I. W. BROEGGER.

CIRCUIT CONTROLLING MECHANISM.

APPLICATION FILED JAN. 26, 1917.

1,336,418. Patented Apr. 13, 1920.

Fig. 1

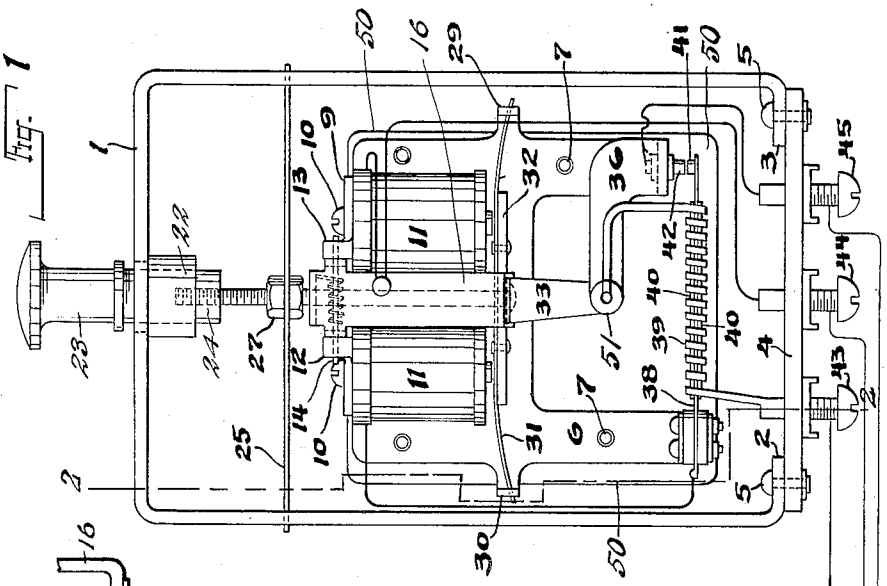


Fig. 3.

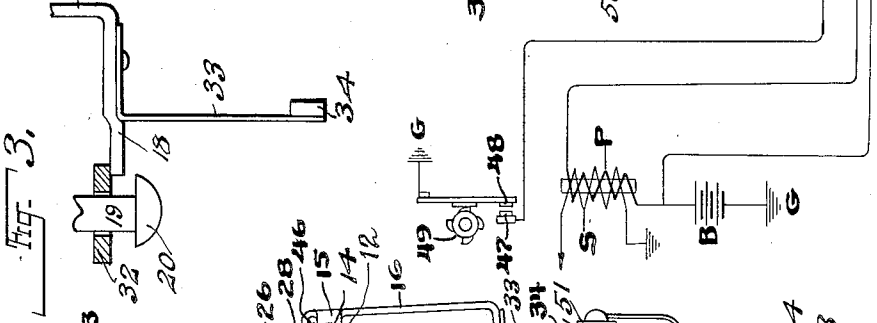
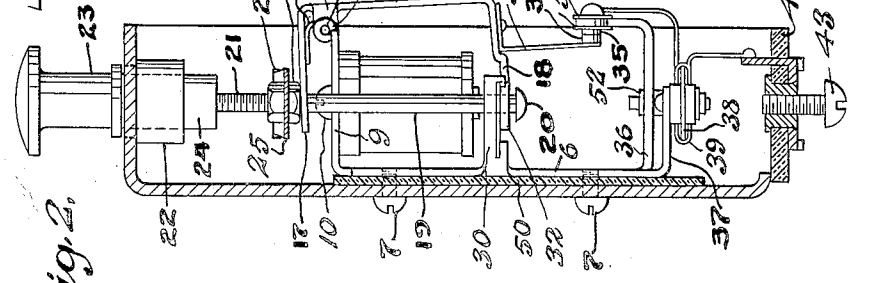


Fig. 2.



INVENTOR
IVAR W. BROEGGER
Albion D. T. Libbey
ATTORNEY

UNITED STATES PATENT OFFICE.

IVAR W. BROEGGER, OF NEWARK, NEW JERSEY, ASSIGNOR TO SPLITDORF ELECTRICAL COMPANY, OF NEWARK, NEW JERSEY.

