

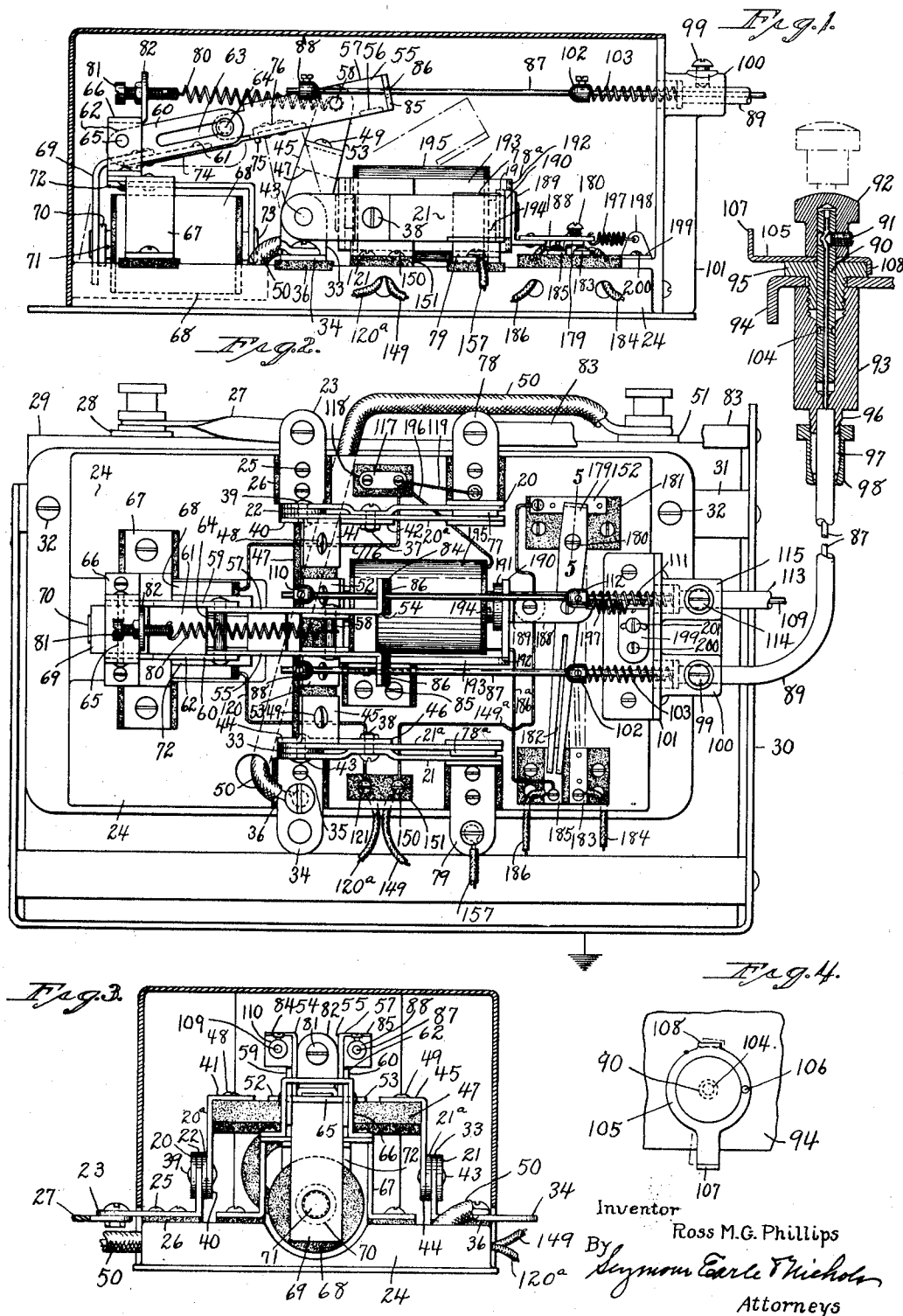
Dec. 6, 1932.

