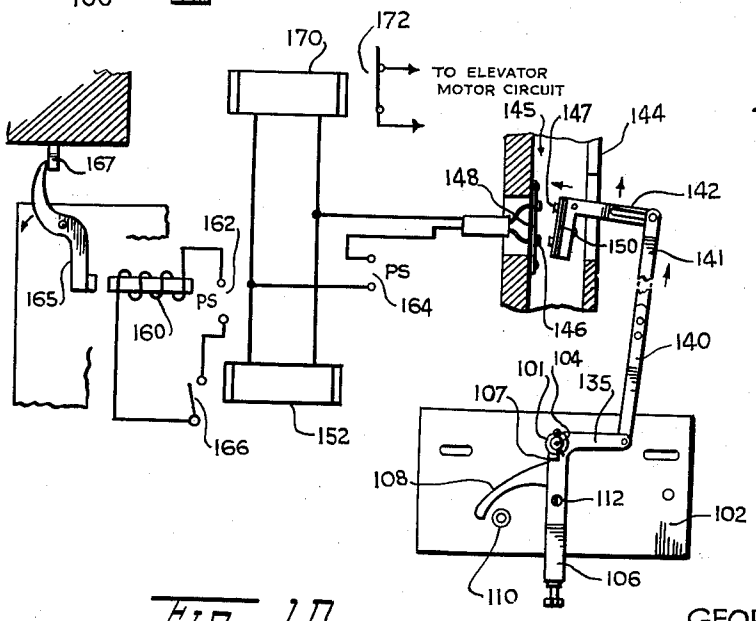

Fig. 10.

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2,996,152

MAGNETIC RETRACTABLE DOOR ROLLER FOR AUTOMATIC ELEVATORS

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5 Claims. (Cl. 187—52)

This invention concerns a device for opening elevator entrance doors at the several floors of a building.

Heretofore sliding elevator entrance doors have been opened by the engagement of door opening members carried by the sliding door of the elevator cab or cage with rollers carried by the elevator entrance doors. The door opening members on the door of the elevator cab have included two spaced, parallel bars disposed vertically. A roller extending outwardly from the elevator entrance door at each floor of the building would pass between the bars. When the elevator stopped and its door opened, the entrance door of the building opened with the door of the elevator cab. The rollers protruding from each door at each floor were made of rubber to cushion the shock of impact when the rollers struck the parallel bars. The rollers were supported on levers which carried contacts of an interlock switch in the elevator drive motor circuit. When the elevator cab door opened the interlock switch opened and the drive motor was held stopped. Frequently due to wear and misalignment the rollers were struck as the elevator cab passed floors where the elevator was not called to stop, causing the interlock switch to open and the elevator cab was stopped. Also the elevator entrance door might be released to open. This rendered the elevator inoperative until the defective door roller was repaired.

The present invention is directed at eliminating this source of trouble by providing a novel door opening structure in which the door opening rollers are held out of the path of movement of the bars on the elevator cab door until the elevator cab is actually at the floor where it is to stop. The roller at that floor is normally in a retracted condition and is pulled outwardly between the parallel bars as the elevator stops. As the elevator cab door opens the elevator entrance door at that floor opens also due to engagement of the roller between the parallel bars.

Associated with the parallel bars is an electromagnet which is energized when the elevator cab arrives at the floor where it is to stop. The roller is formed from magnetic material and is attracted by the electromagnet against a spring bias tending to hold the roller retracted. After the two doors open and close, the electromagnet is deenergized, the roller retracts, and the elevator is free to move on to another floor.

It is therefore a principal object of the invention to provide a sliding door opening mechanism for an elevator including a retractable roller adapted to be extended for engagement with door opening bars on an elevator cab.

A further object is to provide a sliding door opening mechanism including a roller normally retracted on a support by a spring and adapted to be extended against tension in the spring by attraction of an electromagnet including parallel bars spaced to receive the roller in extended condition therebetween.

A still further object is to provide a sliding door opening mechanism of the character described, wherein the support for the roller includes a lever adapted to operate an interlock switch of an elevator motor drive circuit.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIG. 1 is a front elevational view of an elevator cab showing in section a portion of a door opening roller according to the invention.

FIG. 2 is a vertical sectional view taken on line 2—2 of FIG. 1, showing details of the elevator cab door, elevator entrance door, and door opening mechanism.

FIG. 3 is a front elevational view on an enlarged scale of the electromagnet as associated with parallel bars.

FIG. 4 is a rear view of the structure of FIG. 3.

FIG. 5 is a perspective view of the structure of FIG. 3.

FIG. 6 is a perspective view of components of the electromagnet in partially assembled form.

FIG. 7 is an elevational rear view of the roller and support on an enlarged scale.

FIG. 8 is a top plan view of the roller and support.

FIG. 9 is a central sectional view on an enlarged scale of the parts shown in FIG. 8.

FIG. 10 is a diagram of part of the interlock switch circuit and associated parts of the roller support.