CIRCUIT-CONTROLLING MECHANISM.

1,336,418. Specification of Letters Patent. Patented Apr. 13, 1920.

Application filed January 26, 1917. Serial No. 144,639.

To all whom it may concern:

Be it known that I, IVAR W. BROEGGER, a subject of the King of Norway, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Circuit-Controlling Mechanism, of which the following is a specification

This invention relates to means of controlling electrical circuits wherein a safeguard is required to protect certain elements of the circuit that would otherwise be liable to suffer injury owing to the abnormal current conditions which may occur therein and is particularly applicable for use in connection with ignition systems for internal combustion engines in which the current supply for igniting the explosive charges in the engine cylinders is furnished by some direct current source, such as a storage battery or a direct current generator. In order to set forth the principles of my circuit controlling mechanism, I have chosen to describe its use in connection with an ignition system.

In the battery ignition system which is a typical form of those above mentioned, and which is employed to a large extent in the equipment of autovehicle engines, there is involved generally a storage battery connected in circuit with the primary of a high tension induction coil and the contact points of a timer. The function of the timer is to make and break the battery circuit through the primary coil, and for this purpose said timer is usually operated by some engine member in order that it may interrupt the primary circuit at the proper rate and in the correct time relation with the angular position of the crank shaft, or in other words said timer so controls the primary circuit that the high tension currents induced in the secondary may be delivered to the engine cylinders in the well known manner. Considering these facts it will readily be seen that in systems of this type there is always the possibility that when the engine comes to rest the timer contact points may be left in closed position, allowing the battery to discharge itself through the low resistance primary coil, which not only runs the battery down but also impairs said primary coil. These hazardous conditions are liable to occur whether the open or closed circuit timer is used. By open circuit type I mean one which operates in the reverse order of that shown in Figure 1, and in distinction from the "flip" type which cannot be left in circuit closing position. It is then one of the chief objects of this invention to provide a simple and improved means to be used in connection with the primary circuit adapted to utilize the abnormal current so produced when the timer contacts are left in closed position for the purpose of operating a thermostatic device to automatically open the primary circuit, thereby relieving the same from the possibility of injury.

Another object is to provide a device of this character which together with this automatic circuit opening means involves a new arrangement of elements such that the automatically actuated elements may be controlled manually for the purpose of opening the primary circuit.

Another object is the provision in my new arrangement of a single manually operable means such as a hand operated button, the actuation of which serves to open the circuit as above described, and also serves to close said circuit and restore the various elements of the device in position for either manual or automatic operation.

With these and other objects in view my invention is further characterized by certain novel features of construction and operation, all of which will readily be understood by those skilled in the art after having studied the following description, taken together with the accompanying drawing which forms a part of this specification.

In said drawings wherein like characters of reference identify like parts in each of the figures; Fig. 1 is a top plan view of my improved mechanism with the cover removed so as to expose the interior arrangement of the several parts. This view shows the parts in their relative positions when the device has been operated to open the primary circuit of an ignition system shown to illustrate the application of the controlling mechanism.

Fig. 2 shows a side elevation of Fig. 1, with the side casing cut off along the line 2—2 of Fig. 1, and with one of the electromagnets removed to illustrate the arrange-

ment of the manually operated plunger. This view shows the plunger in the position it takes when operated to close the main contact points, the spring member being seen under tension ready to restore said plunger as soon as the pressure is released from the button.

Fig. 3 is an enlarged view showing the normal relation of the armature controlled by the electromagnets and one of the switching members.

Referring to the drawings, 1 is a casing member which may be pressed and formed out of flat stock. When completely formed said casing assumes a suitable rectangular shape having one end left open excepting for the inwardly extending portions 2 and 3. Across said open end an insulating block 4 is fixed as by means of rivets 5 passing through portions 2 and 3 of casing 1. Said block may be made of any good insulating material such as fiber. A supporting member 6 is designed to support substantially the entire structure of my controlling device, which may, if desirable, be insulated in a suitable manner from the casing 1 as by a one piece insulating strip 50. Said member rests within the casing 1 being secured thereto by screws 7. At one end the supporting base 6 has a bracket 9 turned upward therefrom at right angles. Mounted upon the bracket 9 as by screws 10 are two electromagnets 11, the function of which will later be explained. Said bracket when being shaped is provided with two small integral strips which are turned back to form a pair of eyelet members 12 and 13 which support a fulcrum pin 14. Mounted upon said pin by means of lugs 15 for pivotal movement thereabout is a switch lever 16 having its ends bent over to form the depending arms 17 and 18. A coiled spring 46 having one end resting against arm 17 tends to tilt the lever 16 to the left looking at Fig. 2.

