Aug. 3, 1965 A. A. HITCHCOCK 3,198,899

CIRCUIT BREAKER FOR VEHICLES INCLUDING INERTIA-OPERATED SWITCH

Filed April 1, 1963

Fig. 1

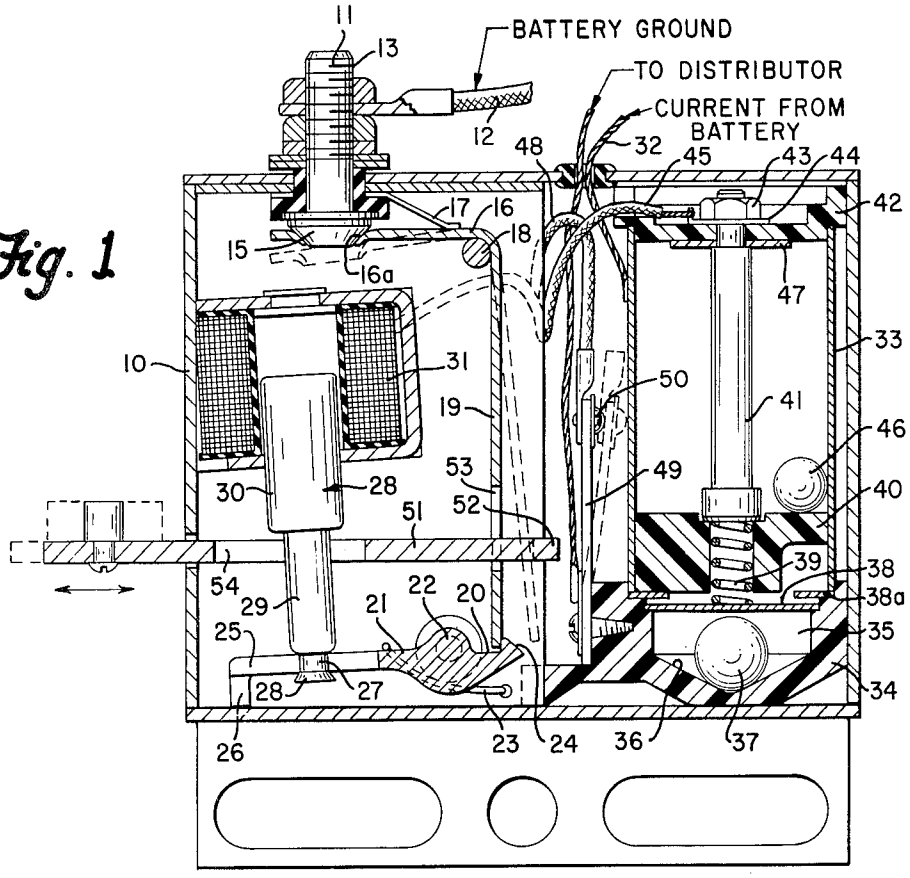


Fig. 3

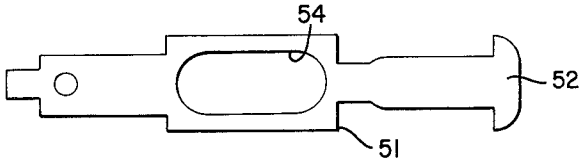
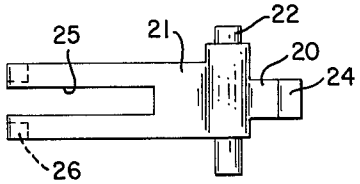


Fig. 2



INVENTOR.
ARTHUR A. HITCHCOCK
BY Malcolm W. Fraser
ATTORNEY

United States Patent Office 3,198,899 Patented Aug. 3, 1965

3,198,899

CIRCUIT BREAKER FOR VEHICLES INCLUDING INERTIA-OPERATED SWITCH

Arthur A. Hitchcock, Cridersville, Ohio, assignor to A.C.B. Corporation, Cridersville, Ohio, a corporation of Ohio

Filed Apr. 1, 1963, Ser. No. 269,589
4 Claims. (Cl. 200—61.45)

This application constitutes a continuation-in-part of my application Serial No. 188,605, filed April 10, 1962, now abandoned.