R. M. G. PHILLIPS

1,890,233

AUTOMATIC CIRCUIT BREAKING APPARATUS

Original Filed Feb. 27, 1929 3 Sheets-Sheet 1



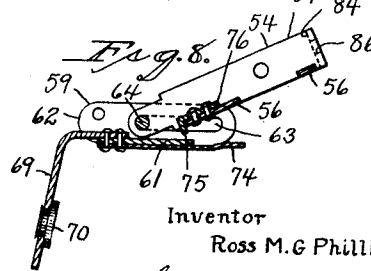
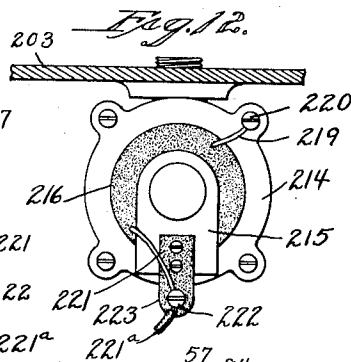
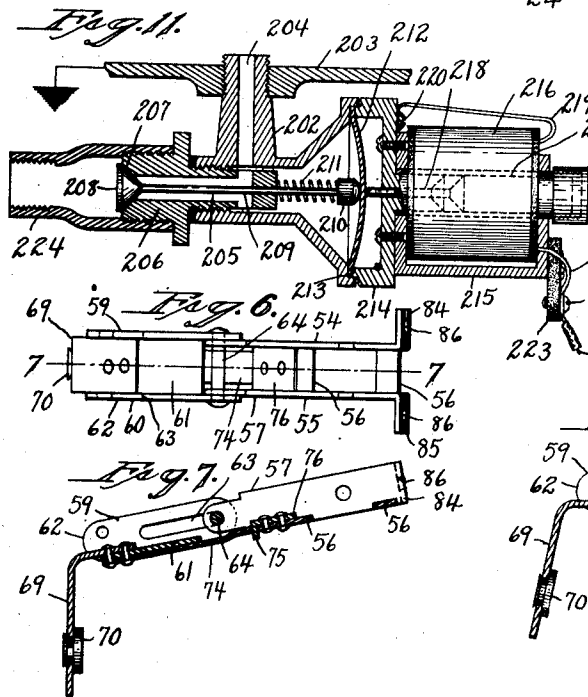
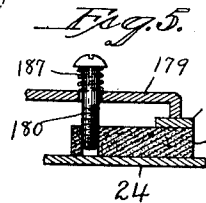
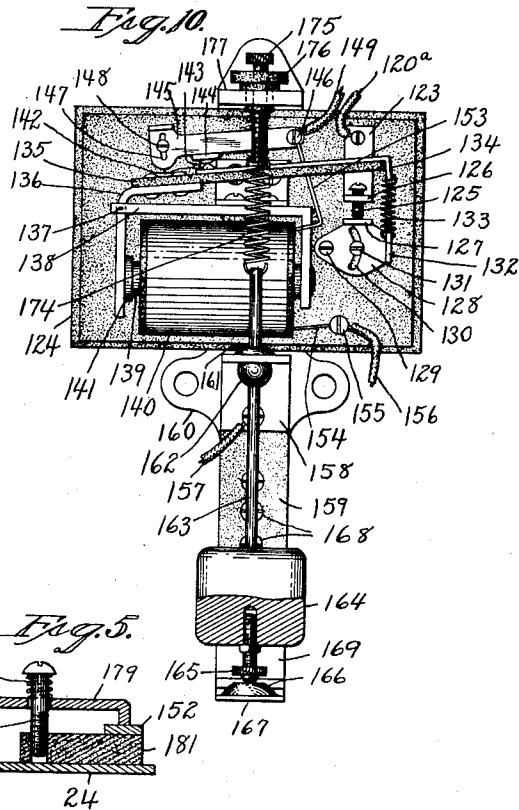
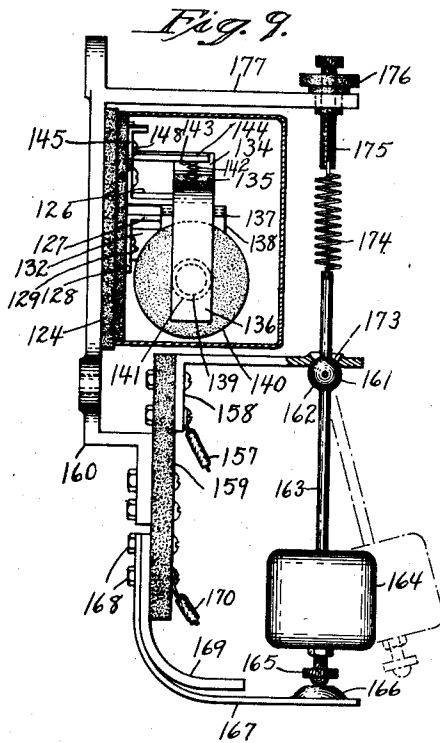
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AUTOMATIC CIRCUIT BREAKING APPARATUS

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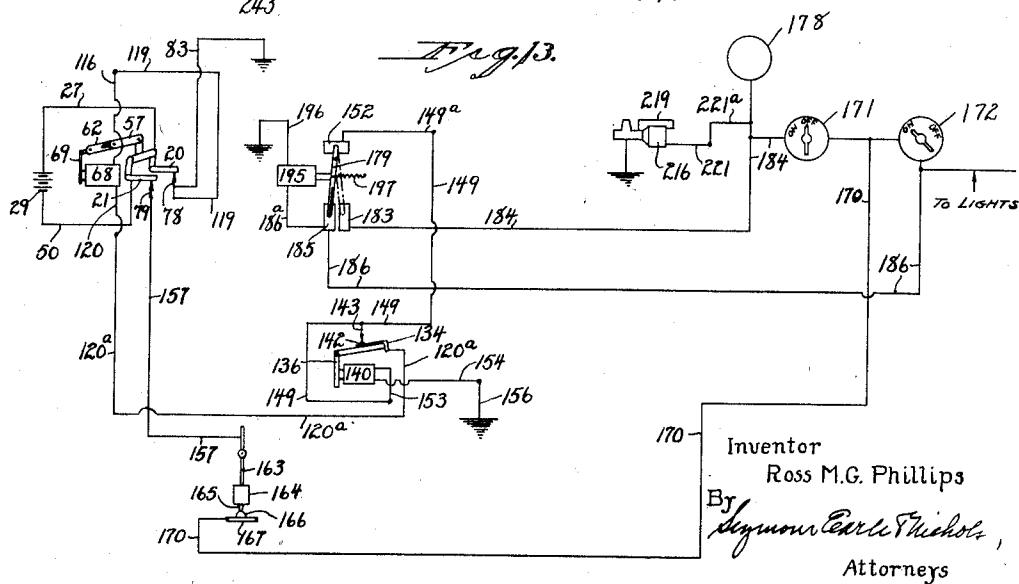
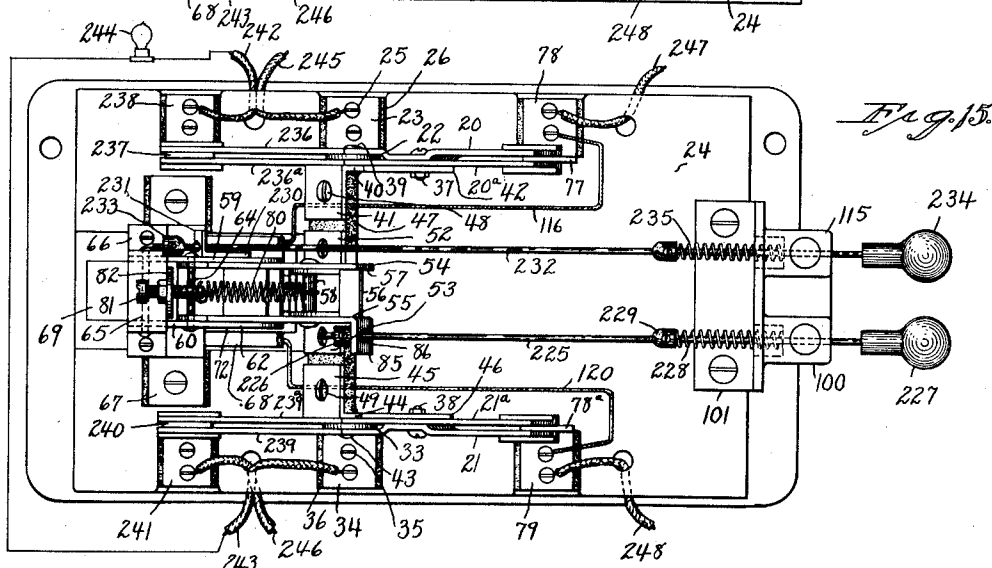
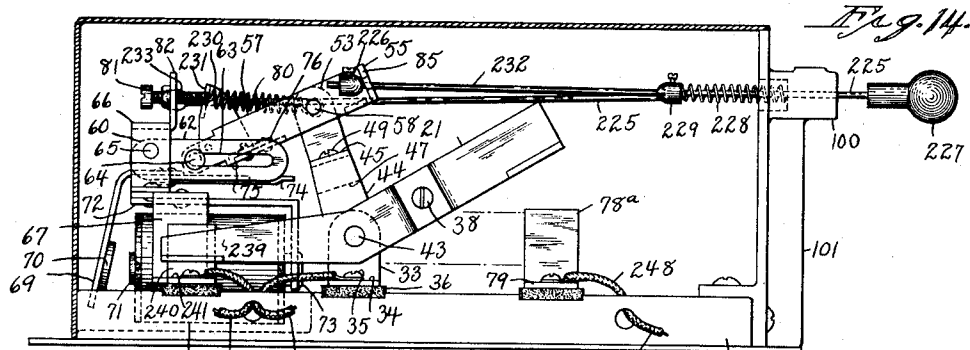
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AUTOMATIC CIRCUIT BREAKING APPARATUS