Centrally arranged within the casing 1 and extending between magnets 11 is an actuating plunger rod 19 one end of which is headed as at 20, the other end having a thread 21 cut thereon. Guidingly supported in a collar 22, which in turn is suitably fastened to the casing 1, is a manually operable button 23 having a shank 24 with a tapped hole therein. The threaded end of plunger 19 is screwed into the shank 24 whereby said plunger is adapted to be operated by the button 23. Said plunger rod when thus assembled passes through a hole in the depending arm 17 and also through a leaf spring 25, which spring spans the casing 1 and is loosely supported thereby in slots 26. Said spring is securely fastened to rod 19 by means of two adjusting nuts 27 and 28 and serves to control said rod in a manner that will be described hereinafter. The said hole in the end of arm 17 is preferably made somewhat larger than plunger 19 in order that switch lever 16 may tilt freely up and down on its fulcrum 14. Supported by the uprights 29 and 30 by means of slots therein is a flexible strip 31 which carries an armature 32 for the magnets 11. This method of supporting the armature enables a quick and easy assembly. Said armature has a clearance hole through which the rod 19 passes in order to permit the magnets 11 to actuate the armature 32 independently of said rod. This structure is clearly seen in Fig. 3 wherein the arm 18 is below the armature 32 thereby holding the resilient member 31 normally under tension. After the switch lever has been operated, as will be hereinafter pointed out, the arm 18 is withdrawn from below the armature 32 and due to the tension of the spring 31, the armature 32 will be forced to the position shown in Fig. 2 wherein it is seen that the armature 32 engages the end of arm 18 holding it in circuit closing position. Fastened to the arm 18 of switch lever 16 is a flexible member 33 which carries one of the main switch contacts 34. The other of said contacts 35 is fastened to a bracket 36 and insulated therefrom by a suitable bushing passing through the end of 36 and insulators 51.

Supported on an upright 37 is a thermostat having a thermostatic couple 38 composed preferably of a strip made of two different materials whose expansion coefficients differ from each other widely. 39 is a heating coil of suitable material wound about the strip 38 and insulated therefrom as by mica strips 40. The heat generated by a sufficiently heavy current flowing in coil 39 bends the strip 38 in a given direction as is well understood by those familiar with such devices. Mounted upon the free end of the strip 38 is a contact 41 adapted to engage a contact 42 when operated by said thermostat, but normally in open circuit relation therewith. The contact 42 is fastened to and insulated as by insulators 52 from the horizontal part of bracket 36. The insulating block 4 has three terminal posts 43, 44, and 45. Post 43 is connected internally to one end of heating coil 39, the other end of which leads to the main contact 35. Posts 44 and 45 are connected respectively to switch lever 16 and contact 42. Said lever is also connected to one terminal of the magnets 11, the other terminal of said magnets being connected to the thermostatic strip 38.

Considering the operation of my improved controlling mechanism, Fig. 1 shows the relative arrangement of parts when the main contacts 34 and 35 are open. To close these contacts it is only necessary to apply a pressure to the button 23 which moves the

