Sept. 28, 1954 J. F. COURTNEY 2,690,481

SWITCH FOR AUTOMATIC SAFETY LOCKING DEVICES AND SYSTEMS

Filed March 25, 1949 4 Sheets-Sheet 1

Fig-1

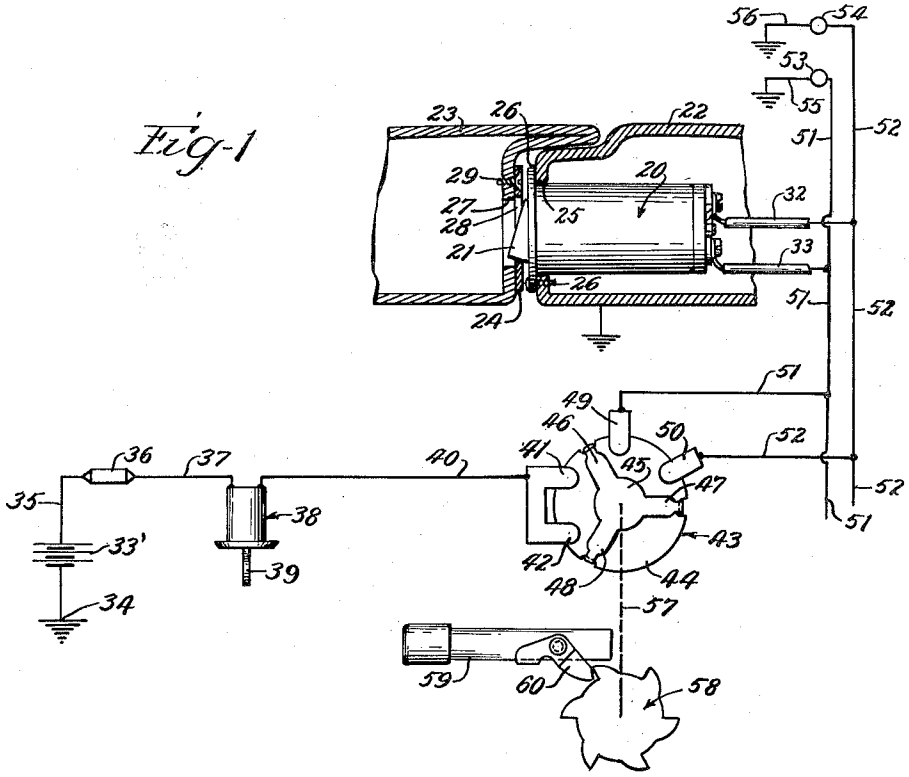


Fig-2

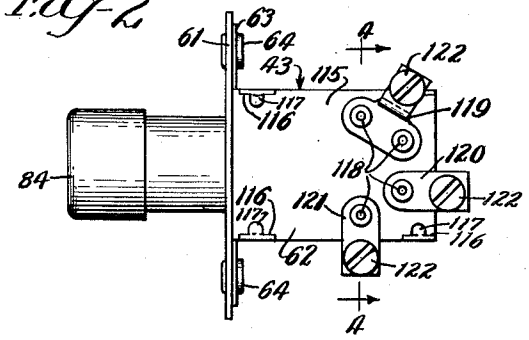
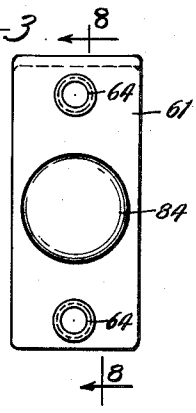


