SAFETY DEVICE FOR AN ELEVATOR DOOR

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The present invention relates to safety devices associated with stationary and movable door parts of an elevator shaft door such as means for checking the closing and locking of the door and more particularly with contactless safety devices having no mechanically interrelated moving parts.

Elevator shaft door safety devices are well known in the art and generally designated as “door contact” and locking contact” safety devices which are often arranged separately on the shaft doors. Each of the safety devices is connected into the safety circuit of the elevator control system so as to prevent the elevator cab from traveling when a shaft door is either open or not locked.

Many different kinds of such devices having electrical contacts are employed. Some use buffer contacts whereby current has to pass the shaft door. According to other known contact type safety devices, a feeler is secured to the door so that when the door is closed the feeler closes a contact arranged in the door frame.

In another contact type safety device known in the art a permanent magnet arranged in the door actuates a mercury switch containing an iron core floating in a pool of mercury arranged in the door frame. Under the influence of the magnetic circuit the floating iron core is forced into the mercury. As the mercury is displaced its level in the glass tube raises and establishes an electrical path between two electrodes.

It is further well known to one skilled in the art that the door locks for elevators must be provided with an electrical device for checking the position of the lock bolt in such a manner that the elevator may follow a call only when all elevator shaft doors are locked. This checking is generally executed by means of electrical contacts such as pill contacts, snap contacts, sliding contacts etc.

All such electrical contacts are provided with mechanical operating means which are often the source of troubles due to wear, spring fractures, dust etc. A further disadvantage of such electrical contacts when used in door lock safety systems resides in the fact that the friction required for their operation often either renders impossible or hinders a complete closing of spring operated shaft doors thus causing an interruption of the elevator operation.

Because of the arcing over of contacts such devices cannot be used in elevators mounted in places in which there is danger of explosion. Also in elevators exposed to high moisture such contacts are forbidden. In either of these cases expensive safety devices having enclosed contacts must be provided.

The invention aims to overcome these afore-mentioned drawbacks by providing safety devices for producing or controlling the electrical signals for an elevator control system associated with the closing and lock checking of the doors wherein the safety devices include contactless switch elements.

It is therefore an object of the invention to provide safety devices comprising saturable magnetic devices having no mechanically interrelated movable parts and which therefore are free of mechanical wear, electrical arcing, corrosion and dirt.

A further object of the invention is to provide contactless safety devices for elevator doors.

Another object of the invention is the provision of control devices with two degrees of signalization for energizing an elevator control circuit of the elevator control system.

Yet another object of the present invention is the provision of improved safety devices which are of simple design and construction, economical to manufacture and highly efficient in the accomplishment of their intended purpose.

In order to accomplish the foregoing objects the present invention proposes the provision of a safety device for an elevator system having a door movable with respect to a door frame for closing off the opening to the elevator shaftway for checking whether the door is closed and whether the door is locked with respect to the door frame.

For these purposes, there is provided an element of saturable magnetic material which is coupled to the door frame, for example, and a permanent magnet coupled to the door; it is to be understood that these elements may be reversed and remain within the scope of the present invention. The element of saturable magnetic material is provided with an electrical conducting wire magnetically coupled thereto and electrically coupling a source of electrical energy to the elevator control circuits of an elevator control system. The saturable magnetic material when saturated presents a low impedance to the flow of electrical current through the electrical conducting wire, and the saturable magnetic material when unsaturated presents a high impedance to the flow of the electrical current through the electrical conducting wire. The permanent magnet when placed in close proximity with the element of saturable magnetic material causes it to become magnetically saturated so that electrical current readily flows through the electrical conducting wire; when the permanent magnet is removed sufficiently from the element of saturable magnetic material, the material becomes magnetically unsaturated so as to present a high impedance and prevent the flow of current through the electrical conducting wire.

There is further provided an iron core element or magnetic short circuiting element which is placed in close proximity with the element of saturable magnetic material to maintain it in its unsaturated condition when not affected by the magnetic field of the permanent magnet. When the permanent magnet is brought into close proximity with the element of saturable magnetic material it is effective to overcome the effect of the magnetic short circuiting element, and further, to cause the saturable magnetic material to become magnetically saturated. Materials, such as ferrites and other well known magnetic materials may be used as the saturable magnetic material.