FIG. 11 is a diagram showing in simplified form, one way in which the electromagnet may be energized and deenergized when installed in an elevator according to the invention.

Referring to FIGS. 1 and 2, there is shown an elevator cab **20** having a sliding cab door or gate **22**. The door is guided for movement in its plane by tracks **24**, **26** on a track plate **28**. Sheaves **25** and **27** supported on brackets **29**, **30** roll on the respective tracks. The door lugs **32** project from its lower end into a groove **34** in the floor **35** of the elevator cab; see FIG. 2.

Mounted vertically on the front of the door **22** by brackets **33** is a rail **36** having a groove **38** in which slides a roller **40** on the end of a lever arm **42**. Arm **42** is rotated by a wheel **43** driven by chain **44**. The chain is driven by sprocket gear **46** keyed on shaft **47** with pulley wheel **48**. The pulley wheel is driven by belt **49** entrained on pulley **50** of motor **52**. The motor is energized to open the elevator door by causing arm **42** to rotate as indicated by the arrows in FIG. 1. A gate or door switch **54** having an arm **56** is engaged by upper sheave **27** when the door **22** is closed. A stop member **58** carried by bracket **59** on the roof **57** of the cab serves to limit upward movement of the arm **42**.

Mounted adjacent to the brackets **33** and rail **36** is electromagnet assembly **60** forming one part of the door opening mechanism. This assembly, as shown to best advantage in FIGS. 3–6, includes a rectangular metal plate **62** provided with holes **63** for receiving screws or bolts **61** by which it is secured to the door **22**. Secured to the plate **62** by screws **65** is a smaller rectangular magnetic plate **64** formed of steel. Attached to plate **64** by screws **66** are two spaced magnetic steel blocks **68**, **69** which serve as pole pieces. Secured to the inner sides of the blocks by screws **70** are two spaced parallel magnetic bars **71**, **73** extending vertically above and below the plate **62**. A pair of insulation wrapped coils **72**, **74** are wound around the blocks **68**, **69**. The coils have terminal wires **76**, **78** which may be connected in an energizing circuit to be described.

An elevator entrance door **80** at one floor of a building is shown in FIG. 2. This sliding door is supported by sheaves **82**, **84** riding on rails **86** secured to wall **90** of the building. Projecting from the bottom of the door **80** are lugs **92** which ride in a groove **93** in the floor **94** of the building. Mounted on the rear of the door is a roller assembly **100** shown to best advantage in FIGS. 7–9, to which reference is now made. The roller assembly includes a rectangular mounting plate **102** in which is fixed by screw **103** a pin **104**. On this pin, held

by washer **101** and cotter pin **107**, pivots a lever **106**. The lever has a laterally extending curved finger **108** which engages a stop member **110** when the lever is tilted. Secured to the lever in a hole **110** is a post **112** having a flange **113** at its outer end abutting the lever. The post is secured to the plate by a nut **114** and a set-screw **116**. Secured to the flange **112** by screws **118** is a cup-shaped member **120** having a hole **122** at its outer end **132**.

A cup-shaped roller **124** is axially slidable on the outside of member **120**. Secured to the inner circular side of the roller is a threaded pin **126** having a flanged head **128**. A coil spring **130** is mounted on the pin between the head **128** and the circular end **132** of the member **120**. Roller **124** has an annular flange **134**. The roller is formed of magnetic metal and is adapted to be attracted by the electromagnet assembly to be extended between the bars **71, 73** as indicated by dotted lines in FIG. 9. Pivotally attached to a slotted finger **135** formed integral with lever **106** is a link **140**. This link is connected by an extension **141** to a switch arm **142** of an interlock door switch (see FIG. 10) pivotally mounted in a switch box **144** on the wall **90** above door **80**. A thin rubber sleeve **123** can be secured to roller **124** if desired.

FIG. 10 shows in simplified schematic form part of the interlock door switch **145** in switch box **144**. This switch includes fixed contacts **146** on insulation plate **148** and movable contacts **147** carried on a conductive plate **150** on the end of arm **142**. When the arm **142** is tilted counterclockwise as viewed in FIG. 10, such as occurs when the door **22** starts to open and roller **124** is engaged and pulled by bar **71**, contacts **146** are bridged. This causes relay **152** to be energized via power supply **164**. Contacts **166** of relay **152** close and solenoid **160** is energized via power supply **162** to tilt bell crank **165** on door **80** and disengage catch **167** on wall **90** so that the door **80** may open. Relay **170** is also energized and its normally closed contacts **172** open. These contacts are in the power supply circuit of the elevator motor (not shown) and serve as an interlock switch to prevent the elevator motor from starting while the elevator is stopped and the doors are open.

FIG. 11 shows in simplified schematic form part of the circuit which energizes the electromagnet assembly **60**. The electromagnet coils **72, 74** are energized by power supply **180** in series with normally open contacts **182** of relay **184**. Relay **184** is in series with a conventional slow-down switch **186** and power supply **188**. The slow-down switch is a conventional type of switch as usually employed in automatic elevators. This switch is closed when an elevator cab begins to slow down at a floor to which it has been called.