Fig-3



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SWITCH FOR AUTOMATIC SAFETY LOCKING DEVICES AND SYSTEMS

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Fig-4

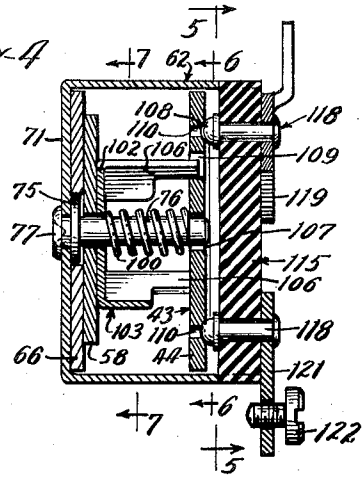


Fig-5

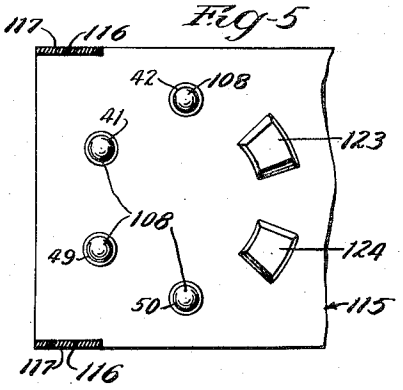


Fig-6

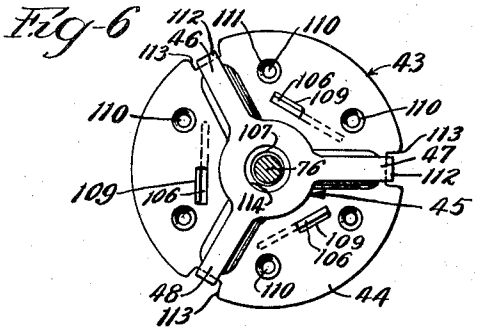


Fig-7

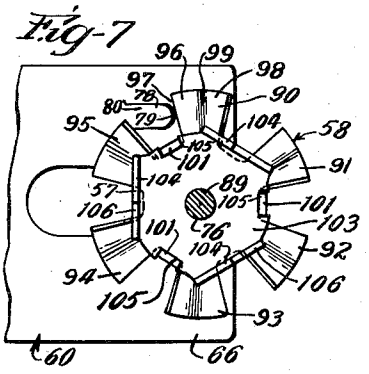
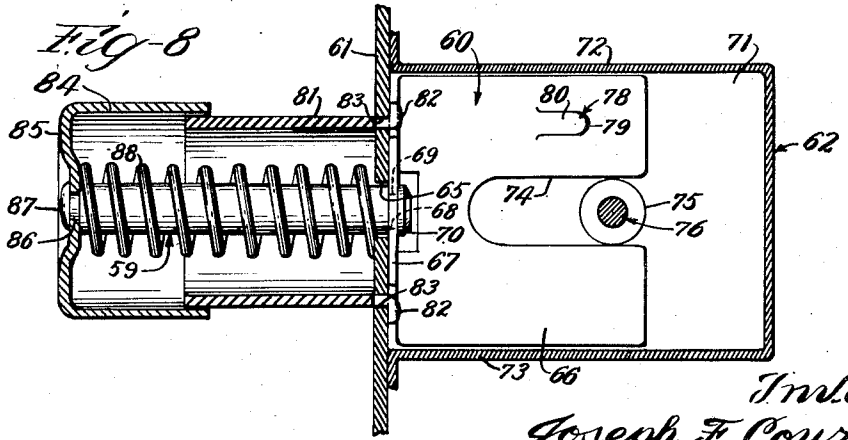


Fig-8



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SWITCH FOR AUTOMATIC SAFETY LOCKING DEVICES AND SYSTEMS

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Fig-9

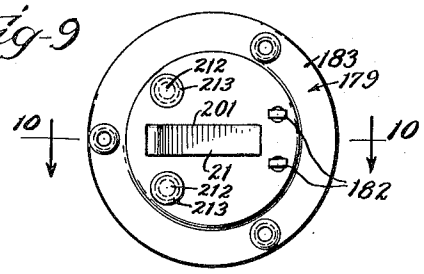


Fig-11

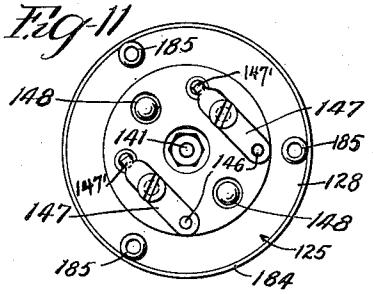


Fig-10

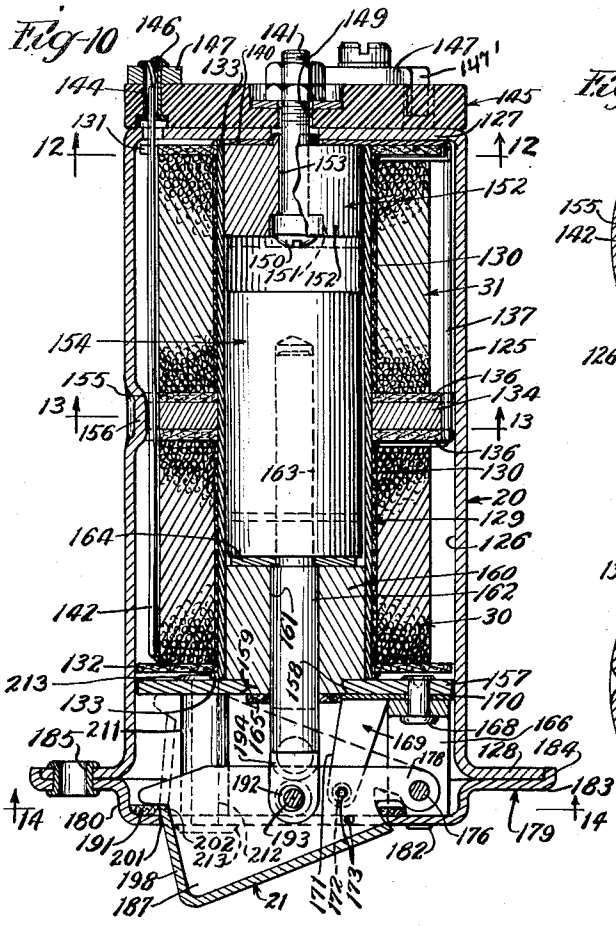


Fig-12

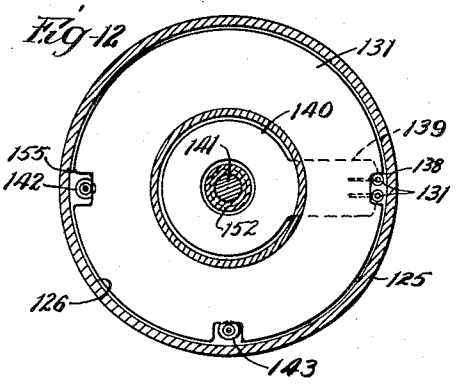
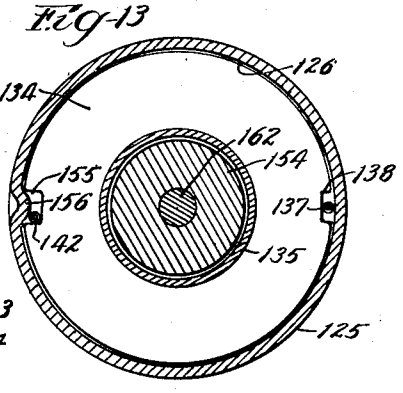