Furthermore, according to the present invention, there is provided a safety device for an elevator system having a stationary door part and a movable door part for an elevator shaftway door. The safety device includes means for checking the closing of the shaftway door together with means for checking the locking thereof and further includes means for transmitting a control signal to an elevator control circuit which comprises a signalling mechanism coupled to a saturable magnetic device for causing the transmitting means to be rendered operative to transmit the control signal in accordance with the degree of saturation of the saturable magnetic device. Means are also provided in association with the shaftway door for changing the degree of saturation of the saturable magnetic device in order to check the closing and locking of the shaftway door.

While the invention is described herein in the context of safety devices for elevator control systems, it will be
appreciated that it also has application to other problems of safety control systems.

Other features and advantages of the invention will become apparent from the following detailed description when read with the accompanying drawings, showing by way of example, in purely diagrammatical representation, embodiments of the invention.

In the drawings:

FIG. 1 shows a schematic view of an elevator shaft containing a cab and means for moving the cab;

FIG. 2 shows a front view of an elevator shaft door with the cab positioned behind it;

FIG. 3 shows an enlarged, partially sectional front view of means for sensing whether an elevator shaftway door is closed;

FIG. 4 shows a partially sectional side view of the shaftway door locking device;

FIG. 5 is a partially sectional top view of the shaftway door locking device of FIG. 4;

FIG. 6 is a partially sectional side view of the shaftway door showing means for operating the locking device of FIG. 4; and

FIG. 7 is a schematic circuit diagram for the elevator control system.

Referring to FIG. 1, there is illustrated a typical elevator shaftway capable of serving n floors or stories. Positioned within the shaftway is elevator cab 151 capable of serving all of the aforesaid stories, with floors a, b and n being shown for simplicity and purposes of explanation, and which is coupled by means of the usual elevator cables 152 at one end thereof to a conventional driving mechanism. Each floor is provided with a usual shaftway door 164 which, in accordance with the present invention, is capable of being opened when in registry or aligned with a cab door 157 movably coupled to the cab 151. A U-rail 170 is provided for each door 164 and is affixed thereto, for a purpose to be hereinafter explained. A movable sidewalk 191 is provided which cooperates with a magnetic element 193 mounted on the roof of the cab 151 to cause doors 157 and 164 to be closed when in an open condition.

The driving mechanism for cab 151 generally comprises a conventional driving motor 153 with a conventional brake mechanism 154 coupled thereto, a conventional gear drive mechanism 155 to which is coupled a drive pulley 156. The elevator cables 152 are coupled in a well known manner to the drive pulley 156 for raising and lowering the cab 151 in accordance with the direction of rotation of the drive motor 153; it is understood that the gear drive mechanism 155 which is coupled to the drive motor 153 via the brake mechanism 154 controls the speed of the cab 151. A weight W in the usual well known manner, see FIG. 7, is coupled to the other end of cables 152.

Refer now to FIG. 2 which illustrates the cab door 157 in registry with the shaftway door 164 for one of the floors in their operative relationship. In order to simplify the drawings, portions of the apparatus of the elevator system not essential to an understanding of the invention have been omitted, it being understood that the invention is applicable to all elevator systems. Accordingly, cab door 157 is suspended, in a well known manner, from two rollers, not shown, which move or roll on a rail for opening and closing the cab door 157. A door driving device 158 is mounted on the roof of the cab and is coupled to the cab door by means of a door handle 159 and a connecting rod 160. Door driving device 158 comprises a driving crank 161 which is suitably coupled to the connecting rod 160. The cab door 157 is provided with a guide way 163 which receives and guides a guide member or pulley 162. Guide member 162 is coupled to one end of the door handle 159 with the other end thereof being coupled to the connecting rod 160.