Original Filed Feb. 27, 1929 3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

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AUTOMATIC CIRCUIT-BREAKING APPARATUS

Application filed February 27, 1929, Serial No. 343,018. Renewed April 15, 1932.

This invention relates to an improvement in automatic circuit-breaking apparatus for the electrical systems of automobiles, airplanes, and other vehicles, though not so limited.

One of the objects of this invention is to provide a simple, reliable and sensitive automatic circuit-breaking apparatus which will act to cut off the supply of current to a wiring-system in case a short circuit of even small magnitude should occur therein.

Another object of this invention is to provide an automatic circuit-breaking apparatus which will act to cut off the supply of current to the wiring-system in case the vehicle upon which it is installed should be involved in a collision.

A further object of my invention is to provide an automatic circuit-breaker which will act to shut off the supply of gasoline from the main storage-tank when the ignition is turned off or in case the supply of current to the wiring-system is shut off, due to either a short circuit therein or as a result of a collision involving the vehicle upon which my improved circuit-breaker is installed.

With the above objects in view my invention consists in an automatic circuit-breaker having certain combinations and arrangements of parts as will be hereinafter described and particularly recited in the claims.

In the accompanying drawings:

Fig. 1 is an edge view with the cover in section of the unit embodying the main cut-out switch and automatic ignition cut-out;

Fig. 2 is a face view thereof with the cover removed, showing also connection extended to a resetting-button upon the dashboard or other convenient point of a vehicle;

Fig. 3 is a view thereof in end elevation;

Fig. 4 is a face view of the outer end of the manually-operable resetting plunger on the dash showing the means for latching it in its pulled-out position;

Fig. 5 is a broken enlarged-scale detail sectional view taken on the line 5—5 of Fig. 2;

Fig. 6 is a detached face view of the main-

switch toggle-mechanism shown in its switch-closing position;

Fig. 7 is a longitudinal sectional view thereof taken on the line 7—7 of Fig. 6;

Fig. 8 is a view corresponding to Fig. 7 but showing the toggle parts in the positions due to them when the main-switch is in its open-circuit position;

Fig. 9 is a view in side elevation of the unit in which my improved collision-switch and short-circuit switch are incorporated;

Fig. 10 is a face view thereof;

Fig. 11 is a view in longitudinal section of the gasoline cut-off unit shown as installed in the main tank which is broken away;

Fig. 12 is an end view thereof;

Fig. 13 is a schematic view showing diagrammatically electrical interconnections between the various elements of my improved automatic circuit-breaking apparatus;

Fig. 14 is a view in side elevation of a main-switch unit for house or similar wiring-systems and adapted to be thrown into its open-circuit position by a short circuit in the service line; and

Fig. 15 is a top or plan view thereof.

In the embodiment of my invention herein chosen for illustration in Figs. 1 to 13 inclusive, I employ two corresponding switch-arms, the upper switch-arm comprising two parallel switch-blades 20 and 20^a and the lower switch-arm being similarly formed of two parallel switch-blades 21 and 21^a.

The blades 20 and 20^a are pivotally mounted upon the opposite sides of the outwardly-projecting arm 22 of an L-shaped terminal-piece 23 which is secured to a rectangular struck-up sheet-metal base 24 by bolts 25 and from which it is insulated by a block of insulating material 26.

The terminal-piece 23 extends slightly outward beyond the base 24 and is electrically connected by a bus-bar 27 to the negative terminal 28 of a storage-battery 29 supported in the usual skeletonized metal-frame 30, to the upper side-bar 31 of which latter the struck-up sheet-metal base 24 is secured by means of screws 32—32.