Fig-13



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SWITCH FOR AUTOMATIC SAFETY LOCKING DEVICES AND SYSTEMS

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Fig-14

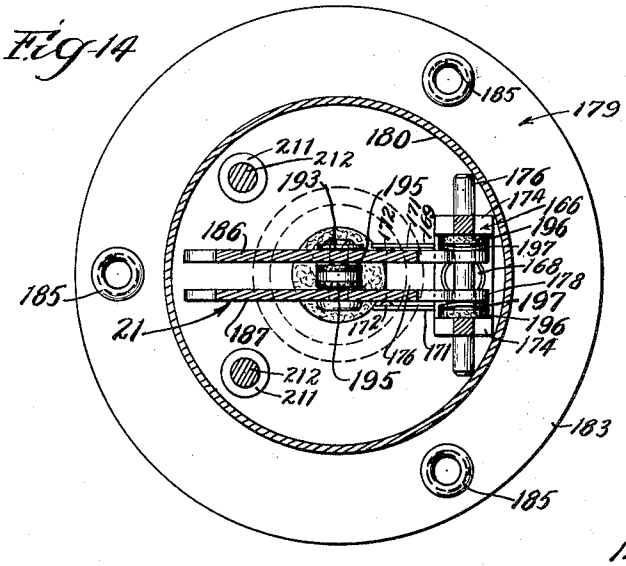


Fig-16

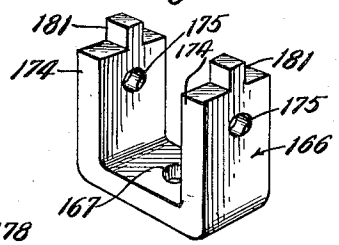


Fig-15

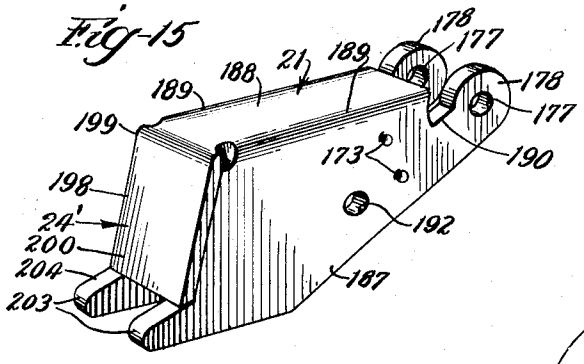
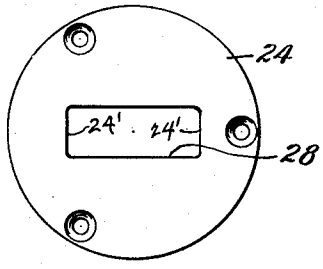


Fig-17



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Patented Sept. 28, 1954

2,690,481

UNITED STATES PATENT OFFICE

2,690,481

SWITCH FOR AUTOMATIC SAFETY LOCKING DEVICES AND SYSTEMS

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Application March 25, 1949, Serial No. 83,395

2 Claims. (Cl. 200—11)

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The present invention relates to automatic safety locking devices and systems, and is particularly concerned with such electrical systems and devices which may be employed for overriding the operation of any ordinary locking system of automotive vehicle doors to prevent the unauthorized entry from the outside or the unauthorized opening of the doors from the inside.

One of the objects of the invention is the provision of an improved electrical locking system and locking devices which may be controlled by the operator of an automotive vehicle to prevent the unauthorized entry into the vehicle of any persons from the outside, such as holdup men, and which is also adapted to prevent children from unlocking and opening the doors from the inside, which has in the past resulted in many children falling out of automobiles while in motion, resulting in their serious injury.

Another object of the invention is the provision of an improved automatic interlocking safety device which may be used to lock or unlock doors or other devices by remote control by means of a single remote switch button, which is to be actuated by the operator at will.

Another object of the invention is the provision of improved electrical locking systems and devices which are of general application and may be used as a means of safety for interlocking remotely controlled electrical devices, machinery operations, truck doors, windows, gates, aircraft controls, etc.

Another object of the invention is the provision of improved systems and locking devices which may be operated to control one or more sets of doors at the option of the operator, and which is also provided with a key tumbler lock to make the system inoperative by unauthorized persons, such as garage and parking lot attendants.

Another object of the invention is the provision of improved systems and devices of the class described, which are simple, capable of economical manufacture with a minimum number of machine operations, permanently and automatically lubricated, sturdy, capable of easy installation, permanently enclosed and protected from unauthorized tampering and from the entry of dust, and which are adapted to be used for a long period of time without necessity for repair or replacement of any of their parts.

Another object of the invention is the provision of improved systems and devices of the class described, which are provided with indicators for indicating whether they are locking or unlocking, and which are so constructed that rattling is

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prevented and the moving parts of the device are held in their actuated position and will not be moved by ordinary vibration or shock.

Another object of the invention is the provision of an improved locking unit which utilizes a minimum amount of current, being actuated by a momentary impulse, and which is so constructed that the locking element will not be damaged by the closure of the door when the locking element is in the locked position.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the four sheets of drawings accompanying the specification,

Fig. 1 is a diagrammatic sectional view of the electrical system, showing the latching arrangements in connection with the door in cross section, and including a wiring diagram for such an electrical system;

Fig. 2 is a side elevational view of a foot actuated switch used in the system;

Fig. 3 is an end elevational view of the switch of Fig. 2;

Fig. 4 is a sectional view, taken on the plane of the line 4—4 of Fig. 2, showing details of construction of the switch;

Fig. 5 is a fragmentary sectional view, taken on the plane of the line 5—5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 is a fragmentary sectional view, showing the rotatable switch member in end elevation on the plane of the line 6—6 of Fig. 4, looking in the direction of the arrows;

Fig. 7 is a fragmentary sectional view, showing the ratchet wheel in elevation, and taken on the plane of the line 7—7 of Fig. 4;

Fig. 8 is a fragmentary sectional view, taken on the plane of the line 8—8 of Fig. 3, showing the details of construction of the housing, switch, actuating plunger, and the pawl;

Fig. 9 is an end elevational view of the solenoid controlled latching unit which forms part of Fig. 1;

Fig. 10 is a longitudinal sectional view on the plane of the line 10—10 of Fig. 9, showing the details of construction of the solenoid controlled latching unit;

Fig. 11 is a top plan view of the upper end of Fig. 10;

Fig. 12 is a sectional view, taken on the plane of the line 12—12 of Fig. 10, looking in the direction of the arrows;

Fig. 13 is a sectional view, taken on the plane

of the line 13—13 of Fig. 10, looking in the direction of the arrows;

Fig. 14 is a sectional view, taken on the plane of the line 14—14 of Fig. 10, looking in the direction of the arrows;

Fig. 15 is a view in perspective of the latching member;

Fig. 16 is a view in perspective of the pivot bracket for the latching member of Fig. 15;

Fig. 17 is an elevational view of the keeper.

Referring to Figure 1, this is a diagrammatic illustration of the wiring circuit and devices which make up the improved safety locking system embodying the invention. 20 indicates a solenoid controlled locking unit provided with a movable latching member 21, and shown in connection with an automotive vehicle body frame 22 and door 23.