Each of the shaftway doors 164 is suspended in a conventional manner from a pair of rollers 165, 166 by means of supports 167, 168, respectively. A rail 169 is provided which is fixed at each end thereof to the conventional material of the shaftway and which supports and guides rollers 165, 166 for rolling action there along. A pulley 171 is positioned on the cab door 157 and cooperates with the U-rail 170 which is fixed onto the shaftway door 164 to open and close the shaftway door 164 in response to the opening and closing of the cab door 157 by means of the door driving device 158. In order to maintain the shaftway door 164 closed in its normal position, there is provided a permanent magnet 90 which is fixed at one end thereof to a wall of the shaftway and at its other end to the support 168, the tension of the spring 172 being sufficient to maintain the shaftway door 164 in its closed position. A control device 180, which forms part of the subject matter of this invention, and which is associated with the conventional elevator system described hereinbefore, is coupled to the shaftway door 164 for controlling the closing position thereof, as will be explained hereinafter. A locking device 185, which also forms part of the subject matter of this invention, is coupled to the shaftway door 164 for maintenance thereof in a locked position, as will be explained hereinafter.

Referring now to FIG. 3, which shows the control device 180 in detail on an enlarged scale together with the associated parts of the shaftway door 164 and with a part of a door frame or jamb 182. Two covers 181 and 183 of non-magnetizable material are provided on the shaftway door 164 and door jamb 182, respectively. Disposed on one side of covers 181 and 183 and affixed to the shaftway door 164 is a permanent magnet 90. Disposed on the other side of covers 181 and 183 affixed to the door jamb 182 and a portion of the shaftway is an element 91 made of saturable magnetic material, preferably of a ferrite. The saturable magnetic element 91 is provided with an aperture 92 through which passes a winding 93 which is connected in a conventional elevator control circuit or in an elevator control circuit of the type shown in FIG. 7, to be explained hereinafter.

FIG. 3 represents a device for checking the closing position of the shaftway door 164. The permanent magnet 90 is secured to the shaftway door 164 and influences a body or saturable magnetic element 91 made of saturable material, preferably of ferrite material and mounted in door jamb 182. The saturable magnetic element 91 is provided with a boring or aperture 92 through which a winding 93 is guided and connected. The latter is connected with the appliance shown in FIG. 7.

When the door is closed the permanent magnet 90 magnetically saturates the element 91, more particularly in the restricted portions 94 and 95. Thereby the self-induction of winding 93 is substantially reduced so that an alternate current applied to the winding 93 easily passes in order to influence the elevator control circuits. Preferably the windings 93 of the different floor doors are connected in series.

Saturable magnetic materials have the property of providing a high or a low impedance as a function of their degree of magnetization. A decrease in the amount or degree of magnetization increases the impedance of the saturable magnetic material and therefore decreases the amount of A.C. current or alternating current power which can pass through winding 93; and, when there is an increase in the degree of magnetization there is an associated decrease in the impedance of the saturable magnetic element 91 with an increase in the amount or degree of magnetization. The saturable magnetic element 91 can pass through winding 93. It is not a simple question of energizing and de-energizing an electromagnetic element which has no degree of magnetization.

When the shaftway door 164 is closed, permanent magnet 90 will cause saturable magnetic element 91 to become saturated magnetically so as to decrease the
impedance of saturable magnetic element 91 so as to diminish substantially the self-induction of the winding 93, whereby A.C. current applied to winding 93 is enabled to pass because of the low impedance of saturable magnetic element 91. It will be evident that as permanent magnet 90 causes saturable magnetic element 91 to become saturated magnetically, especially in the restricted positions 94, 95 of element 91, any additional magnetizing force applied to saturable magnetic element 91 by means of the A.C. current flowing through winding 93 will have a negligible effect on the increase of the impedance of element 91; similarly, when element 91 is magnetically unsaturated, the self-induction of the A.C. current flowing through winding 93 will have a negligible effect on the decrease of the impedance of the saturable magnetic element 91 so that element 91 will present a high impedance to the flow of A.C. current through winding 93 and thereby act as a substantially open circuit and prevent the flow of current therethrough.