The switch-blades 21 and 21^a are respectively pivoted on the opposite sides of the

outwardly-projecting arm 33 of an L-shaped terminal-piece 34, corresponding to the terminal 23 aforesaid and is secured to the base 24 by screws 35 and insulated therefrom by a block of insulating material 36. About mid-way their length the switch-blades 20 and 20^a are united for concurrent movement by a screw 37 and similarly the blades 21 and 21^a are coupled together by a screw 38.

The switch-blades 20 and 20^a swing upon a rivet 39 passing through their inner ends, through the arm 22 of the terminal-piece 23, and through the inwardly-projecting arm 40 of an angle-bracket 41 which is also provided with an arm 42 through which the screw 37 aforesaid passes, so as to firmly couple the angle-bracket 41 to the switch-blades 20 and 20^a for concurrent movement.

Similarly, the switch-blades 21 and 21^a swing upon a rivet 43 which passes through their inner ends, through the outwardly-extending arm 33 of the terminal-piece 34, and through the inwardly-projecting arm 44 of an angle-bracket 45 which is also provided with an arm 46 through which the screw 38 aforesaid passes, so as to firmly couple the said angle-bracket 45 to the switch-blades 21 and 21^a for concurrent movement.

A transverse bar 47 of insulating material is secured at one end by means of a screw 48 to the angle-bracket 41 and at its opposite end is secured by means of a screw 49 to the angle-bracket 45, with the effect of coupling the switch-blades 20 and 20^a to the switch-blades 21 and 21^a for concurrent movement.

A relatively-heavy feed-wire 50 leads from the positive terminal 51 of the storage-battery 29 to the angle-bracket 34, as clearly shown in Fig. 2 of the drawings. Thus, the switch-blades 20 and 20^a make and break the negative side of the circuit while the switch-blades 21 and 21^a make and break the positive side of the circuit, whatever its ramifications.

Secured to the insulating cross-bar 47, near the central portion thereof, are a pair of complementary L-shaped brackets 52 and 53, against the respective outer faces of which are located side-bars 54 and 55, which are connected together by integral transverse-webs 56 to form a toggle-link generally designated by the numeral 57. A transverse rivet 58 extends between the side-bars 54 and 55 aforesaid of the toggle-link 57 and also through the upstanding-arms of the angle-brackets 52 and 53 aforesaid, so as to pivotally couple the switch-blades with the said toggle-link.

The toggle-link 57 above referred to is adapted to reciprocate between the side-plates 59 and 60, which are coupled together by an integral web 61 to form an outer toggle-link generally designated by the numeral 62. The side-plates 59 and 60 of the said toggle-link 62 are each formed with a longi-

tudinal slot 63 through which a transverse-pin 64 extends and slides.

The transverse-pin 64 also extends through the outer end of the side-plates 54 and 55 of the inner toggle-link 57, so that both of the said toggle-links are coupled together for relative pivotal movement and a slight relative sliding movement.

The outer end of the toggle-link 62 has extending through it a transverse pivot-pin 65 which is mounted at its extreme opposite ends in the side-walls of a U-shaped bracket 66 which is secured upon the outer face of a U-shaped bridge-member 67 secured at its respective opposite ends to the base 24 and straddling a main-switch latching-magnet 68, to be hereinafter described.

Secured to the outer end of the web 61 of the toggle-link 62 is an L-shaped armature-arm 69 carrying an armature 70 which is positioned to be attracted by the pole-piece 71 of the main-switch latching-magnet 68 before referred to, which latter is supported by means of an L-shaped bracket 72 projecting inward from the bridge-member 67 and having the inner end of the pole-piece 71 of the magnet 68 riveted to it as at 73, as shown in Fig. 1 of the drawings.

In the normal position of the toggle-links 57 and 62 they are arranged in line, as shown in Figs. 1 and 7, so as to hold the blades 20—20^a and 21—21^a in their circuit-closing positions, as will hereinafter appear.

The said toggle-links are held in their aligned position by the draft exerted upon the armature 70 by the latching-magnet 68 and are yieldingly latched in this position by means of a latch-spring 74 secured to the inner face of the web 61 of the link 62 and having its free end co-act with the inwardly-turned nose 75 of a latch-dog 76 secured to the outer face of the web 56 of the toggle-link 57.

As above described, the magnet 68 normally tends to keep the two toggle-links 57 and 62 in alignment with the end of the latch-spring engaged with the nose 75 of the latch-dog 76 so as to hold the switch-blades 20—20^a in engagement with the outwardly-projecting arm 77 of an L-shaped terminal-piece 78 and similarly maintain the blades 21—21^a in engagement with the outwardly-projecting arm 78^a of an L-shaped terminal-piece 79.

For the purpose of moving the switch-blades 20—20^a out of engagement with the terminal-piece 78 and the switch-blades 21—21^a out of engagement with the terminal-piece 79 when the pull of the magnet 68 is lessened or ceases entirely, I provide a helical switch-opening spring 80 which at its forward end is hooked over the transverse-pin 58 and at its rear end is hooked through an adjusting-screw 81 mounted in an arm 82 projecting from the U-shaped bracket 66 aforesaid.

The terminal-piece 78 is connected by means of a bus-bar 83 to the frame 30 of the storage-battery, which is grounded in the usual way.

the latter may be swung by its finger-piece 107 laterally so as to project into the said groove and retain the plunger in its extended position against the tension of the spring 103, as shown by broken lines in Fig. 4. 70

A slight additional outward pull upon the plunger will free the said plate 105 of frictional restraint and permit it to swing into its normal position shown by full lines in Fig. 4, thereby disengaging the said plate 75 from the locking-groove 104 and thus permitting the spring 103 to act to move the collar 88 away from the ear 85.

The out-turned ear 84 of the toggle-link 57 also has passing through it a flexible resetting-wire 109 which carries at its end a resetting-collar 110 adapted to engage the back face of the said ear. A helical spring 111 encircling the wire 109 and thrusting against a collar 112 thereon normally tends 85 to force the said wire inward and thus move the collar 110 out of engagement with the ear 84.