The present devices may be installed with the keeper 24 on the frame or on the door, the locking unit 20 being installed on the opposite member comprising the door or frame. For the purpose of illustration, the frame 22 has its edge adjacent the door provided with a circular aperture 25 for receiving the locking unit, the attaching flange 26 of which is secured to the frame by a plurality of self-tapping screw bolts 26.

The door 23 has its adjacent edge provided with an aperture 27, which may be round for ease in boring with ordinary tools, this aperture being covered by a keeper or striker plate 24, which has an elongated slot 28 for receiving the elongated latching member 21.

The keeper 24 is secured in place by a plurality of self-tapping screw bolts 29, which pass through apertures in the keeper and are threaded into the edge wall of the door. The locking unit 20 preferably includes a pair of solenoid coils 30, 31, Figure 10, the common terminals of both coils being grounded, as will be further described, and the other terminals being connected to the conductors 32, 33 of the wiring diagram, Figure 1.

The present system may be embodied in a grounded system which employs the frame as one of the conductors, or it may be embodied in a completely wired system, in which case an extra wire would be used instead of the ground. As illustrated, the system is energized by means of a battery 33', one terminal of which is connected to ground at 34 and the other terminal of which is connected to a conductor 35, which includes a line fuse 36 in series.

From the line fuse 36 the conductor 37 extends through a key-actuated tumbler barrel switch 38, so that the entire system may be made inoperative by turning and removing the key 39 to prevent its unauthorized use by garage and station attendants, or children in the front seat. When thus locked, by means of the key switch 38, the circuit is broken at this switch and the locking unit 20 will be maintained in the unlocked or locked condition, whichever the case may be at the time.

This is an important safety feature as it prevents the inadvertent actuation of the controlling switch until the operator uses the key, and if anyone should step upon the actuating switch it will not unlock the door as long as the switch 38 is on open circuit.

From the switch 38 a series conductor 40 extends to the two fixed contacts 41, 42, carried by a switch housing and forming a part of the controlling switch, these contacts being joined together so that both are energized.

The controlling switch which is indicated in its entirety by the numeral 43, includes a rotatable switch member 44 which has a movable contact member 45, with a plurality of arms 46, 47, 48 adapted to serve as bridging contact members for the momentary closure of the circuit.

The switch housing also supports a pair of fixed contact members 49, 50, which are connected to the coils of the locking unit 20 for controlling the locking unit. Conductor 51 extends from contact 49 to conductor 33 which leads to one of the coils. Conductor 52 extends to the other conductor 32 leading to the other coil terminal.

In order to indicate the momentary energization of the locking unit 20, the conductors 51 and 52 are extended and connected to the two signal lights 53, 54, one of which is preferably green and the other of which is red. The other terminals of these signal lights are connected by conductors 55 and 56 to ground.

Thus the green light may be used to indicate the locking of the locking unit, indicating a condition of safety, and the red light may be used to indicate the act of unlocking the locking unit 20, indicating a condition of danger.

The rotary switch unit 44 is provided with detent means for holding it in its fixed positions intermediate all of the fixed contacts, such as the position illustrated in Figure 1, where all of the circuits are open. This is the condition which preferably exists at all times except when the switch is being actuated, so that the present device utilizes a minimum amount of electrical energy and does not impose a severe drain on the batteries, as is the case with some of the devices of the prior art. The same is true of the signal lights which are turned on only momentarily when the switch is being actuated from one position to another.

The rotatable switch member 44 is provided with an operative connection 57 with a ratchet wheel 58, this being indicated by the dotted line in Figure 1. The ratchet wheel is adapted to be actuated step by step by means of a slidably mounted plunger 59, further to be described, and provided with a pawl 60, all of which is shown diagrammatically in Fig. 1.

At each actuation of the plunger 59 the ratchet wheel 58 is stepped one step in a clockwise direction, carrying with it the rotatable switch member 44, which causes one of the contact arms 46—48 to momentarily establish a bridging connection between the fixed contacts 41, 42, and one of the other fixed contacts 49 and 50. The contact engagement is momentary because the rotatable switch member 44 only establishes a circuit while wiping over the contacts, and immediately moves on to another inoperative position in which it is positioned sixty degrees from the position shown in Fig. 1.

The extended lines 51 and 52 of the conductors in the diagram indicate that this circuit may include a multiplicity of the locking devices 20 and signal lights, such as, for example, a locking device on both front doors. It may also include a pair of locking devices for both back doors with a separate controlling switch 43, and all of the doors may be controlled by one switch and four locking units.

The switch or switches are preferably placed on the floor at some position remote from the usual dimmer switch, such as, for example, between the brake and clutch pedals, where it can be actuated by the toe of the right foot. If two switches are used, they are preferably placed side by side.

Referring to Figs. 2 to 8, these are illustrations of the structure and arrangement of the step-by-step controlling switch preferably employed. The switch may include a supporting plate 61, which supports a box-like switch housing 62 to which it is secured at the attaching flanges 63 by means of a plurality of eyelet rivets 64. The eyelet rivets are also used for passing screw bolts which secure the switch to the floor.

The face plate 61 of the switch has a through bore 65, Figure 8, for passing the reciprocating plunger 59, which carries the ratchet wheel actuator 60 at its inner end. This ratchet wheel actuator comprises an angular metal plate having a guide flange 66 and an attaching flange 67. The attaching flange 67 has a through bore 68 which receives the reduced end 69 of plunger 59, the plunger being riveted over at 70 to secure the plunger and ratchet actuator 60 together.

The guide flange 66 is preferably rectangular in shape, having a sliding fit against the bottom 71 of the housing 62, and it is guided by the sides 72, 73 of the housing. The guide flange 66 has a longitudinally extending slot 74 which may slide on the opposite sides of a circular portion 75 of the stub shaft 76. The end of the stub shaft 76 passes through the bottom wall 71 and is riveted over at 77.

The guide flange 66 preferably has a punched finger or tab 78 punched out of its body at a suitable distance from the shaft 76 and extending diagonally upward out of the body of the flange 66. The end 79 of the tab constitutes the actuating shoulder of a pawl comprising the tab 78, and the sloping surface 80 of this tab constitutes a camming surface which cams the ratchet wheel 58 axially on the shaft 76 to pass the ratchet wheel shoulder on the return movement to the left.