When the shaftway door 164 is opened, it will be evident that permanent magnet 90 is removed from the magnetic circuit with saturable magnetic element 91 so that a high impedance will be presented to winding 93 because saturable magnetic element 91 becomes unsaturated. In order to provide a fool-proof and tamper-proof mechanism for insuring that shaftway door 164 is closed, the control device 180 is operatively related to the locking device 185 since it is possible for a permanent magnet whether inadvertently or intentionally to be placed across saturable magnetic element 91 in order to simulate the condition in which the shaftway door 164 is closed.

Referring now to FIGS. 4 to 6 in which the locking device 185 is shown in detail, with the shaftway door 164 in its closed position relative to the door jamb or door frame 182. Shaftway door 164 is provided along its narrow wall with an opening 186 which is in registry with a complementary opening 87 provided in the door jamb 182 for use in connection with the locking device 185.

Locking device 185 comprises a locking bolt 102 rotateably coupled at one end thereof by means of a pin 103 to shaftway door 164 and extends through openings 106 and 187 when it is to be engaged at its other end with a locking edge 188 at the bottom of the opening 187 on door jamb 182. Pin 103 is positioned within the inner wide walls of the shaftway door 164 by means of bearings 100 and 101. The locking bolt 102 is provided with a gripping portion which grips and passes over the locking edge 188 when the elevator cab 151 is not in position behind it.

Shaftway door 164 is provided with a second opening or aperture 188 (FIG. 5) in one of the wide walls thereof through which projects a release lever 104 of non-magnetic material. Release lever 104 which forms part of the subject matter of this invention projects through shaftway door 164 in a direction substantially perpendicular to locking bolt 102 for engagement with the underside thereof. Release lever 104 projects from the inside portion of the shaftway through the wide side of the shaftway door 164 facing the shaftway for cooperative engagement with the movable slideways when the elevator cab 151 is positioned behind shaftway door 164. Access to the release lever 104 is obtainable solely from the inside of the shaftway. Release lever 104, when shaftway door 164 is closed and when elevator cab 151 is not positioned therebehind, is normally held in engagement with a stop 190 fixedly provided at the bottom edge of the door facing the floor entrance to the elevator cab 151 by means of a spring 189. Spring 189 has one end thereof coupled to a projecting member coupled to shaftway door 164 and the other end coupled to release lever 104; the tension of spring 189 is normally effective to maintain releasement of engagement with the stop 190. The movable slideway 191 is coupled via a connecting rod 192 to the magnetic element 193 (see FIG. 1) for a purpose to be hereinafter explained and is effective to press against release lever 104 to raise it into engagement with locking bolt 102 by overcoming the tension of spring 189 on the release lever 104 when the elevator cab 151 is positioned behind shaftway door 164. Release lever 104 is then effective to raise locking bolt 102 so as to disengage it from locking edge 188.

In order to indicate that shaftway door 164 is locked to the elevator control system, a permanent magnet 106 is fixed to the locking bolt 102. An element 107 of saturable magnetic material is built into the door jamb or frame 182 and is preferably provided with a boring or aperture 186 through which passes a winding 109 which is coupled to the elevator control system. Directly adjacent to the winding 109 is an element 107 which is a magnetic short-circuiting element for example, an iron plate 110 which has an effect such that the magnetic lines of flux of the permanent magnet 106 are effectively short-circuited until the locking bolt 102 has gripped sufficiently over the locking edge 188 to provide a high impedance and maintain element 107 magnetically unsaturated. Iron plate 110 which is positioned close to element 107 is effective to maintain it with a low degree of magnetization when an A.C. current passes through winding 109 and therefore a high impedance to the flow of the A.C. current through the winding 109 in a manner similar to the operation of control device 180.