same together with rod 19 to the position shown in Fig. 2. Such longitudinal movement of plunger rod 19 causes the nut 28 to engage the depending arm 17 which tilts the switch lever 16 to the right looking at Fig. 2 thereby carrying contact 34 into engagement with contact 35. As soon as lever 16 assumes this position the spring 31, which while said contacts are open is flexed as seen in Fig. 1, straightens out and thereby moves armature 32 in line with the end of arm 18 of lever 16. Upon the pressure being released from button 23 to spring 25, which it will be understood had been flexed, straightens out to its horizontal position, at the same time restoring plunger 19 to its normal position with the head 20 resting closely to armature 32 and with a considerable clearance between nut 28 and arm 17 as shown in Fig. 1. The arm 18 now bearing against the side of armature 32 holds switch lever 16 in its contact closing position against the action of the spring 46. As hereinbefore noted the contacts 34 and 35 may be opened either by automatic or by manual means. When conditions occur such that a circuit is completed through electromagnets 11 said magnets are energized to attract the armature 32 upwardly out of the path of the arm 18. This permits spring 46 to tilt the switch lever 16 inwardly to open contacts 34 and 35. It will be noted that the clearance above referred to between nut 28 and arm 17, provided as the plunger 19 automatically assumes its normal position after being operated, now serves a useful purpose. That is, when the armature 32 has been attracted away from arm 18 and the switch lever 16 is rotated about its axis by spring 46, the arm 17 of said lever is permitted, due to said clearance, to accomplish its movement. In this manner the small spring 46 merely has to do work on switch lever 16 and is not obliged to restore or assist in restoring the plunger rod 19. If however it be desired to operate my device manually for opening said contacts a pull is applied to button 23 which moves the rod 19 upwardly and causes the head 20 to carry the armature 32 therewith with the same results as those described in connection with the automatic operation. In this case the plunger has been displaced from its normal position in the other direction and spring 25 is flexed oppositely from the first operation. As soon as the pull is released from button 23 said spring will restore rod 19 to its normal position independently of and without affecting any of the other elements.

Referring to the application of my controlling mechanism to an ignition system there is shown a battery B, an induction coil having primary and secondary coils P and S, and timer contacts 47 and 48 actuated by a cam 49, which elements are well known in connection with ignition systems for gas engines. There is also indicated the manner in which my improved device is adapted to be connected in circuit with these elements for the purposes hereinbefore explained. Assuming the engine, with which this apparatus is associated, is to be started, the operator presses in on the button 23 which action closes the main contacts 34 and 35. A circuit may now be traced from battery B through coil P to post 44, thence to lever 16, contacts 34, 35, coil 39, post 43, timer contacts 47, 48 to ground and back to battery thereby giving a complete primary circuit, the operation of which serves to furnish the ignition current for the engine. When it is desired to stop the engine the button 23 is pulled outwardly which, as already explained, opens contacts 34 and 35 and consequently breaks the primary circuit. Should for any reason the engine stop without opening said circuit, and in such a position that the timer contacts remain closed, the battery would then be closed through a circuit of comparatively low resistance with the result of an abnormally high current. This high current passing through the coil 39 heats up the thermostatic couple 38 causing the same to deflect and close contacts 41 and 42. Immediately this occurs a second circuit may be traced from battery B, post 45, contacts 42, 41, strip 38, electro-magnets 11, lever 16, contacts 34, 35, heating coil 39, post 43, closed contacts 47, 48 and thence to ground. Thus the magnets 11 are energized and automatically actuate the armature 32 to open the circuit as described. The primary circuit is in this way relieved of the abnormally high current before any damage can be done, and the thermostat then returns to its normal position.

By my invention I am enabled to produce a circuit controlling mechanism wherein circuit opening devices may be actuated automatically or manually and in either case independently of the other. I have also provided to have this manual means further serve to operate said device for the purpose of closing the circuit, and also to restore said automatic means. Another feature is that the single manually operable circuit controlling means assumes the same normal inoperative position independently of the other elements after having been actuated to either open or close the circuit in which the device is connected.

While I have confined the foregoing description particularly to ignition systems for gas engines it will be apparent that my device is not limited to such use, but may well be applied to various other systems wherein it is desired to control electrical circuits in a manner similar to that described. I am also well aware that my invention is

not limited to the embodiment shown but that many changes and alterations may be made therein.

Having thus described my invention what I claim is:—

1. In an electrical circuit, a switch having two contacts one of which is carried by a lever, a manually operable non-indicating rod movable in one direction to move said lever and close said contacts, flexible means to hold said contacts closed, a thermostat operated by excessive current in said circuit, means brought into service by said thermostat to move said flexible means and thereby cause an automatic opening of said contacts, said rod also being movable in the other direction independently of said lever to effect an opening of said contacts, and means for restoring said rod to its non-indicating position, as described.

