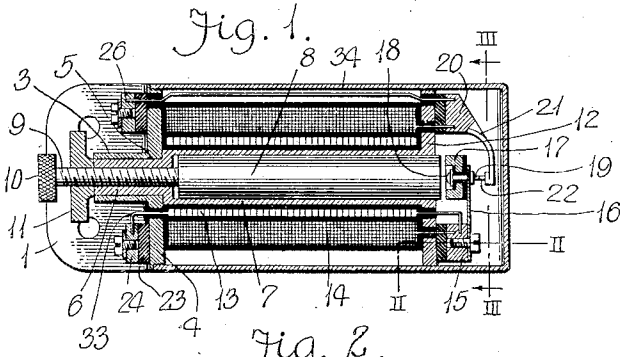
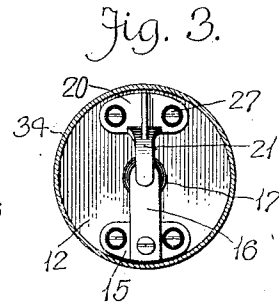
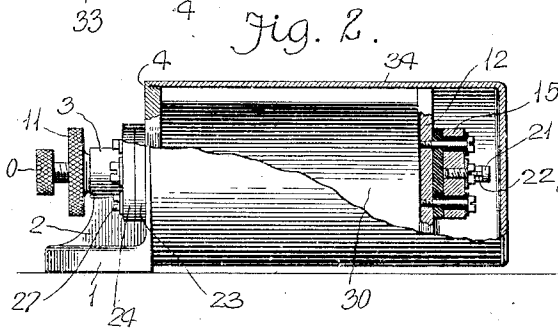
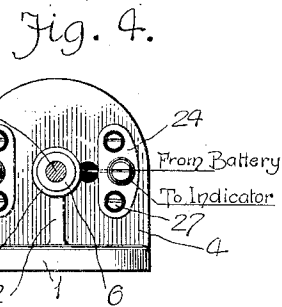
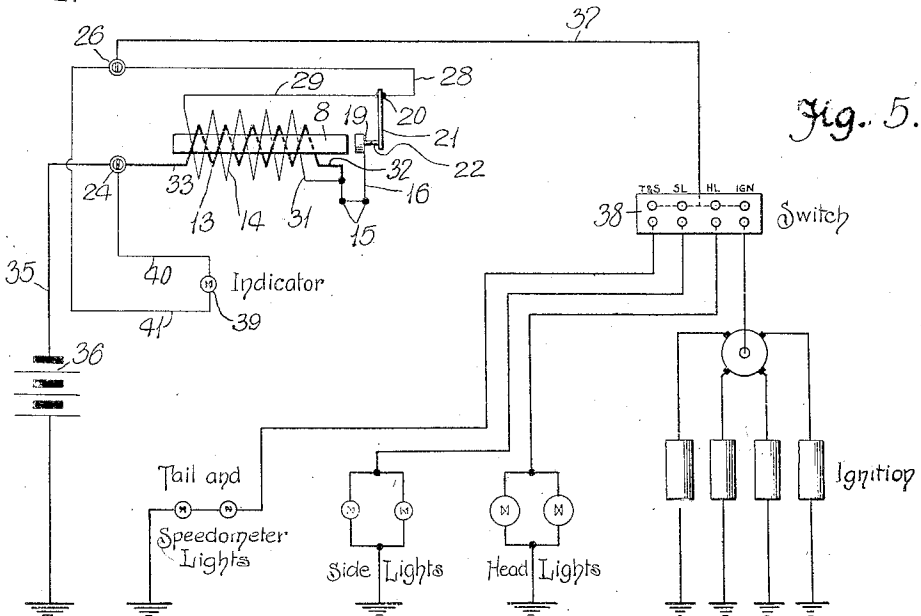


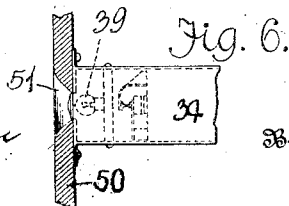
R. C. FRYER.
CIRCUIT BREAKING RELAY.
APPLICATION FILED JUNE 7, 1915.

1,207,016.

Patented Dec. 5, 1916.



Witnesses
Chas. W. Stauffer
Karl H. Butler



Inventor
Roy C. Fryer,
By *[Signature]* Attorney

UNITED STATES PATENT OFFICE.

ROY C. FRYER, OF DETROIT, MICHIGAN.

CIRCUIT-BREAKING RELAY.

1,207,016.

Specification of Letters Patent.

Patented Dec. 5, 1916.

Application filed June 7, 1915. Serial No. 32,491.

To all whom it may concern:

Be it known that I, ROY C. FRYER, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Circuit-Breaking Relays, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to a circuit breaking relay, and the primary object of my invention is to provide a non-vibrating relay that is positive in its action, but liable to injury from ordinary use, and highly efficient for controlling electric circuits.