When the shaftway door 164 is locked, the permanent magnet 106 acts on element 107 which magnetically saturates. When the elevator cab 151 moves behind the shaftway door 164, the pulley 171, see FIG. 2, engages the U-strap 170. The elevator control system interrupts the current to the magnet 193, as explained subsequently in connection with FIG. 7 so that the movable slideway 191 moves into its position as shown in FIG. 6 thus causing, by way of the release lever 104, the disengagement of the locking bolt 102 from the locking edge 188. The permanent magnet 106 is no longer able to act on the element 107 which, therefore, becomes unsaturated. This change of condition in the element 107 is used for signal control in FIG. 7 as is hereinafter described. As soon as the locking bolt 102 has reached its release position, the door driving device 158, see FIG. 2, is set in motion and opens the elevator cab door 157 and the shaftway door 164 in a manner known per se.

Referring now to FIG. 7 which shows a simplified circuit diagram for the elevator control system together with its associated mechanical elements of the elevator system. While a particular elevator control system is shown, it will be obvious to those skilled in the art, that other conventional controls may be used. The same reference characters designate the same elements throughout all of the figures. Driving motor 153 is fed from a three-phase power source having lines R, S and T and is directly coupled to line R and through the parallel circuit of reversing switches RU1 and RU2 to lines S and T for causing upward and downward movement of elevator cab 151. Coils 231 and 232 energized from elevator control 200 are effective when energized to cause switches RU1' and RU2' respectively, to be closed. It is understood that either coil 231 or 232 is energized so that only one switch, switch RU1 or RU2 is closed when the elevator cab 151 is to be operated. Also coupled to lines S and T is the primary winding of transformer T which has two secondary windings 201 and 202. Secondary winding 201 is coupled to elevator control 200 through a rectifier G1. Coupled to brake mechanism 154 is a braking solenoid 230 that is coupled to and operable in response to the energization from the elevator control 200 to release the brake mechanism 154 so that elevator cab 151 may be raised or lowered as determined by the closing of switches RU1' or RU2'. Magnetic element 193 is coupled to the elevator control 200 and when energized thereby causes cab door 157 and shaftway 164 to be opened.

Another rectifier G2 comprising diodes 203 and 204 connected in full wave relationship and condensers 205
3,054,475 7 and 206 is coupled to and across the output of secondary winding 202. One conductor coupling the secondary winding 206 to rectifier 202 is coupled to one end of capacitor 205 and 206 and leads to an output conductor L1. Two other output conductors L2 and L3 leading from rectifier G2 are provided. Conductor L2 is coupled to the other end of capacitor 206 and through diode 204 to the other conductor leading from secondary winding 202, and conductor L3 is coupled to the other end of capacitor 205 and through diode 203 to said other conductor leading from secondary winding 202, conductors L2 and L3 branching from said other conductor through diodes 203 and 204.

An oscillate 207 comprising transistors 212 and 213, connected in push-pull, is connected at an input 208 to conductor L1 and to the one conductor leading from the secondary winding 202 and at a second input 209 to conductor L2. The emitters of transistors 212 and 213 are coupled together and are connected to conductor L2 through input 208. The collectors are coupled to a center-tapped primary winding of an iron-core transformer Tr1. The bases are coupled through reaction or feed back with the collectors 214 and 215 and to the junction of resistors 210 and 211 coupled between inputs 209 and 208 respectively. Resistor 211 is coupled to the junction of input 203 and the emitters. The secondary winding of transformer Tr1 has two output lines 216 and 217, line 216 being coupled directly to conductor L1 and line 217 being coupled to the windings 93 and 109 of the control device 180 and locking device 185, respectively (FIGS. 2, 3 and 5).

As noted in FIG. 3, a single control device 180 was shown for purposes of simplification of the explanation of the invention, it being understood that a control device 180 is provided for each floor a, b and n. The windings 93a, 93b, and 93n are connected in series through their associated saturable magnetic elements 91a, 91b and 91n, respectively. Permanent magnets 90a, 90b and 90n cooperate with saturable magnetic elements 91a, 91b and 91n in accordance with the discussion in connection with FIG. 3 to control relay RT which is effective to control the operation of control switch K1 coupled to the elevator control 200 to block the same when it is in its open condition as shown.