When switch **186** closes, the relay **184** is energized which closes contacts **182** and causes the coils **72, 74** to be energized so that the electromagnet **60** attracts the roller **124** as bars **71, 73** arrive opposite the roller. After the door of the elevator has opened and closed, the switch **186** is opened and the electromagnet becomes de-energized so that roller **124** is retracted by spring **130**. The roller **124** is thus taken out of the path of movement of bars **71, 73** as the elevator rises or descends.

While we have illustrated and described the preferred embodiment of our invention, it is to be understood that we do not limit ourselves to the precise construction herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described our invention, what we claim as new, and desire to secure by United States Letters Patent is:

1. In a door opener for an automatic elevator, a base plate, a magnetic plate carried by said base plate, pole pieces secured to said magnetic plate, connected coils wound around the respective pole pieces, and elongated magnetic bars secured to the respective pole pieces and extending parallel to each other, said bars having free ends extending beyond opposite ends of said base plate, said bars being spaced to receive a magnetic roller when the coils are energized to magnetize the magnetic plate, pole pieces and bars.

2. In a door opener for an automatic elevator, a base plate, a magnetic plate carried by said base plate, pole pieces secured to said magnetic plate, connected coils wound around the respective pole pieces, and elongated magnetic bars secured to the respective pole pieces and extending parallel to each other, said bars having free ends extending beyond opposite ends of said base plate, said bars being spaced apart a predetermined distance, a magnetic roller having a diameter less than the spacing of said bars to fit therebetween when the coils are energized to magnetize the magnetic plate, pole pieces and bars, a support, a cylindrical member mounted on said support, said roller being axially mounted on said member and movable axially thereon, and spring means retaining and retracting said roller on said member, said roller being extended and held between said bars only when the coils are energized.

3. In a door opener for an automatic elevator, a base plate, a magnetic plate carried by said base plate, pole pieces secured to said magnetic plate, connected coils wound around the respective pole pieces, and elongated magnetic bars secured to the respective pole pieces and extending parallel to each other, said bars having free ends extending beyond opposite ends of said base plate, said bars being spaced apart a predetermined distance, a magnetic roller having a diameter less than the spacing of said bars to fit therebetween when the coils are energized to magnetize the magnetic plate, pole pieces and bars, a support, a cylindrical member mounted on said support, said roller being axially mounted on said member and movable axially thereon, and spring means retaining and retracting said roller on said member, said roller being extended and held between said bars only when the coils are energized, said support including another base plate, a lever pivotally mounted on said other base plate, said cylindrical member being secured to said lever, an interlock switch, and a link operatively connecting said lever and interlock switch for actuating said switch when said roller is contacted by one of said bars.

4. A door opener for an automatic elevator, comprising a roller carried by a support adapted to be mounted on a slidable elevator entrance at a floor of a building, an electromagnet including guide bars adapted to be carried by a slidable gate of an elevator cab, said guide bars being spaced to receive said roller therebetween, spring means on said support normally retracting the roller out of the vertical path of movement of said guide bars when the elevator cab is ascending and descending, said electromagnet being operative to attract and pull said roller against spring tension between the guide bars when the roller is opposite the bars and the elevator cab is stopping at said floor, whereby the elevator entrance door will be opened with the gate of the elevator cab, said electromagnet further including a magnetic plate, pole pieces secured to the magnetic plate, connected coils wound around the respective pole pieces, said guide bars being magnetic members secured to said pole pieces and extending parallel to each other with free ends extending beyond opposite ends of said plate, said support including a base plate, a lever pivotally mounted on said base plate, a cylindrical member secured to said lever, said roller being axially mounted and movable on said cylindrical member, an interlock switch, and a link operatively connecting said lever and interlock switch for actuating said switch when said roller is contacted by one of said bars as the elevator entrance door is opened with the gate of the elevator cab.

5. A door opener for an automatic elevator, comprising a roller carried by a support adapted to be mounted on a slidable elevator entrance at a floor of a building, an

electromagnet including guide bars adapted to be carried by a slidable gate of an elevator cab, said guide bars being spaced to receive said roller therebetween, spring means on said support normally retracting the roller out of the vertical path of movement of said guide bars when the elevator cab is ascending and descending, said electromagnet being operative to attract and pull said roller against spring tension between the guide bars when the roller is opposite the bars and the elevator cab is stopping at said floor, whereby the elevator entrance door will be opened with the gate of the elevator cab, said support including a base plate, a lever pivotally mounted on said base plate, a cylindrical member secured to said lever, said roller being axially mounted and movable on said

cylindrical member, an interlock switch, and a link operatively connecting said lever and interlock switch for actuating said switch when said roller is contacted by one of said bars as the elevator entrance door is opened with the gate of the elevator cab.

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