The actuating plunger 59 is preferably surrounded by a metal tube 81 which has a pair of integral elongated fingers 82 on its right end, Figure 8, passing through slotted apertures 83, and bent outwardly to secure the tube 81 to the face plate 61. The open end of the tube 81 is closed by means of a telescoping cap 84, which has an easy sliding fit on the tube 81 and has its end wall 85 fixedly secured to the plunger 59.

For this purpose the plunger 59 may have a reduced portion 86 which passes through an aperture in the end wall 85 of the cap 84, this reduced portion being riveted over at 87 in a pressed recess in the top of the cap. A helical compression spring 88 preferably surrounds the plunger 59 and engages the inside of the cap 84 at one end and the outside of the face plate 61 at the other end.

Thus the spring 88 constantly urges the telescoping cap 84 into extended position, the plunger 59 carrying with it the ratchet actuator 60 which is normally held in the position of Figure 8. The ratchet wheel 58 preferably comprises a metal disc provided with a central aperture 89 for receiving stub shaft 76, and with a plurality of radially extending integral arms 90—95, each of which has a flat portion 96 on its trailing side, the edge 97 of which serves as a ratchet wheel abutment for engagement with the end 79 of the pawl 78.

The leading portion 98 of each arm on the ratchet wheel is bent upwardly at an obtuse angle along the radial line 99, so that its lower surface may serve as a cam for riding over the pawl 78 as the pawl moves backward to the

position of Figure 8. During this backward movement the ratchet wheel 58 must be moved bodily in an axial direction on the shaft 76 against the pressure of spring 100, Figure 4, in order to let the pawl pass the arm of the ratchet wheel which it has just actuated.

In order to connect the ratchet wheel to the rotatable switch member 43, the ratchet wheel preferably has a plurality of axially extending rectangular tabs 101, these being located between the axially spaced arms. Three such tabs are sufficient, and they are located between alternate arms. The tabs 101 engage in peripheral slots in the base plate 102 of the connecting member 103, Figure 4, which is preferably in the form of a spider to permit an adequate length of the spring 100.

The spider 103 has a hexagonal base plate, three of the sides being wider and provided with axially extending flanges 104. The narrow sides have the peripheral slots 105. The flanges 104 extend in an axial direction and are long enough to extend from the ratchet wheel 58 to the rotary switch member 43, the latter being provided with rectangular apertures or slots to receive the ends 106 of the flanges 104.

Thus the spider 103 constitutes a connecting member or drive between the ratchet wheel 58 and the rotary switch member 43 which is mounted on the same shaft. The rotary switch member 43 preferably comprises a disc of insulating material, such as insulating fiber re-enforced with fabric having a central aperture 107 for receiving the stub shaft 76.

The length of the spring 100, which surrounds the shaft 76, is such that it is already initially compressed when the rotary switch disc is placed on the shaft; and the rotary switch disc 43 may be moved axially against the spring 100 on shaft 76 to permit the rotary switch member to slide over its detents indicated at 108. During this sliding motion the ends 106 of the spider 103 slide in the apertures 109 in the disc 43.

The rotary switch disc 43 is provided with a plurality of apertures 110, each of which is countersunk at 111 to form a detaining shoulder which can be held by the ball-shaped detents 108, but which can also cam itself off the detent by rising axially of the shaft 76 as the disc is rotated.

The apertures 110 are arranged in a circle about the center of the disc 43. The rotary switch member 43 also carries the movable contact member 45 which has the three radially extending contact arms 46—48, and this contact member may be secured in place by having the ends of the arms bent over at 112 in peripheral slots 113, these ends being bent backwardly to U-shape on the other side of the disc 43.

The movable contact member 45 has a centrally located aperture 114, which has a clearance with respect to the shaft 76 and with respect to the bearing bore 107 in the disc 43. The connector plate 115, Figure 4, may consist of a rectangle of insulating material which is provided on its opposite sides adjacent each corner with angular cuts or recesses 116 for receiving the securing flanges 117 which project axially from the housing walls 72, 73, and which can be bent over on the outside of the connector plate 115 to hold it in fixed position in or on the end of the housing 62.

The connector plate 115 has a plurality of through rivets 118, the inner ends of which have the partly spherical heads 108 which serve as

the ball detents for engaging in the countersunk holes 110. These rivets and their ball heads are located in a circle and may also serve as the fixed contacts already indicated at 49, 50, 41, 42.

The same rivets may be used for securing connectors 119, 120, 121 to the plate 115, as shown in Figure 2, and the connector 119 may form that part which joins the two contacts 41 and 42, being the two common energized contacts of Figure 1. The connectors 120 and 121 correspond to the contacts 49 and 50; each of these connectors is provided with a screw threaded bore and a screw bolt 122 for securing a wire conductor to it.

Referring to Figure 5, 123, 124 indicate integral inwardly projecting bosses on the plate 115 flush with the surface of the rotary switch disc 43, when it is in the position of Figure 4, so as to prevent as far as possible the tilting of the disc which might take place in the absence of such lugs.

The operation of the switch is as follows:

The normal position of the rotary switch member 43 is with a plurality of its countersunk apertures 110 engaging about the spherical detent heads 108, in which position the rivets 118 are spaced from any of the movable contact arms 46—48.

When the operator steps upon the cap 84, compressing spring 88, the ratchet actuator 60 slides to the right, in Figure 8, and the pawl 78 engages with its end 79 the edge 97 of one of the ratchet arms 96, Figure 7. The rotating force is sufficient to cam the countersunk surfaces of the holes 110 over the ball-shaped detents 108, the rotary switch disc 43 being permitted to move to the left in Figure 4 by spring 100, but being maintained always in contact with the rivet heads 108.

As the switch disc 43 is released by the detents 108, it moves with a snapping action in a rotary direction until its apertures 110 again receive the next ball detents 108 which all register with the apertures at the same time. In the course of this movement from one detent to another, the switch arms 46—48 momentarily pass over the contacts 41, 42, and either the contact 49 or 50 and the switch again comes to rest in a position in which the movable contact 45 with three arms is insulated from the fixed contacts.