The wire 109 passes through a flexible-tube 113 which is secured by a set-screw 114 in a boss 115 in the bracket 101. The wire 109 is adapted to reset the toggle-links 57 and 62 in the same manner that they are reset by the wire 87 for the purpose of moving the main-switch into its circuit-closing position, and if desired the said resetting-wire 109 may be coupled to the starter-switch so that when the same is operated the main switch will be automatically moved into its circuit-closing position. 100

The main-switch latching-magnet 68 is connected by a wire 116 to a junction-plate 117 secured to the base 24 and insulated therefrom by a block of insulating material 118. A short wire 119 extends from the said junction-plate to the terminal-plate 78 which, as before described, is connected to the ground side of the circuit. 105

The opposite lead of the main-switch latching-magnet 68 is connected by a wire 120 to a terminal-screw 121 from which a wire 120^a extends to an L-shaped terminal-bracket 123 of a unit combining a short-circuit cut-out and a collision circuit-breaker, shown in Figs. 9 and 10. 115

The terminal-bracket 123 is mounted upon a base 124 of insulating material and carries an adjusting-screw 125 in its outwardly-projecting arm 126 which bears against the outwardly-turned ear 127 of a pivotal-spring adjusting-plate 128 hung upon a stud 129 and formed with an arcuate slot 130 through which a binding-screw 131 extends. 120

The spring adjusting-plate 128 has a spring-arm 132 turned outward from its free end, to which is coupled the lower end of a helical spring 133, the upper end of which is hooked through the downwardly-turned end of a movable contact-plate 134 mounted upon 125

To provide for moving the switch-blades 20—20^a and 21—21^a into engagement with the terminals 78 and 79 for closing the circuit after the same has been broken by the switch-opening spring 80, due to the lessening or cessation of the supply of current to the main-switch latching-magnet 68, I turn the side-plates 54 and 55 of the toggle-link 57 outward to respectively form ears 84 and 85, each of which is provided with a perforation 86.

Passing through the perforation in the ear 85 is a reciprocating resetting wire 87 carrying near its end a collar 88 adapted to be moved into engagement with the back face of the said ear for re-latching the toggle-links 57 and 62 and thus move the switch into its circuit-closing position. The said resetting wire 87 extends through a flexible tube 89 and has its extreme outer end passed axially through a plunger 90 in which it is secured by a set-screw 91 and which is provided with a finger-button 92.

The plunger 90 is mounted for reciprocation in a cylindrical body-member 93 which is mounted in the instrument-panel 94 of an automobile by means of a clamping-bushing 95. The inner end of the body-member 93 is reduced in diameter to form an externally-threaded extension 96 which is counterbored to receive the outer end of the flexible-tube 89 and is split as at 97 so as to permit it to be clamped upon the said flexible-tube by means of a clamping-nut 98.

The opposite end of the flexible-tube 89 is secured by a set-screw 99 in a boss 100 formed on the outer face of a bracket outwardly projecting from the right-hand end of the base 24.

Encircling the wire 87 between the bracket 101 and an adjustable collar 102 is a helical spring 103 exerting a constant effort to move the collar 88 away from the out-turned ear 85 and to draw the finger-button 92 inward into the position in which it is shown in Fig. 2.

For the purpose of holding the finger-button 92 in its pulled-out position, as indicated by broken lines in Fig. 2, so as to positively hold the switch-blades 20—20^a and 21—21^a in their circuit-closing positions if circumstances require, I provide the plunger 90 with a circumferential groove 104 which is adapted to be entered by a pivotal locking-plate 105 through which the said plunger passes and which is hung upon an eccentric pivot 106 and provided with a finger-piece 107 and with a stop-finger 108 engaging the periphery of the bushing 95.

When the plunger 90 is pulled out so as to align its groove 104 with the locking-plate,

the upper face of a bar 135 of insulating material.

The said bar 135 is secured at its opposite end to the horizontal arm of an armature-lever 136 which swings about a pin 137 in an L-shaped bracket 138 secured to one end of the core 139 of a cut-out magnet 140. The depending arm of the armature-lever 136 carries an armature 141 co-acting with the core 139 of the magnet 140.

The contact-plate 134 is operated in its circuit-closing direction by the armature-lever 136 and in the opposite or circuit-breaking direction by the spring 133 and is provided with an upwardly-offsetting domical contact 142 adapted to engage a reversely-turned domical contact 143 mounted upon the underface of a horizontal finger 144 offsetting from an adjustable but normally-stationary contact-plate 145 swinging at one end about a screw 146 extending into the insulating base 124 and provided at its opposite end with an arcuate slot 147 receiving a locking-screw 148 by means of which the relation between the domical contacts 142 and 143 may be regulated.

A wire 149 leads from the screw 146 of the contact-plate 145 to a terminal-screw 150 mounted in a block 151 of insulating material upon the base 24 of the main switch (Figs. 1 and 2). Leading from the terminal-screw 150 and in electrical connection with the wire 149 is a wire 149^a extending to a contact-plate 152 of an ignition cut-out switch-mechanism to be hereinafter described.

One lead of the cut-out magnet of the unit shown in Figs. 9 and 10 is connected by a wire 153 to the terminal-screw 146 of the contact-plate 145. The opposite lead of the said magnet is connected by a wire 154 to a binding-screw 155 to which is also connected a lead-out wire 156, the opposite end of which is grounded.

A feed-wire 157 is connected to the terminal-piece 79 (Figs. 1 and 2) and leads therefrom to an L-shaped bracket 158 (Figs. 9 and 10) which offsets from a plate 159 of insulating material secured to the lower end of a mounting-bracket 160 which also carries the base 124 of the cut-out magnet 140.

The outer end of the bracket 158 is formed in its under face with a downwardly-facing spherically-contoured socket 161 receiving a spherical boss 162 pinned to the stem 163 of a weight 164 which, as will hereinafter appear, is swung out of its normal position as the result of shock due to collisions.