Relay RT is coupled at one end to conductor L2 and at its other end to the collector of a transistor 220. A capacitor 222 which by-passes relay RT is provided to smooth the current energizing relay RT and to prevent arcing and a false holding at the contacts thereof. The emitter of transistor 220 is coupled to the output 216 of the secondary winding of transformer Tr1 and conductor L1. The base of transistor 220 is coupled through resistor 221 to conductor L3 to apply a bias to the transistor. The base of the transistor 220 is also coupled to winding 93, and particularly winding 93n, through a blocking or coupling capacitor 218 and resistor 219. Winding 93n is also coupled at its point of connection to capacitor 218 to one end of an operating resistor 223 the other end of which is coupled to conductor L1.

In a further manner, a locking relay RV is provided to control the operation of a locking switch KV which is coupled to the elevator control 200 to block the same when switch KV is in its open condition as shown. The circuits for the control device 180 and the locking control device 185 between the outputs of the secondary winding of transformer Tr1 and conductors L1, L2 and L3 being the same.

The locking control device 185 consists of elements 107a, 107b and 107n with the windings 109a, 109b, 109n connected in series. The elements 107a, 107b, 107n are influenced by permanent magnets 106a, 106b, 106n (see also FIGS. 4 and 5). The winding 109a is connected to the output 216 of the secondary winding of transformer Tr1 which is the signal output of the oscillator 207. An operating resistor 230 is connected to the winding 109a and to the emitter of a transistor 227. Furthermore, a conductor couples the base of the transistor 227 via resistor 228 to the conductor L3. The emitter of the transistor 227 is connected to a connection between the output 216 and the conductor L1. The collector of the transistor 227 is coupled via relay RV to the conductor L2. A smoothing capacitor 229 is connected in parallel to the relay RV.

The circuit shown employs transistors of the NPN junction or point contact type. In a PNP transistor, the emitter is positive with respect to the collector. If an NPN transistor is used, it is necessary to reverse the polarity of the collector with respect to the emitter, and accordingly it is necessary to reverse the connections of the diodes 203 and 204 to change the polarities of the direct current voltage applied to the collector-emitter circuits of the transistors.

For the purpose of explanation of the operation of the novel control and locking devices 180 and 185, it is assumed that the elevator cab 151 is in a position of rest at the floor designated a, as shown in FIG. 1, with the elevator cab door 157 and shaftway door 164 assumed to be closed. It is for this reason that permanent magnets 90a, 106a and 106b are shown in a saturated condition with respect to elements 91b and 107b, respectively, in FIG. 7. Permanent magnet 90b is now unable to cooperate with saturable magnetic element 91b so as to cause it to become magnetically saturated. When saturable magnetic element 91b is not magnetically saturated, an alternating current which is generated as an output from the secondary winding of transformer Tr1 is blocked so that an A.C. current is prevented from passing from output 217 to the base of the transistor 220. Consequently, no voltage is generated by current passing through operating resistor 223 so that the emitter-base circuit of transistor 220 is cut off whereby to render transistor 220 non-conductive or inoperative. When transistor 220 is inoperative no direct-current voltage from conductors L1, L2 can be applied across relay RT to energize the same so as to close switch KT. When switch KT is open the elevator control 200 is blocked and rendered inoperative.

The operation of the circuit for the locking device 185 is the same as for the control device 180. Consequently, when shaftway door 164 is open relay RV is deenergized and its associated locking switch KV is also open so as to render the elevator control 200 inoperative independently of switch KT. It is understood that when permanent magnetic elements 107a, 107b, 107n are unsaturated and no A.C. current can pass through winding 109b so as to apply an A.C. voltage on operating resistor 230.

If a passenger now enters the elevator cab 151 and operates the cab push button on the n-th floor, the elevator control 200 causes the doors 157 and 164 to close by way of the door driving device 158, as explained in connection with FIG. 2. The magnet 193 attracts the movable slide 191. The magnets 90a and 106b saturate the elements 91a and 107b. The alternating current generated by the oscillator 207 is now able to pass through the windings 93a and 93b, and the transistors 220 and 221 are rendered conductive or operative to cause the energization of the relays RT and RV. The contacts KT and KV are closed and counteract the blocking or deenergization of the elevator control 200. The braking magnet 230 is energized to release the brake mechanism 154, and the coil 231 of the relay RUI is also energized and closes same, so that the elevator cab 151 is set in motion in an upward direction to move it from floor b to floor n.