This invention relates to automatic circuit breakers, but particularly to an inertia switch for automobiles and other vehicles.

An object is to produce an inertia operated switch for automobiles or the like which is operative in the event of collision or upon encountering an object provided there is some bending action or advancing movement of the vehicle to a slight extent but which is not operative when the vehicle stops abruptly, such for example as when vehicle bumpers hit each other in a parking area.

Another object is to produce a switch of the above character which is effective in the event the vehicle capsizes or is partially overturned.

A further object is to produce a device of the above character which can be additionally operated manually to render the storage battery ineffective.

A still further object is to produce a simple and efficient device of this character which by manual manipulation can be readily reestablished for rendering the storage battery effective.

Other objects and advantages of this invention will hereinafter appear, and for purposes of illustration but not of limitation, an embodiment of the invention is shown in the accompanying drawings, in which

FIGURE 1 is a longitudinal sectional view of the circuit breaker device for vehicles embodying an inertia-operated switch;

FIGURE 2 is a plan view of the catch lever; and

FIGURE 3 is a plan view of the reset bar.

The illustrated embodiment of the invention comprises a vertically disposed housing **10** which may be of metal or other electrically conducing material, and at one end is disposed a metallic binding post or stud **11**, to which extends a lead **12** from the ground connection of a battery (not shown). The binding post **11** is in the form of a stud with the screw threads **13** at the upper end receiving clamping nuts for clamping the binding post in position, and securing the battery ground lead. The stud **11** is formed at its lower end with a head **15** in the form of a truncated cone, with the small end thereof disposed downwardly. Adjacent to the cone **15** is a bell crank arm **16** disposed at substantially right angles and provided with a hole **16***a* at one end, the sides of which are tapered to conform to the taper of the cone, so as to fit the cone intimately when in engaged position.

When the arm **16** is in contact with the nose **15** a suitable ground is established for the battery but when the arm **16** is moved away from the contact nose **15**, the ground for the battery is broken. A leaf spring **17** has one end fastened to the housing and the other end slidably engages the bell crank arm **16** to urge it in a direction away from and out of engagement with the contact nose **15**.

The metallic bell crank of which the arm **16** is a part is mounted for rocking movements on a pivot **18** over which the arm loosely rests to insure a relatively free, frictionless pivotal action. Integral with the arm **16** and disposed at substantially right angles thereto is a somewhat longer bell crank arm **19**. The free end portion of the arm **19** extends into a notch **20** in the upper

side of a horizontally disposed metallic catch lever **21** which is pivotally mounted in the housing **10** on a pivot **22** disposed adjacent the notch **20**. The pivot **22** is of trunnion-like construction engaging suitable bearings on the housing. When the arm **19** is engaged in the notch **20**, it is under tension and due to the inherent resilience of the arm **19**, the arm **16** is urged into intimate contact with the nose **15**. A spring **23** urges the arm **21** to the position shown on FIGURE 1. At one side of the notch **20** of lever **21** is an inclined or cam surface **24** which is adapted to engage the end portion of the bell crank arm **19** for forcing it back into the notch **20** to place the device in operative position.

The opposite end of the catch lever **21** is bifuricated to provide a notch **25** and on the ends of the bifurcated arms are downwardly extending feet **26** to abut the bottom wall of the housing **10**. As will hereinafter appear, the end of the catch lever **21** normally is held in engagement with the bottom wall of the housing. A reduced neck portion **27** extends through the slot **25** in the catch lever **21** and has an outwardly flared head **28** at the outer end. The reduced neck **27** forms part of a vertically inclined armature **28**. The armature is disposed in vertically inclined position and has a smaller diameter stem **29** and a large upper portion **30** which is slidable axially within a solenoid **31**. When the solenoid **31** is energized, the armature is moved upwardly in an inclined path, thereby to rock the catch lever **21** in a clockwise direction sufficient to release the bell crank arm **19** which then rocks in counter-clockwise direction due to the spring **17** so that the bell crank arm **16** is moved away from the tapered contact nose **15**, thereby to break the ground connection for the battery. It will be understood that the parts described such as the bell crank, the catch arm and the feet **26** all ground the lead **12** to the housing **10**.