15 Another object of my invention is to provide a circuit breaking relay that can be advantageously used in connection with the well known electric light and control system of automobiles, the relay shunting a circuit to an indicator whereby the operator of an automobile can ascertain short circuits or electrical imperfections in the system.

25 A further object of this invention is to obviate the necessity of using fuses as part of the circuits of a lighting system, as the relay offers the same protection to an apparatus or system, and has the advantage of automatically restoring itself to normal position. It is in this connection, that with slight modification, principally in the switch, the relay can be used on any car having an electrical system, or as another instance, in connection with isolated storage battery lighting systems for farms using two wires instead of a ground connection.

30 With the above and other objects in view, the invention resides in the novel construction, combination and arrangement of parts to be hereinafter described and then claimed.

Reference will now be had to the drawing, wherein—

45 Figure 1 is a horizontal sectional view of the relay; Fig. 2 is a cross sectional view taken on or about the line II—II of Fig. 1; Fig. 3 is a side elevation of the relay, partly broken away and a portion thereof in section as denoted by line III—III of Fig. 1; Fig. 4 is an end view of the relay; Fig. 5 is a diagrammatic view illustrating the relay in connection with an electric light

and control system, and Fig. 6 is an elevation of a modified form of relay.

In the drawing, 1 denotes an angle bracket having a central web 2 supporting a barrel 3. The angle bracket 1 has a circular exteriorly screwthreaded head 4 provided with a concentric opening 5 in communication with the barrel 3. Extending through the opening 5 of the head 4 and the barrel 3 of the web 2 is the tubular stem 6 of a core casing 7. This core casing is cylindrical and contains an adjustable core 8 provided with a screw 9 in threaded engagement with the tubular stem 6 of the core casing. The screw 9 has the end thereof provided with a knurled button 10 to facilitate rotating the same, and with a jam or lock nut 11 for holding the screw in an adjusted position. The core casing 7 has a head 12 cooperating with the head 4 of the angle bracket 1 in forming the ends of a spool upon which there is wound a main line coil or winding 13 and a shunt coil or winding 14, these windings being insulated from each other and from the core casing 7 and the heads 4 and 12.

Suitably connected to the head 12 and insulated therefrom is a support 15 for a resilient armature arm 16 which has the outer end thereof in the longitudinal axis of the core 8. The outer end of the armature arm 16 is provided with an armature piece 17 adapted to engage the core 8 and said armature piece is suitably insulated from the armature arm 16 and retained in engagement therewith by a rivet 18 or similar fastening means terminating in a contact 19. Diametrically opposite the support 15 is another support 20 on the head 12 and this support has an arm 21 provided with a contact 22 normally engaged by the contact 19 of the resilient armature arm 16.

The outer side of the head 4 of the angle bracket 1 is provided with pieces of insulation 23 and with terminal pieces 24 and 26, said terminal pieces and the insulation 23 being held in engagement with the angle bracket by insulated screws 27 or similar fastening means. As shown in Fig. 3 similar screws are employed for holding the supports 15 and 20 and said screws are held by the head 12, as shown in Fig. 2. The

terminal 26 is connected by a wire 28 to the support 20 and said support is connected by a wire 29 to the shunt winding 14. The support 15 is connected by wires 31 and 32 to the windings 14 and 13 respectively. The terminal 24 is connected by a wire 33 to the winding 13, and inclosing exposed wires and the armature end of the relay is a cylindrical shell 34 screwed upon the head 4 of the angle bracket 1.

The operation of the circuit breaking relay can be best understood when considered in connection with an electric lighting and control system of an automobile, and referring to Fig. 5, it is to be noted that the terminal 24 is connected by a wire 35 to batteries having a ground connection. The terminal 26 is connected by a wire 37 to a multiple switch or control board 38 having electrical connection with the ignition, head lights, side lights, tail and speedometer lights of an automobile. In addition to these lights an electrically operated indicator or lamp 39 is connected by wires 40 and 41 to the terminals 24 and 26 respectively.

Considering the source of electrical energy 36 as a storage battery of six volts and the circuit breaker in normal position, the path of the current is as follows:—from the battery 36 to terminal 24, where three paths are offered between terminals 24 and 26 viz:

(a) From terminal 24 by wire 40 to indicator 39 and by wire 41 to terminal 26.

(b) From terminal 24 by heavy winding 33—32 through support 15 of arm 16 to contacts 19 and 22 and by wire 28 to terminals 26.

(c) From terminal 24 by heavy winding 33—32, to fine winding 31 and by wires 29 and 28 to terminals 26. With the fine winding of the coil as a continuation of the heavy winding and wound in the same direction back to the starting point of the heavy coil, the fine winding will have the same polarity as the heavy winding. The heavy winding, as will hereinafter appear, receives sufficient current to attract the armature to the coil, and then the current required for such attraction passes through the fine winding and coöperates with the current of the heavy winding in maintaining the core or such magnetism as to prevent vibration of the armature.