As soon as the desired floor is reached, the switch RUI opens and the brake mechanism 154 is engaged to prevent any further movement of the elevator cab 151. The magnet 193 drops out, and the movable slideway 191 causes, by way of the release lever 168 (see FIG. 6), the disengagement of the locking bolt 192 from the locking.
edge 105. The door driving device 158 opens the doors 157 and 164. The magnets 90n and 106n are no longer able to hold the doors 57 and 564 in the closed position, as shown in FIGs 91a and 107a, thereby causing the opening of the contacts KT and KV and rendering elevator control 200 inoperative whereby to prevent operation of the elevator cab 151 or the opening of the shaftway doors 164 on floors a, b.

Consequently, while we have shown and described what are now thought to be the preferred forms of the invention, it is to be understood that the same is susceptible of other forms and expressions. Consequently, we do not limit ourselves to the precise structures shown and described hereinabove, except as hereinafter claimed.

We hereby claim:

1. A safety device for an elevator system having a stationary door part and a movable door part of a shaftway door for an elevator system, means for checking the closing of said shaftway door and for checking the locking of said shaftway door with means for transmitting a control signal to an elevator controller, comprising a saturable magnetic device associated with said shaftway door, signal means coupled to said saturable magnetic device for rendering said transmitting means operative to transmit said control signal in accordance with the degree of saturation of said saturable magnetic device and means associated with said shaftway door for measuring the degree of saturation of said magnetic device to detect the closing and locking of said shaftway door.

2. A safety device as claimed in claim 1 wherein said saturable magnetic device includes a body of saturable material provided with at least a winding, said body being influenced by magnetic elements producing at least a partial saturation, the saturating effect being varied by movable members and the obtained variation being used for signaling.

3. A safety device as claimed in claim 1 wherein said saturable magnetic device includes a short-circuiting element arranged immediately next to said signal means and having the effect that the signal for the locking check of the door is transmitted to the elevator control only after sufficient locking of the lock.

4. A safety device for an elevator control system provided with a shaftway door closing into a door frame forming part of an elevator shaftway enclosure for an elevator cab and a signal control system when energized that said shaftway door is locked to said door frame, comprising a locking device associated with said shaftway door and said door frame, said locking device including a saturable magnetic element, a magnetic short circuiting element directly adjacent to said saturable magnetic element, the same in its unsaturated condition and a permanent magnet movable to a first position adjacent to said saturable magnetic element to cause it to become magnetically saturated and overcome the effect of said magnetic short circuiting element when said locking device locks said shaftway door to said door frame and movable to a second position out of magnetic circuit with said saturable magnetic element to permit said magnetic short circuiting element to control when said locking device does not cause said shaftway door to be locked with said door frame, a signal control winding magnetically coupled to said saturable magnetic element, to a source of alternating current and to said signal control system, said winding being rendered conductive when said permanent magnet is moved to said first position thereof, said winding energizing said signal control system when said permanent magnet is in said first position thereof.

5. A device as claimed in claim 4, in which said shaftway door is provided with a first opening facing said door frame, and with a second opening in one panel thereof facing said elevator shaftway and said door frame being provided with a locking edge and a third opening in alignment with said first opening, said locking device comprising a locking bolt rotatably coupled to said shaftway door between the panels thereof, said locking bolt having a gripping edge at a free end thereof for gripping said locking edge when said shaftway door is locked and said locking bolt passing through said aligned second and third openings, for maintaining said shaftway door in said closed position, said saturable magnetic element and said short circuiting element being coupled in spaced positions to each other and on an inner portion of said door frame adjacent said third opening, said permanent magnet being coupled to said gripping edge of said locking bolt and rotatable therewith, said permanent magnet being moved to said first position thereof when said gripping edge grips said locking edge and when said gripping edge is ineffective to grip said locking edge said permanent magnet is in said second position thereof and ineffective to cause said saturable magnetic element to become saturated whereby said short circuiting element maintains said saturable magnetic element unsaturated, and means coupled to said locking bolt through said second opening for moving said permanent magnet to said second position also effecting the movement of said locking bolt.