The motion of the switch takes place during movement of the ratchet wheel actuator 60 toward the right in Figure 8, and when the operator has pushed the cap 84 down and removes his foot, the spring 88 moves the cap again to the left, as in Figure 8, withdrawing the ratchet wheel actuator 60.

During this motion the pawl 80 slides under the upwardly turned diagonal portion 98 of the adjacent ratchet wheel arm. The ratchet wheel is held fixed by its connection through the spider 103 to the switch disc 43, which is held against rotation by its detents 108.

The pawl then passes backward to the left under the ratchet wheel arm, while the ratchet wheel is permitted to move axially toward the right in Figure 4, to permit this motion of the pawl, until the pawl again resumes the position of Figure 7 with its end behind the next ratchet wheel arm. Thus the switch plunger is adapted to move the rotary switch member step by step, first closing a circuit through contact 49, Figure 1, and upon the next depression of the plunger closing the circuit through the contact 50 of Figure 1. Current is only utilized momentarily after the switch moves to open circuit position again.

Referring to Figures 9 to 17, these are views showing the structure of the electrically actuated locking unit 20. This unit preferably comprises a drawn sheet metal housing member 125, the outer wall of which is substantially cylindrical and provided with a cylindrical bore 126. This housing member has one closed end wall 127, and at its open end is provided with a radially extending attaching flange 128.

The housing member is preferably made of paramagnetic material, such as soft steel or iron, as it forms the external part of the magnetic circuit of the solenoid which it encloses. The solenoid comprises a pair of solenoid coils 30 and 31 of insulated wire of suitable size and resistance; and these coils are preferably wound upon a tube 129 of nonmagnetic metal, such as brass.

The tube 129 is preferably insulated from the wire, which may be of the enameled type, by a sleeve 130 of insulation, such as a paper tube or wrapping; and the tube supports spool flanges 131, 132 at each of its ends, where they are secured against sliding off by having the ends of the tube spun over at 133.

Intermediate the ends of the tube there is a soft iron washer 134, which has an aperture 135 having a frictional fit on the tube, and the size of the washer is such as to provide a sliding fit in the bore 126 of housing 125.

The soft iron washer 134 provides an intermediate portion of the magnetic circuit which is alternately used by one or the other of the solenoid coils. On each side of the soft iron washer 134 there is preferably located a fiber washer 136 for keeping the spool formation.

The turns of wire which form the coils 30, 31 are preferably so proportioned that they may be energized with a suitable amount of current by a 6-volt battery when used for automotive purposes, but they may be proportioned for any suitable voltage.

One common end of each coil is brought out adjacent the fiber washer 136 and these coil terminals indicated at 137 are brought longitudinally of the assembly through suitable slots 138 in the washers 134, 136 and 131, so that these conductors may be connected to a connector 139 located outside the end spool washer 131 and engaging the end 127 of the housing to constitute a ground connection.

Connector 139 comprises a strip of conducting metal having a central circular portion 140 which surrounds the screw bolt 141, Figure 10, by means of which it is clamped against the end 127 of the housing.

The other two terminals of the two coils 30, 31 also extend longitudinally of the coils through suitable slots in the washer, as indicated by the conductor 142, 143, Figure 12, and they may pass through tubular rivets 144 in the connector plate 145, where they are secured at their outer ends by a drop of solder 146. These tubular rivets also serve to secure to the end of the assembly or to the connector plate 145, a pair of connector members 147, which may be substantially similar to the connectors previously described.

The connectors 147 have transversely bent fingers 147' which extend into sockets in the connector plate 145 (Figure 10) to prevent the connectors from turning on the rivets 146.

The connector plate 145 comprises a disc of insulating material which is secured to the end of the housing 125 by a pair of rivets 148. This insulating plate also has a central aperture 149 for passing the screw bolt 141, which may be used

to connect this unit to the frame of the vehicle to complete the ground.

The screw bolt 141 is preferably of the type having a fillister head 150, which is located in a counterbore 151 in a plug of paramagnetic metal 152. This plug is cylindrical and fills the end of the brass tube 129, and the bolt 141 passes through a bore 153 and through an aperture in the end wall 127; and is provided with a pair of nuts, the first one of which clamps the plug against the bottom of the housing which assures a good contact with the ground connector 140, and with the second nut serves to secure a ground conductor to the unit.

The fillister head 150 preferably projects slightly from the inner end of the plug 152, and constitutes a stop for the end of the plunger armature 154. Sticking of the armature against the plug or bolt may be avoided by using a brass bolt which keeps the armature 154 from engaging the magnetic plug 152.

The plunger armature 154 is preferably of such length that it extends only partially into one coil when it has been drawn into the other coil, and the plugs are of such length that they prevent the armature from being drawn into centered position midway between the ends of either coil. Thus the armature has a limited movement but it is subject to a powerful pull because it is always partly outside the coil which is acting upon it.

The central washers 134, 136 and the end washer 131 are preferably provided with peripheral slots 155, which are aligned with each other for passing an integral inwardly extending protuberance 156, which extends longitudinally of the housing, is narrow enough to be passed by the slots 155 and long enough to be engaged by both the washers 136. This projection 156 on the inside of the housing serves to prevent rotation of the coil assembly and spools inside the housing.

At its open end the housing 125 is preferably provided with another cover or closure washer 157 of paramagnetic metal for completing the magnetic circuit at this end of the coils 30. This magnetic disc has a central aperture 158 which receives the reduced end 159 of a paramagnetic plug 160 of cylindrical shape for filling this end of the tube 129 and limiting the range of movement of the armature 154.

Plug 160 has a through bore 161 for passing the connecting rod 162, the end of which has a pressed frictional fit in a bore 163 in the armature 154. A washer of brass 164 may be secured on the end of the armature 154, by a shoulder on the connecting rod 162, and this washer prevents sticking between the plug 160 and armature 154 which might be caused by residual magnetism. Connecting rod 162 is made of nonmagnetic metal.