The weight of the armature **28** is such that it normally bears against the arm **21** and assists holding the latter in its horizontal position. The solenoid **31** is grounded by a suitable lead extending to a side wall of the housing **10**.

A lead **32** extends from a storage battery (not shown) through an insulated opening in the top wall of the housing **10** to a vertically disposed cylindrical housing **33** of electrically conductive material. The housing **33** contains a base block **34** of electrically insulating material which rests upon and may be suitably connected to the bottom wall of the housing **10**. The base block **34** is formed with a cavity **35**, the bottom wall of which is V-shaped to form a cylindrical cone-shaped ramp surface, as indicated at **36**. Seated normally in the bottom of a conical cavity is a steel ball **37**. The ball **37** is normally spaced below and out of contact with a metallic electrically conductive plate **38** which seats loosely on a ledge in the insulating block **34**. An helical coil spring **39** bears against the upper face of the plate **38** and holds it yieldably in seated position. Disposed directly above the plate **38** is a rim **38***a* which forms part of the housing **33** and against which the plate **38** contacts in response to action of the ball **37**. The coil spring **39** is of electrically conductive material and extends freely through an insulating block **40** which is suitably fixed within the cylindrical housing **33**. The upper end of the coil spring **39** engages the lower end of an electrically conductive stem or post **41**. The upper end of the post **41** extends through an insulating cup **42** which is in engagement with the upper end of the cylindrical housing **33** and also the housing **10**. The upper end of the post **41** is screw threaded to receive a clamping nut **43** engaging an electrically conductive disk **44** which is connected by a lead **45** to the solenoid **31**.

Normally resting upon the upper surface of the block **40** is a steel ball **46** which, in the event the vehicle over-

turned, would engage a portion of an electrically conductive disk 47 as well as the adjacent wall of the housing 33 to establish a circuit from the battery lead 32, housing 33, ball 46, disk 47, post 41, disk 44, and lead 45 to the solenoid 31.

In the operation of the device so far described, it will be understood that in the event that a severe rate of change of speed of the vehicle takes place to which the device is attached, the steel ball 37 will travel in one direction or the other up the adjacent inclined or cam surface 36, thereby imparting movement to the plate 38 causing it to engage the housing rim 38*a* enabling the flow of current from the housing 33, through the plate 38, spring 39, post 41, disk 44, and lead 45 to the solenoid 31. This movement of the steel ball 37 is an important feature of the device because a timing element is involved. In the vent of an abrupt stop of the vehicle, such as is ordinarily occasioned by the contact of a bumper with an adjacent car in a parking maneuver or as occasioned by a truck bumping into a loading dock, the ball 37 travels up the inclined surface or ramp reaching its extremity and rebounding to the original position so quickly that insufficient time is afforded for the solenoid 31 to be energized for tripping the catch lever 21. Experience has shown that the device will not operate even though a severe impact takes place so long as the forward motion of the vehicle does not continue at least to a small degree. It is essential that there be at least some slight motion whether it be forward, rearward or lateral after the impact for this device to function. It is further found that if there is some bending action in either the moving vehicle or the object struck, causing a resistance slightly greater than that experienced in a severe braking maneuver and existing for a split second of time, the contact plate 38 will be held in contact with the rim 38*a* long enough to energize the solenoid 31 and cause the armature 28 to trip the catch lever 21. Thereupon the bell crank is released and the spring 17 rocks the arm away from the cone 15 breaking the ground connection for the battery.

Branching from the lead 45 is a lead 48 extending to a spring contact arm 49, one end of which is anchored to the block 34. The other end of the arm 49 carries a contact point 50 which is moveable into engagement with the outer wall of the cylindrical housing 33.