2. In an electrical circuit, a switch having two contacts one of which is carried by a lever, a manually operable rod movable in one direction to actuate said lever and close said contacts, electro-magnetic means brought into service by a thermostat to automatically open said contacts when the current in said circuit becomes excessive, said rod also being operable in the other direction to effect a manual opening of said contacts, and means to automatically restore said rod to the same inoperative position after having been moved in either direction.

3. In an electrical circuit, a switch device having switch contacts in said circuit, a lever carrying one of said contacts, a plunger manually movable in one direction to actuate said lever to close said contacts, means independent of said plunger to hold said contacts closed, means to automatically act on said first mentioned means to open said contacts when the current in said circuit becomes excessive, said plunger being movable in the other direction to manually open said switch contacts, and means to restore said plunger to normal position.

4. In an electrical circuit, a switch having switch contacts in said circuit, a lever carrying one of said contacts, a plunger manually movable in one direction to actuate said lever to close said contacts, means independent of said plunger coacting with said lever to hold said contacts closed, thermostatic means automatically actuated when the current in said circuit becomes excessive for acting on the first mentioned means for causing said contacts to be opened, said plunger being movable in the opposite direction to manually open said switch contacts, and a resilient member for restoring said plunger to its normal inoperative position.

5. A switch for an electrical circuit having in combination, switch contacts in said circuit, a switch lever carrying one of said contacts and pivotally mounted, an electromagnet having a flexibly mounted armature normally held in restraint by said switch lever, a pair of auxiliary contacts for closing a circuit through said electromagnet, a plunger rod passing through both said lever and armature and adapted for relative movement with respect to each, a thermostat operable when an excessive current flows in said circuit to close a circuit through said pair of auxiliary contacts to bring said magnets into service, said rod when manually moved in one direction coacting with said lever to close said contacts and allow said restrained armature to move to engage and hold said lever in contact closing position, said magnets when energized acting on said armature to move it out of engagement with the lever and into the restrained position, said rod when manually moved in the other direction coacting with said armature to also move it out of engagement with the lever and into restrained position, means on said rod to automatically restore the same independently of both the switch lever and armature to its normal inoperative position after having been actuated in either direction and means for moving the lever to open said contacts.

6. A switch for an electrical circuit having in combination, an electromagnet, a switch lever, switch contacts, an armature, a thermostat, a base member supporting the above mentioned elements, a casing carrying said base member and elements, a plunger rod actuated by a manually operated button, said button being guidingly arranged in said casing, said rod being movable to engage said lever and thereby close said contacts, said armature serving to hold the switch lever in contact closing position, said thermostat serving to bring said magnets into operation to remove the armature from said lever holding position, said plunger rod also being movable to manually remove the armature from said lever holding position, a leaf spring supported by said casing and acting to restore said rod and button to the same normal position after having been operated to either close or open said switch contacts, and resilient means acting on said switch lever to open said contacts after said armature has been removed from said holding position.

7. In an electrical circuit in combination, a pair of switch contacts for closing said circuit, a switch lever on which one of said contacts is mounted, a single manually operated plunger for moving said lever to close or open said contacts, an armature engaging and holding said lever in its closed contact position, an electromagnet for acting on said armature to withdraw it from said lever holding position, automatic means for bringing said electromagnet into service when said circuit remains closed for an ab-

normal period and means for moving said switch lever to open circuit position after said armature has been acted on by said electromagnet.

8. In an electrical circuit in combination, a pair of switch contacts for closing said circuit, a pivotal switch lever having two projecting arms one of which carries one of said contacts, a manually operated plunger coacting with the other of said arms to close said contacts, an armature engaging the arm carrying said contact to hold said contact in closed position, an electromagnet for acting on said armature to withdraw it from said engagement with said lever arm, automatic means for bringing said electromagnet into service when said circuit remains closed for an abnormal period and spring means acting on the second mentioned arm of said switch lever to move said lever and first mentioned arm to open circuit position when said armature has been acted on by said electromagnet.