The underface of the weight has screwed into it an adjustable contact 165 having a spherical terminal engaging with a contact-boss 166 struck upward from the horizontal reach of an L-shaped spring-contact arm 167 which has its vertical reach secured to the backface of the insulating-plate 159 by means of bolts 168 which also pass through a

correspondingly-bowed guard-arm 169 which serves to limit the upward movement of the horizontal reach of the said contact-arm 167 when the contact 165 is moved out of engagement with it, as indicated by broken lines in Fig. 9 of the drawings. A wire 170 fastened to one of the bolts 168 electrically connects the contact-arm 167 with an ignition-switch 171 and a light-switch 172 of an automobile, airplane, or other vehicle, so as to supply current thereto.

The stem 163 of the collision-actuated weight 164 extends upward through a passage 173 in the horizontal arm of the bracket 158 and has hooked into its extreme upper end a helical spring 174 arranged axially in line with it and having its upper end in turn connected to a tension adjusting-screw 175 mounted in an insulating bushing 176 in an arm 177 forming part of the bracket 160 which mounts the insulating-plates 124 and 159 aforesaid. The said spring 174 exerts a constant effort to hold the contact 165 in engagement with the contact-boss 166 and at the same time seats the boss 162 in engagement with the socket 161.

The circuit-breaking apparatus illustrated in Figs. 1 to 13 inclusive of the drawings is primarily designed for use on vehicles propelled by internal combustion engines, such as automobiles and airplanes. Under certain circumstances, such as when an automobile is parked with the engine idle and with its lights on, it is desirable, if not essential, that electrical energy supplied to the lights be not permitted to pass through the ignition system of the internal combustion engine, represented by the distributor 178 in Fig. 13 of the drawings, since the passage of current therethrough while the engine is idle would damage the same.

For the purpose of automatically cutting out the supply of electrical energy to the ignition system represented by the distributor 178, when the ignition-switch 171 is "off" and the light-switch 172 is "on," I employ an ignition cut-out switch 179 (Figs. 1 and 2) rocking about a screw-stud 180 threaded into a plate 181 of insulating material, which plate is secured to the base 24 and also carries the contact-plate 152 before referred to.

One end of the ignition cut-out switch-blade 179 bears upon the contact-plate 152 and its opposite end is bifurcated as at 182 and is adapted to ride upon an ignition-circuit terminal-plate 183 connected by a wire 184 to the outlet-side of the ignition-switch 171 and a lighting-circuit terminal-plate 185 connected by a wire 186 to the outlet-side of the lighting-switch 172, so as to electrically connect one or the other of the said terminal-plates and hence either of the respective outlet-sides of the ignition and lighting switches 171 and 172 with the contact-plate 152 and thence through the wires 149^a and 149, con-

tacts 142 and 143 and wires 120^a and 120 to the main-switch latching-magnet 68 and also through the wire 153 to the cut-out magnet 140.

A helical spring 187 (Fig. 5) encircling the stud 180 upon which the switch-blade 179 rocks, serves to yieldingly force the respective opposite ends of the said switch-blade in engagement with the contact-plate 152 and the terminal-plates 183 and 185.

For automatically operating the ignition cut-out switch-blade 179 to shift it from the terminal-plate 183 to the terminal-plate 185 when the ignition-switch 171 is "off" and the lighting-switch 172 is "on," I pivotally connect to the said blade 179 one end of a link 188, the opposite end of which is connected by an L-shaped bracket 189 to an armature-arm 190 carrying an armature 191 and hung for pivotal movement upon a pin 192 in a bracket 193.

The armature 191 is adapted to be attracted by the pole-piece 194 of an ignition cut-out magnet 195 (Figs. 1, 2 and 3) mounted upon the base 24.

One lead of the said magnet is connected by a wire 186^a to the terminal-plate 185 and thence to the wire 186, while its opposite lead is connected by a wire 196 to the junction-plate 117 and thence to the ground.

As above described, the pull of the magnet 195 tends to swing the armature-arm 190 from right to left and so move the connecting parts as to shift the switch-blade 179 from the ignition terminal-plate 183 to the lighting-circuit terminal-plate 185. For moving the said switch-blade in the opposite direction when the magnet 195 is unenergized, I provide a helical spring 197, one end of which is hooked into the link 188 and the opposite end of which is hooked through the outwardly-projecting arm 198 of a spring adjusting-plate 199 swinging upon a stud 200 and locked in adjusting position by a binding-screw 201.

As will hereinafter appear, both leads of the storage-battery 29 are cut off from connection with the electrical system which the said battery is designed to feed, in the event that a short circuit should occur in the said circuit or in the event that a vehicle upon which my improved apparatus is mounted should be involved in a collision, or in the event that the ignition-switch 171 and lighting-switch 172 should both be turned into their "off" position, so that the fire hazard due to electrical sparking is practically eliminated.

It is also desirable for additional safety to cut off the supply of gasoline from the main tank when the ignition-circuit is opened by its switch 171 or in the event that the entire electrical system is disconnected from the battery, as the result of a collision or a short circuit.

For the purpose last above mentioned, I employ a gasoline shut-off device comprising a body-member 202 threaded into the outlet-opening of the main gasoline tank 203 and having a vertical gasoline passage 204 formed therein and intersecting a horizontal passage 205 axially formed in a bushing 206 threaded into the said body-member 202, as clearly shown in Fig. 11.

The outer end of the passage 205 in the said bushing is counterbored to form a valve-seat 207 which is adapted to be engaged by a conical valve-head 208 having a stem 209 and provided at its opposite end with a collar 210.

For the purpose of normally urging the valve-head 208 into engagement with the seat 207 I provide a helical valve-closing spring 211 encircling the stem 209 of the said valve and bearing at one of its ends against the end of the bushing 206 and at its opposite end against the collar 210.