A bar 51 extends through an opening in a side wall of the housing 10 to be operated from the outside. It can be manually shifted laterally in order to depress the contact spring 49 against the housing 33, manually to energize the solenoid for breaking the ground connection for the storage battery, thereby to place the vehicle out of operation in the event that were desired. This bar performs another function and that is to reset the parts into operative position after the solenoid 31 had been energized to break the ground connection for the battery. It will be observed that the bar 51 has a head 52 at its free end so that by movement of the bar 51 to the left of the figure, the bell crank arm 19 can be rocked in a clockwise direction to replace it in the notch 20 of the catch lever 21. As indicated the bar 51 extends through an aperture 53 in the bell crank arm 19. The bar 51 is also provided with a longitudinally elongate slot 54 through which the lower end portion 29 of the armature 28 extends, the slot being so dimensioned as to enable shifting movement of the bar 51 without interfering with the armature 28.

From the contact arm 49 extends a lead 55 which may extend to the generator or distributor of the vehicle (not shown) and serves the purpose of blocking current from the generator after the ground cable 12 has been blocked out so that if the vehicle motor is still running, this will serve the purpose of stopping it. With respect to diesel engines the same lead 55 may be used to ground the fuel switch solenoid, thereby shutting off fuel to the diesel engine.

What I claim is:

1. An inertia-operated switch for motor driven vehicles having a storage battery comprising a binding post for receiving the ground lead from the storage battery, a spring biased lever of conductive material for engaging said binding post for establishing the ground connection, a metallic catch lever releasably holding said spring biased lever in operative position, solenoid means including an armature for actuating said catch lever to release said spring biased lever for breaking the ground connection, means to energize said solenoid means in the event of an impact followed by a slight time delay such as occasioned by some slight vehicle motion, said energizing means comprising an upright cylindrical housing of electrically conductive material adapted to receive current from the storage battery, a member of electrical insulating material at the base of said housing having a chamber provided with a conical ramp surface constituting the bottom wall thereof, a relatively heavy ball in said chamber and moveable along said ramp surface, said housing an opening in the bottom wall thereof, a contact plate beneath said bottom wall and normally seated against said insulating member and moveable by impact of said ball thereagainst into engagement with the edge of said housing opening, an electrically conductive spring bearing against said plate to hold same out of contact with said housing, and an electrical connection between said spring and said solenoid so that movement of said plate by said ball against said cylinder enables current from the storage battery to flow from said cylinder through said contact plate and spring to energize said solenoid and thereby cause breaking of the ground connection for the storage battery.

2. An inertia-operated switch as claimed in claim 1 comprising a spring contact arm associated with the cylindrical housing but normally out of contact therewith, a lead from said arm to the solenoid so that by moving said contact arm into engagement with said cylinder the solenoid is energized, a shiftable bar moveable in one direction into engagement with said contact arm for moving same into engagement with the cylindrical housing and moveable in the opposite direction to reset the spring biased lever into engagement with the binding post.

3. An inertia-operated switch as claimed in claim 1 in which the contacting end of the binding post providing the ground connection from the storage battery is in the form of a truncated cone, and the adjacent end portion of the spring biased lever has a hole the sides of which are tapered to conform to the taper of said cone.

4. An inertia-operated switch as claimed in claim 1, comprising an insulating member closing the upper end portion of said cylindrical housing, a post of conductive material secured at its upper end to said insulating member and providing at its lower end a seat for the contact plate engaging spring, a lead extending from said post to said solenoid, an electrically conductive disc on the upper end of said post, and an electrically conductive ball within the cylindrical housing and normally resting against the insulating member at the base of the housing, said ball in the event of overturn of the vehicle engaging a portion of said disc as well as the adjacent wall of the housing to establish a circuit for energizing the solenoid.

References Cited by the Examiner

UNITED STATES PATENTS

1,890,233	12/32	Phillips	200—61.5
1,995,780	3/35	Phillips	180—82
2,155,758	4/39	Hinde	180—82.3
2,415,086	2/47	Detwiler	260—61.45
2,966,562	12/60	McElvain	200—61.5
3,110,780	11/63	Schultz et al.	200—61.5

BERNARD A. GILHEANY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*