9. In an electrical circuit in combination, a pair of switch contacts for closing said circuit, a pivotally mounted switch lever having two projecting arms one of which carries one of said contacts, an armature mounted in operative relationship with the arm carrying said contact, a manually operated plunger, means carried by said plunger for engaging the other of said arms whereby when said plunger is operated in one direction said contacts are closed, means associated with said armature for carrying said armature into the path of movement of said arm carrying said contact when the said contact is moved to closed position by said plunger, means carried by said plunger for engaging said armature to move it from the contact engaging position, an electromagnet for acting on said armature to also withdraw it from said engagement with said lever arm, automatic means for bringing said electromagnet into service when said circuit remains closed for an abnormal period and means for moving said switch lever to open circuit position after said armature has been withdrawn from the path of movement of said arm by said electromagnet or said plunger.

10. In an electrical circuit in combination, a pair of switch contacts for closing said circuit, a switch lever having two projecting arms one of which carries one of said contacts, a manually operated plunger rod passing through the other of said switch arms and acting thereupon to close said contacts, an electromagnet having an armature normally carried in such a manner that when said contacts are closed it is moved into the path of movement of said contact carrying arm to hold said contacts closed, a thermostat for automatically bringing said electromagnet into service when said circuit remains closed for an abnormal period to withdraw said armature to normal position, means associated with said plunger rod for engaging said armature whereby said armature may be manually withdrawn from said contact closing position, and means on the switch lever to move to open said contacts after said armature has been moved to normal position.

11. In an electrical circuit in combination, a pair of switch contacts for closing said circuit, a switch lever on which one of said contacts is mounted, a single manually operated plunger for moving said lever to close or open said contacts, an armature for engaging and holding said lever in its closed contact position, an electromagnet for acting on said armature to withdraw it from said lever holding position, a thermostat for automatically bringing said electromagnet into service when said circuit remains closed for an abnormal period, means for moving said switch lever to open circuit position after said armature has been acted on by said electromagnet and means to restore said plunger to its normal position independently of said switch lever after said plunger has been operated.

12. In an electrical circuit in combination, a heating coil, a pair of switch contacts for closing said circuit through said heating coil, a switch lever carrying one of said contacts, a single manually operated spring restored plunger rod for moving said lever to close said contacts, an armature engaging and holding said lever in its closed contact position, a pair of auxiliary contacts normally separated, a thermostatic couple closely adjacent said heating coil carrying one of said auxiliary contacts, an electromagnet in coöperative relationship with said armature and controlled by said auxiliary contacts whereby an excessive current through the heating coil brings said magnets into service to withdraw said armature from its circuit holding position and means for operating the switch lever to open the contacts after said armature has been removed from said closed position.

13. In an electrical circuit in combination, a pair of switch contacts for closing said circuit, a switch lever carrying one of said contacts, an electromagnet having an armature supported on a resilient member, said armature being normally held by said switch lever in such position as to tension said resilient member, a plunger manually movable to engage and move said lever to close said contacts and to release said armature whereby the tension of the resilient member moves said armature to engage said switch lever to hold said contacts in closed position, means responsive to a prolonged flow of current in said circuit for causing said electromagnet to move said armature

to normal position, means for moving the switch lever to open said contacts after said armature has been moved to normal position, said plunger also coöperating with said armature to manually move the same for the purpose described.

14. A switch for an electrical circuit having in combination, switch contacts, an electromagnet having an armature supported on a leaf spring normally under tension, a switch lever carrying one of said contacts and normally holding said leaf spring under tension, a plunger rod passing through said armature and held in normal position by a second leaf spring, said plunger when operated acting on said switch lever to close said contacts and to withdraw the switch lever from engagement with said armature whereby said first mentioned leaf spring moves the armature to engage the switch lever to hold said contacts closed, said second leaf spring acting to return said plunger to normal position after having been operated and means depending on the prolonged flow of current in said circuit for causing said electromagnet to withdraw said armature from said circuit closing position, said plunger serving also to withdraw said armature from said circuit closing position substantially as and for the purpose described.

In witness whereof I affix my signature.

IVAR W. BROEGGER.