The connecting rod 162 is surrounded by a lubricant impregnated felt washer 165, which is secured to the outside of the end wall 157 by a suitable adhesive cement. Thus the connecting rod 162 is constantly lubricated; and the ingress of dust, etc., is prevented.

The end wall 157 also supports a pivot bracket 166, Figure 16, for the latching member 21. This pivot bracket may consist of a U-shaped member of nonmagnetic metal bent to substantially rectangular form, the flat yoke of which has an aperture 167 for receiving the rivet 168, by means of which it is secured to the end plate 157.

A resilient detent member, indicated at 169, also has its attaching flange 170 clamped between the bracket 166 and the end plate 157. This resilient detent member 169 is substantially U-shape, but its yoke carries a laterally extending attaching flange 170. Its two resilient parallel legs 171 are each formed with a pressed dimple 172, which may also be described as a pressed partially spherical projection on their inner sides.

The latching member 21 has a pair of partially spherical depressions or sockets 173 on each side, these sockets being adapted to receive the spherical projection 172. The resilient legs of this detent member 169 constantly pinch toward the latching member 21 and tend to engage in the sockets 173. One pair of sockets is located so that the detent member 169 holds the latching member 21 in its latched position; and the other pair of sockets is arranged to hold the latching member 21 in its withdrawn position.

The pivot bracket 166 has its two legs 174 provided with aligned apertures 175 for receiving a pivot pin 176, which has a floating fit in the apertures 175. This pivot pin also passes through the apertures 177 in the pivot flanges 178 of the latching member 21, which is pivotally mounted on said pin between the legs of the bracket 166.

The pivot pin 176 floats in its bearings but is prevented from moving longitudinally out of its bearings by its ends engaging the cover 179, which has a cup-shape formation, the side walls 180 of which limit longitudinal movement of the pin 176. The bracket 166 preferably has longitudinally extending rivet lugs 181 (Figure 16), which pass through apertures in the cover 179 and are riveted over at 182 (Figure 10).

The cover 179 also has a radially extending attaching flange 183, which engages the attaching flange 128 on the housing, and the cover may include a cylindrical rim 184 which engages the edge of the attaching flange 128. The cover 179 is preferably permanently secured on the housing to prevent tampering by a plurality of riveted eyelets 185, the holes of which serve for passing the screw bolts 26 which secure the latching unit 20 when it is installed.

The latching member 21 is preferably made of suitable sheet metal, such as brass, a piece of which is bent to substantially U-shape with two parallel flanges 186, 187. These flanges preferably extend at substantially right angles to the yoke 188 which may be flat, and the bends at 189 are easy bends at substantially right angles.

At the smaller end of the flanges 186, 187, the pivot flanges 178 project longitudinally and serve to provide for the pivotal support of the latch 21. These pivot flanges are partially circular but are joined by a neck portion 190 of reduced width so that this portion will not interfere with the pivotal movement of the latch, room being provided for a felt lubricator 191.

The parallel flanges have the partially spherical sockets 173 previously described for the spring detent 169, and they are provided with the aligned bearing apertures 192 for receiving the pivot pin 193, Figure 10, by means of which the latching member 21 is connected to the connecting rod 162.

Connecting rod 162 preferably has a reduced flattened portion 194 which is received between the parallel flanges 186, 187 of the latching member 21, but also permits room for a pair of lubricant impregnated felt washers 195.

The pivot pin 193 may consist of a rivet passing through the connecting rod 162 and the two parallel flanges 186, 187. The pivot pin 176 is also preferably lubricated by carrying a pair of

lubricant impregnated felt washers 196 inside the legs 174 of the bracket 166 on each side of the latching member. A thin spring washer 197, between the felt washers 196 and the pivot flanges 178, serve to prevent rattling and keep the felt washers in tight engagement with the adjacent surfaces.

At its larger or left end the latching member 21, Figure 15, has its yoke 188 provided with an integral closure flange 198, which is bent downward to provide an end abutment for the latch which engages the keeper, and is indicated by the numeral 24 in Figure 1. This flange 198 preferably extends at right angles to a radius drawn from the axis of pivot of the latch 21; and its end portions 199 and 200 are at the same radial distance from the axis.

The cover 179 has its end provided with a rectangular opening 201 for passing the latch 21, and this cover carries on its inner side a felt washer 191 impregnated with lubricant, and also having a slightly smaller rectangular aperture 202 so that the felt wipes against the end flange 198 and the two side flanges 186, 187 of the latch to maintain a substantial closure.

The center parallel flanges 186, 187 may also be provided with longitudinally extending stop lugs 203 at the larger or left end, the surface 204 of these lugs engaging the inside of the felt washer 191 to limit the outward pivotal movement of the latch 21.

The inward movement of the latch 21 is limited by the engagement of the plunger armature 154 with the fillister head 150 of bolt 141, and in this position the yoke 188 of the latch 21 is substantially flush with the outside of cover 179.

The operation of the locking unit 20 is as follows:

When neither coil is energized the latching member 21 is held in the projected position of Figure 1 or Figure 10 by the spring detent 169, the projections of which engage in the innermost sockets 173. Likewise when the latch 21 is retracted it is held in that position by the detent 169.

The present device utilizes no current when it is locked or unlocked, but only utilizes current momentarily during the locking or unlocking action, when it also gives a signal of the character of its action. When the coil 31 is energized the armature 154 is pulled into the coil 31 by the flux generated, which completes its magnetic field through the housing 125, end wall 127 and soft, iron washer 134.

The flux also passes through the armature and tends to draw the armature into a position in which the armature is drawn into the coil, and would continue to draw the armature inward until the armature extended from end to end of the coil were it not for the plug 152.

The force exerted upon the armature diminishes as the armature passes into the coil, and this force is at a maximum in the present device because of the limited movement of the armature, and because the armature is kept from entering entirely into the coil.

Upward movement of the armature 154 pulls the latching member 21 into the cover 179. In so doing it is opposed by the spring detents 169 which, however, being spherical are cammed out of their sockets 173 so that they ride on the side of the latch until they snap into the other sockets 173, where they hold the latch in retracted position.