The collar 210 of the valve-stem 209 bears against a diaphragm 212 clamped in a groove 213 in the flared inner end of the valve-body 202 by a cup-shaped clamping-member 214 which mounts on its outer face a U-shaped bracket 215 between the arms of which is mounted a solenoid 216 having the usual axially-positioned movable core 217 which is formed with a stem 218 projecting through the clamping-member 214 and engaging the diaphragm 212 in line with the stem 209 of the valve 208.

One lead of the solenoid 216 is connected by a wire 219 to a screw 220 which serves to ground the said wire to the automobile or airplane structure. The opposite lead of the said solenoid is connected by a wire 221 to a binding-screw 222 mounted upon an insulating-plate 223 depending from the bracket 215. A wire 221^a is attached to the binding-screw 222 and forms a continuation of the wire 221 and connects into the wire 184 on the outlet-side of the ignition-switch 171 so that when the said switch is turned in its "on" position to supply current to the wire 184 and to the ignition system, through the said wire 184, energy will also be supplied to the solenoid 216 so as to cause the movable core 217 thereof to move from right to left therein, with the effect of moving the valve-head 208 from its seat 207 and permitting the gasoline to flow from the main tank 203 through the passages 202, 205 and thence through a pipe-coupling 224 and such piping as may be connected thereto, to the carburetor.

As soon as the ignition-switch 171 is turned to its "off" position or in the event that the entire electrical circuit is cut off from the battery by a short circuit or collision, the solenoid 216 will be de-energized and thus permit the valve-closing spring 211 to move the valve-head 208 into the seat 207 and prevent the out-flow of gasoline from the main tank 203.

Having fully described the apparatus set forth in Figs. 1 to 13 inclusive, I will now proceed to describe its operation by presupposing that it is mounted upon an automobile or other vehicle.

In the event that a short circuit should occur anywhere in the ignition or lighting circuits, the voltage to the cut-out magnet 140 will fall below its normal value, thus decreasing the pull of the said magnet upon the armature 141 and thereby permitting the spring 133 to shift the movable contact 142 out of engagement with the normally-stationary contact 143 so as to interrupt the flow of current through the wires 120^a and 120 and 119 to the main-switch latching-magnet 68.

This de-energization of the main-switch latching-magnet 68 permits the spring 80 to buckle the toggle-members 57 and 62 so as to disengage the locking-spring 74 from the nose 75 of the locking-dog and thus permit the said toggle-members to move into the position shown in Fig. 8 and simultaneously move the switch-blades 20—20^a and 21—21^a out of engagement with their respective terminal-pieces 78 and 79, as indicated by broken lines in Fig. 1. Thus, the connection through the terminal-piece 78 to the frame 30 of the storage-battery and thence to the ground is broken and also all connection between the positive terminal 51 of the storage-battery and the terminal-piece 79 is similarly broken.

In another event, should the vehicle upon which my improved apparatus is mounted be involved in a collision of dangerous force, the contact 165 carried by the weight 164 (Figs. 9 and 10) will be swung out of engagement with the contact-boss 166, momentarily breaking the flow of current from the terminal-piece 79 to the cut-out magnet 140 thereby permitting the contact 142 to be moved away from the contact 143 by the spring 133, and thereby in turn cutting off the supply of current to the main-switch latching-magnet 68 with the final effect of permitting the spring 80 to move the main-switch into its open-circuit position.

In each of the above instances, when the main-switch is moved to its open-circuit position, the supply of current is also shut off to the solenoid 216 controlling the flow of gasoline from the main tank, so that the spring 211 will be permitted to assert itself and move the valve-head 208 into engagement with its seat 207.

It is also to be noted that the solenoid 216 will be automatically de-energized in the normal operation of the automobile when the ignition-switch 171 is turned to its "off" position, thus automatically shutting off the supply of fuel from the main tank when the engine is stopped, in addition to shutting off the said supply in the event of any untoward short circuit or collision.

After the blades 20—20^a and 21—21^a of the main-switch have been moved into their open-circuit positions, it will be noted from the diagram shown in Fig. 13 that current can no longer flow through the magnets 68, 140, 195, and the solenoid 216, owing to the fact that the flow of current therethrough is checked in common with the rest of the electrical system by the movement of the said switch-blades into their open-circuit positions.

An outward pull upon either of the wires 87 or 109 will serve to move the switch-blades 20—20^a and 21—21^a into their circuit-closing positions and to re-latch the toggle-members 57 and 62, thus permitting current again to flow through the various magnets and the solenoid, as well as the rest of the electrical system provided only that any short circuit which may have occurred has been remedied and the contact 165, or the weight 164 has been restored to its normal position in engagement with the contact-boss 166.

An important feature of my improved circuit-breaking apparatus is the provision of means for preventing the flow of current through the ignition system when the ignition-switch is "off" and the engine idle and the lighting-system is in its "on" position.

Thus, as indicated diagrammatically in Fig. 13, the turning on of the light-switch 172, as for instance when the car is parked, serves to energize the ignition cut-out magnet 195 by current flowing from the said lighting-switch through the wires 186 and 186^a with the effect of swinging the outer end of the switch-blades 179 from the ignition-circuit terminal-plate 183 to the lighting-circuit terminal-plate 185 against the counterurge of the spring 197, thereby preventing current fed out of the lighting-switch 172 through the wire 186 from passing back through the wire 184 to the ignition system represented by the distributor 178. This, however, in nowise prevents the flow of current to the ignition-system when the ignition-switch 171 is turned on.

The device shown in Figs. 14 and 15 of the drawings is intended for use in connection with the lighting-circuits of homes, etc., though also useful in connection with other types of circuits supplying current to motors and other devices.

The device shown in these figures corresponds generally to that shown in Figs. 1 and 2 with the exception that the ignition cut-out switch, ignition cut-out magnet and related parts are omitted and the main-switch mechanism has certain additional features which will be now described.