6. A device as claimed in claim 4, in which said shaftway door is provided with a first opening facing said door frame, and with a second opening in one panel thereof facing said elevator shaftway, said door frame being provided with a locking edge and a third opening in alignment with said first opening, said locking device comprising a locking bolt rotatably coupled to said shaftway door between the panels thereof, said locking bolt having a gripping edge at a free end thereof for gripping said locking edge when said shaftway door is locked and said locking bolt passing through said aligned second and third openings, for maintaining said shaftway door in said closed position, said saturable magnetic element and said short circuiting element being coupled in spaced positions to each other and on an inner portion of said door frame adjacent said third opening, said permanent magnet being coupled to said gripping edge of said locking bolt and rotatable therewith, said permanent magnet being moved to said first position thereof when said gripping edge grips said locking edge and when said gripping edge is ineffective to grip said locking edge said permanent magnet is in said second position thereof and ineffective to cause said saturable magnetic element to become saturated whereby said short circuiting element maintains said saturable magnetic element unsaturated, and means coupled to said locking bolt through said second opening for moving said permanent magnet to said second position also effecting the movement of said locking bolt.

7. A safety device for an elevator control system provided with a shaftway door and a door jamb therefor and a signal control system when energized indicating that said shaftway door is in a closed position with respect to said door jamb, comprising a control device associated with said shaftway door and said door jamb including a saturable magnetic material and a permanent magnet, and a signal control winding magnetically coupled to said saturable magnetic material and to a source of alternating current and to said signal control system, said saturable magnetic material when unsaturated presenting a high impedance to the flow of said alternating current through said control winding and when saturated presenting a low impedance to the flow of alternating current through said control winding to allow said alternating current to pass through to energize said signal control system.

8. In an elevator control system including an elevator shaftway, an elevator cab movable within said shaftway, a door frame forming part of the structure of said shaftway, a shaftway door coupled to said door frame and a safety device coupled to said door frame and said shaftway door for rendering said elevator cab immobile when said door and door frame are in an unlocked condition, comprising a saturable magnetic element associated with said door and movable between a first position in which said door is locked to said door frame and a second position when said door is unlocked to said door frame, an electrical current conducting winding magnetically coupled to said saturable magnetic element rendered conductive when said permanent magnet is in said first position and non-conductive when in said second position.

9. In an elevator control system as claimed in claim 8, including a locking bolt coupled to said door frame, a gripping member on said locking bolt, a locking edge coupled to said door frame, said gripping member gripping said locking edge in said first position of said permanent magnet whereby to lock said door to said door frame.

10. In an elevator control system as claimed in claim 9, in which said short-circuiting element is effective to maintain said saturable element desaturated to present a high impedance to the flow of electrical current through said wire.

11. In an elevator control system as claimed in claim 10, in which said permanent magnet is coupled to said gripping member and is positioned in close proximity to said saturable element and said iron plate whereby to cause said saturable magnetic element to become satu-
11. In an elevator control system as claimed in claim 11, in which said saturable element is provided with a bore, said wire passes through said bore for the magnetic coupling with said saturable element.

12. In an elevator control system as claimed in claim 12, including a signal control device associated with said door and said door frame when energized indicating when said shaftway door is in a closed position and in an open position with said door frame and comprising, a saturable magnetic material, a permanent magnet operatively associated with said saturable magnetic material and a signal control winding magnetically coupled to said saturable magnetic material, said saturable magnetic material when unsaturated presenting a high impedance to the flow of electrical current through said signal control winding and a low impedance when saturated, said saturable magnetic material being provided with an aperture therethrough for coupling thereto said signal control winding, said permanent magnet being placed in close proximity to said saturable magnetic material when said door is in said closed position to saturate said magnetic material and to remove said permanent magnet from the magnetic field of said saturable magnetic element when said door is in said open position to unsaturate said saturable magnetic material.

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