Continuing from the terminal 26 by wire 37 current flows to the switch 38 and is distributed hence by the way of ignition to ground; headlights to ground; side lights to ground, tail and speedometer to ground, returning through the frame of an automobile, known as the ground, to the grounded side of the battery 36, thus completing the circuit.

Indicator 39 will consist in a six volt system as shown, of an incandescent bulb, the

resistance of which is twelve ohms, thus permitting a passage of only one-half ampere through circuit described as (a).

Heavy winding shown as 33—32 consists of a few turns of heavy wire about number ten or number twelve B and S gage copper, and there will be approximately three feet of this wire. As the resistance of number ten copper annealed is $17\frac{1}{4}$ ohms per foot, it follows that the resistance of this heavy winding is extremely small, about $\frac{1}{10}$ of 75 an ohm, for circuit outlines in (b).

The fine winding 31 is wound to from twelve to twenty-four ohms, permitting a passage of one-half to one-fourth of an ampere on a six volt circuit outlined by (c). Next, note that the circuits outlined as (a), (b), (c), are shown in the diagram normally in parallel, therefore, the current will divide in proportion to their respective conductivities and as the resistance of (a) or (c), are six thousand nine hundred and thirty-six times that of (b), it follows that the current through (a) or (c) will be but $\frac{1}{36}$ of that flowing through (b), and as (b) is designed to carry about thirty amperes, the current flowing through circuit outlined as (a) is not sufficient to cause the indicator filament to glow while in parallel with (b). Neither will the circuit outlined in (c) exert much influence upon the core while in parallel with (b).

By means of adjusting nut 10 and lock nut 11 the pole piece 8 may be adjusted to such a distance from the armature 17 that any predetermined current will cause sufficient magnetism in the core to open the circuit (b), at contacts 19 and 22, by means of attracting the armature 17. For instance, suppose core 8 is drawn back until a current of thirty amperes produces just enough magnetism to pull armatures 17 sufficient to open contacts 22 and 19. The instant any current over thirty amperes, or ground occurs in wire 37 or between wire 37, ignition, lights or ground, armatures 17 will open contacts 22 and 19 instantly breaking circuit outlined as (b), thus leaving the circuits (a) and (c) in parallel, and as (a) and (c) are more nearly alike in resistance, the current flowing will be divided almost equally between the two, causing a full current of one-half ampere to actuate the indicator 39 and a current of from one-quarter to one-half ampere through the fine winding 31 in the circuit described in (c), to hold armature 17 against core 8 thus allowing only a current of three-fourths ampere to flow through wire 37 and switch 38, or ground or short circuit or whatever may complete the circuit. This condition will be maintained until supply of current is exhausted or ground removed, or circuit interrupted at switch, then armature 17 will

rebound and contacts 22 and 19 will remain closed in normal operating position.

In Fig. 6 there is shown a slight modification of my invention, consisting of locating the indicator lamp 39 within an end of the shell and the end of the shell secured to a control or dash board 50 having an opening 51 alining with an opening in the end of the shell. Such arrangement places the relay under the hood of an engine or the cowl of an automobile with the indicator lamp convenient for observation and a minimum amount of wiring.

What I claim is:—

1. A circuit breaking relay comprising a bracket, a barrel carried thereby, a core casing having a stem at one end thereof extending into said barrel, a core in said casing, adjustable means in the stem of said casing for moving said core, a main line coil on said casing and insulated therefrom, a shunt coil on said main line coil and insulated therefrom and connected to one end of said main line coil, a resilient armature arm at the opposite end of said core casing and connected to said main line coil, a fixed arm opposing said armature arm and connected to said shunt coil, a contact carried

by said fixed arm, and an armature on said armature arm normally engaging said contact and adapted to be moved out of engagement with said contact when said armature is attracted by said core.

2. A circuit breaking relay comprising a core casing; a core in said casing, a resilient armature arm at one end of said casing; an armature carried thereby and adapted to be connected to said core; an arm opposing said armature arm; a head on said arm normally engaged by said armature; an insulated main line coil on said core casing in circuit with said armature, and an insulated shunt coil on said main line coil as a continuation of the main line coil and wound in the same direction back to the starting point of said main line coil and adapted with said main line coil for energizing said core sufficiently to attract said armature and magnetize said core to hold said armature against vibration.

In testimony whereof I affix my signature in presence of two witnesses.

ROY C. FRYER.

Witnesses:

ANNA M. DORR,
KARL H. BUTLER.

Correction in Letters Patent No. 1,207,016.

It is hereby certified that in Letters Patent No. 1,207,016, granted December 5, 1916, upon the application of Roy C. Fryer, of Detroit, Michigan, for an improvement in "Circuit-Breaking Relays," an error appears in the printed specification requiring correction as follows: Page 1, line 13, for the word "but" read *not*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of January, A. D., 1917.

[SEAL.]

Cl. 175—268.

F. W. H. CLAY,
Acting Commissioner of Patents.