The out-turned ear 85 of the side-plate 55 of the toggle-link 57 has passing through its perforation a resetting pull-rod 225 corresponding to the wire 87 of the device shown in Figs. 1 and 2 and being provided with a collar 226 engaging the rear face of the said

ear, so as to re-set the toggle after it is uncoupled and flexed to open the main-switch comprising the blades 20—20^a and 21—21^a. The outer end of the said pull-rod 225 is provided with a finger-button 227 by means of which it may be pulled outward, and is encircled by a spring 228 bearing at its forward end against the bracket 100 and at its opposite end against a collar 229 on the said rod.

For the purpose of manually flexing the toggle-links 57 and 62 so as to uncouple the latching-spring 74 from the locking-nose 75 of the locking-dog and thus permitting the switch-opening spring 80 to act to swing the switch-blades 20—20^a and 21—21^a upward to break the circuit I secure to the side-plate 59 of the toggle-link 62 an extension 230 having an out-turned ear 231 through which a tripping-rod 232 passes.

The inner end of the said tripping-rod is provided with a collar 233 engaging the rear face of the ear 231 when the rod is pulled outward so as to tend to rock the toggle-link 62 about the transverse-pin 65 and thereby uncouple the latching-spring 74 from the nose 75 of the locking-dog 76. The tripping-rod 232 is provided with a finger-button 234 and like the rod 225 is held in its retracted position by a spring 235.

Thus, in the device shown in Figs. 14 and 15, I provide manual means for moving the main-switch into both its open and closed-circuit positions.

When controlling a house-circuit it is desirable to have a trouble-light available when a short circuit so lessens the flow of current through the main-switch latching-magnet 68 as to weaken its pull and permitting the spring 80 to move the switch into its open-circuit position. For this purpose the switch-blades 20 and 20^a are respectively provided with rearward extensions 236 and 236^a which latter are adapted to receive between them, when the switch is in its so-called "open-circuit" position, the upstanding arm 237 of an L-shaped terminal-piece 238.

Similarly, the switch-blades 21 and 21^a are respectively provided with rearward extensions 239 and 239^a adapted to receive between them, when the switch is in its so-called "open-circuit" position, the outwardly-extending arm 240 of an L-shaped terminal-piece 241.

Wires 242 and 243 are respectively connected to the terminal-pieces 238 and 241 and lead to an electric lamp 244 which will be automatically lighted when the main circuit is broken, due to a short circuit and thus enable the operator to see his way to reset the switch.

The terminal-piece 23 has connected to it one of the main feed-wires 245, the complementary main feed-wire 246 being connected to the terminal-piece 34. Service-wires 247 and 248 respectively lead from the terminal-pieces 78 and 79.

The means herein shown and described for

automatically shutting off the electric current when a short circuit or overload occurs is not itself claimed herein, but is made the subject matter of a separate application, filed November 9, 1932, Serial No. 641,868.

I claim:

1. An automatic circuit-breaking apparatus comprising a switch; yielding-means normally tending to move the said switch into its open-circuit position; electro-magnetic means constructed and arranged to hold the said switch in its circuit-closing position against the counterurge of the said yielding-means; and an inertia-operated collision-switch interposed in the electrical circuit so as to control the flow of current through the said electro-magnetic means; whereby when a vehicle mounting my improved apparatus is involved in a collision the said inertia-operated collision-switch will move into its open-circuit position and effect the similar movement of the first mentioned switch.

2. An automatic circuit-breaking apparatus comprising a main-switch; yielding-means normally tending to move the said main-switch into its open-circuit position; electro-magnetic means constructed and arranged to hold the said main-switch in its open-circuit position against the counterurge of the said yielding-means; a secondary-switch interposed in the circuit of the said electro-magnetic means; yielding-means normally tending to move the said secondary-switch into its open-circuit position; secondary electro-magnetic means constructed and arranged to hold the said secondary-switch in its circuit-closing position; and an inertia-operated collision-switch interposed in the electrical circuit so as to control the flow of current through the said secondary electro-magnetic means; whereby when a vehicle mounting my improved apparatus is involved in a collision, the said inertia-operated collision-switch will move into its open-circuit position and effect the similar movement of both the said main and secondary switches.

3. An automatic circuit-breaking apparatus comprising a switch; yielding-means normally tending to move the said switch into its open-circuit position; electro-magnetic means constructed and arranged to hold the said switch in its circuit-closing position against the counterurge of the said yielding-means; a fuel-control valve; yielding-means normally tending to move the said control-valve into its closed position; electro-magnetic means tending when energized to hold the said control-valve in its open position and interposed in the electrical circuit in such manner that its supply of current is controlled by the said switch; whereby when the supply of current to the said electro-magnetic means of the said switch is weakened or fails, the said switch will be moved into its open-circuit position by its yielding-means and

permit the said fuel-control valve to be moved into its closed position by its yielding-means.

4. An automatic circuit-breaking apparatus comprising a switch; yielding-means normally tending to move the said switch into its open-circuit position; electro-magnetic means constructed and arranged to hold the said switch in its circuit-closing position against the counterurge of the said yielding-means; a manually-operable switch coupled into the electrical circuit in such manner that the supply of current to the said electro-magnetic means is dependent upon the said manually-operable switch being in its circuit-closing position; a fuel-control valve; yielding-means normally tending to move the said control-valve into its closed position; electro-magnetic means tending when energized to hold the said control-valve into its open position and interposed in the electrical system in such manner that its supply of current is controlled by the said manually-operable switch; whereby when the latter is moved into its open-circuit position the flow of current through the said electro-magnetic means of the said control-valve will be interrupted to permit the yielding-means thereof to move it into its closed position.

5. An automatic circuit-breaking apparatus as defined in claim 4, and having the electro-magnetic means of the fuel-control valve interposed in the electrical circuit so as to be de-energized by the movement of either or both the first-mentioned switch and the manually-operable switch.

In testimony whereof, I have signed this specification.

ROSS M. G. PHILLIPS.

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