When the coil 30 is energized, armature 154 is pulled downward in Figure 10, and the latch 21 is projected by the connecting rod 162 until either the armature or the latch reaches the limit of its movement. During this action of the coil 30, the magnetic circuit is completed through the soft, iron washer 134, side of housing 125, end plate 157, plug 160 and the armature.

The operation of the complete system is as follows:

It is assumed that the vehicle car doors will be provided with the ordinary locking devices, which can be actuated from the outside or the inside. The present safety system is auxiliary to those locking devices, which it overrides insofar as the locking of the doors is concerned.

When the operator of the vehicle wishes to use a safe condition of his doors, he merely steps upon the plunger cap 84 of the controlling switch 43. The actuation of this plunger steps the ratchet wheel and rotary switch member in a rotary direction one step, during which it passes from off-circuit position to another off-circuit position, but during its motion it momentarily closes a contact through the circuit which includes the coils 30.

This causes the armatures of any number of locking units 20 to move the latching members 21 out into latching position, in which position the latching members project into the apertures of their keepers 24. The latching members do not necessarily engage these sides or edges of the apertures in the keepers, and the abrupt shoulder 24' on the latching member 21 need only engage the keeper when someone tries to open the door. At other times it is preferably free of the keeper, but interposed into the keeper aperture. This permits the latch to operate more freely while still performing its blocking or locking function.

The operator may have a locking unit on each of his four doors, controlling them all by one switch, or he may have one switch for the two front doors and another for the two back doors. The present devices are simple and foolproof and are sealed against tampering by any unauthorized persons. The units of the system are dustproof and assured of constant and adequate lubrication. The locking unit can be installed on the doors if desired, by providing the usual pigtail conductors extending from door to frame at the hinges.

One of the most important features of the invention lies in the fact that any user is protected against holdup men who now have the practice of quickly opening the door at a stop light, stepping into the car and taking a seat beside the driver or some other occupant.

The system also protects the driver in the event of altercations with other drivers who may try to gain access to the occupant of the automotive vehicle, but are prevented by the present safety system. The best thing that anyone can do when engaged in such an altercation with another driver is to stay inside the vehicle with the doors locked; and with the present system no one can reach in a window and unlock the door from the inside.

The present safety system also prevents children from unlocking and opening the doors from the inside, and this is of the utmost importance as many children have fallen out of vehicles while in motion, resulting in severe bodily injury and frequently in concussion and fracture of the skull.

The present devices are also simple and eco-

nomical in their construction, and they do not constitute a severe drain on the source of electric current with which they are used.

The cover 179 carries all parts contained in the open end of the housing member 125, including the end wall 157, the plug 160, the connecting rod 162, and the armature 154. To provide a rigid connection between the end wall 157 and the cover 179, in addition to that provided by the bracket 166, I have shown tubular spacers 211 proportioned in accordance with the height of the bracket 166 and to receive the rivets 212. The rivets 212 extend through the end wall 157 and the cover 179 and are upset as at 213 to secure the parts in operative relationship.

The assembly of parts and particular construction described, provides a separate subassembly unit which can be readily inserted in the housing assembly with a minimum amount of labor.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In an electric switch for controlling electric door locks, the combination of a metal supporting plate with a tubular housing having integral tabs passing through apertures in said plate and bent over, said plate having a central aperture, an actuating cap telescoping with said housing and carried by a plunger passing through said aperture, a coil spring about said plunger and compressed between said plate and cap, an angle plate having one flange riveted on the end of said plunger, a switch housing carried by said supporting plate and mounted in sliding engagement with and enclosing the other flange of said angle plate, said latter flange having a slot for passing a shaft, an insulating plate carried by said housing at right angles to said supporting plate, spherical headed metal studs carried by said insulating plate to act as contacts and indexing members, said heads projecting inward into said housing, an insulating rotor disc having a central bore and a plurality of inner tapered through bores acting as detent sockets on the spherical heads of said metal studs, said rotor having a plurality of peripheral grooves, a bridging contact on said rotor, comprising a central disc having a plurality of radial contact arms bent over the edge of said rotor into U shape in said peripheral grooves, said latter disc having an enlarged aperture, a shaft secured in said housing and projecting through said rotor, a ratchet wheel on said shaft adjacent said angle plate flange, and having a plurality of radial wings turned upwardly at their leading edges, said angle plate having a tab bent out of said angle plate flange to engage the trailing edges of said wings and to slide under the leading edges, means drivably connecting said ratchet wheel and said rotor, and a helical spring on said shaft urging said ratchet wheel against said tab and said rotor against said spherical headed studs.

2. In an electric switch for controlling electric door locks, the combination of a metal supporting plate with a tubular housing having integral tabs passing through apertures in said plate and bent over, said plate having a central aperture, an actuating cap telescoping with said housing and carried by a plunger passing through said aperture, a coil spring about said plunger and compressed between said plate and cap, an angle plate having one flange riveted on the end of said plunger, a switch housing carried by said supporting plate and mounted in sliding engagement with and enclosing the other flange of said angle plate, said latter flange having a slot for passing a shaft, an insulating plate carried by said housing at right angles to said supporting plate, spherical headed metal studs carried by said insulating plate to act as contacts and indexing members, said heads projecting inward into said housing, an insulating rotor disc having a central bore and a plurality of inner tapered through bores acting as detent sockets on the spherical heads of said metal studs, said rotor having a plurality of peripheral grooves, a bridging contact on said rotor, comprising a central disc having a plurality of radial contact arms bent over the edge of said rotor into U shape in said peripheral grooves, said latter disc having an enlarged aperture, a shaft secured in said housing and projecting through said rotor, a ratchet wheel on said shaft adjacent said angle plate flange, and having a plurality of radial wings turned upwardly at their leading edges, said angle plate having a tab bent out of said angle plate flange to engage the trailing edges of said wings and to slide under the leading edges, means drivably connecting said ratchet wheel and said rotor, and a helical spring on said shaft urging said ratchet wheel against said tab and said rotor against said spherical headed studs, said means comprising a spider having a base plate slidably mounted on said shaft against said ratchet wheel, to which it is secured, said spider having three axially extending flanges engaging slidably in apertures in said rotor.

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