

Aug. 7, 1923.

1,464,307

C. A. BOWLUS

IGNITION DEVICE

Filed April 21, 1921

2 Sheets-Sheet 1

Fig:1.

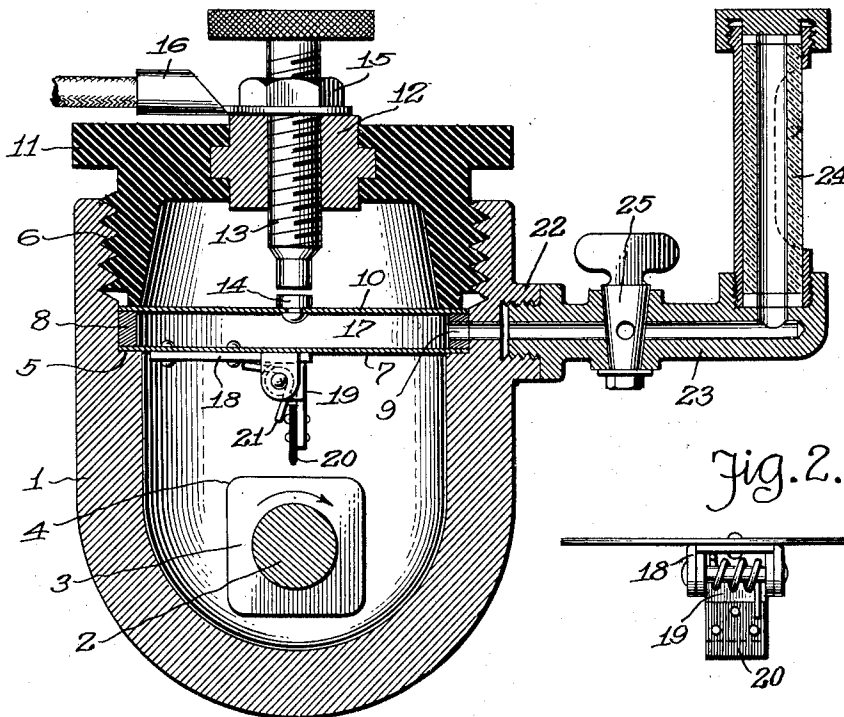


Fig. 2.

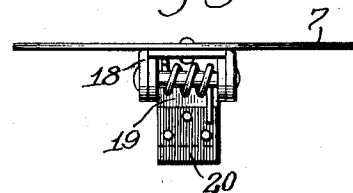


Fig. 4.

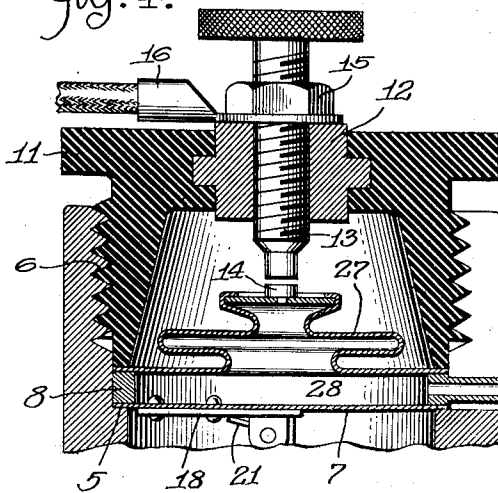
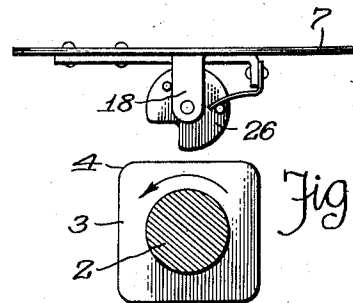


Fig. 3.



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2 Sheets-Sheet 2

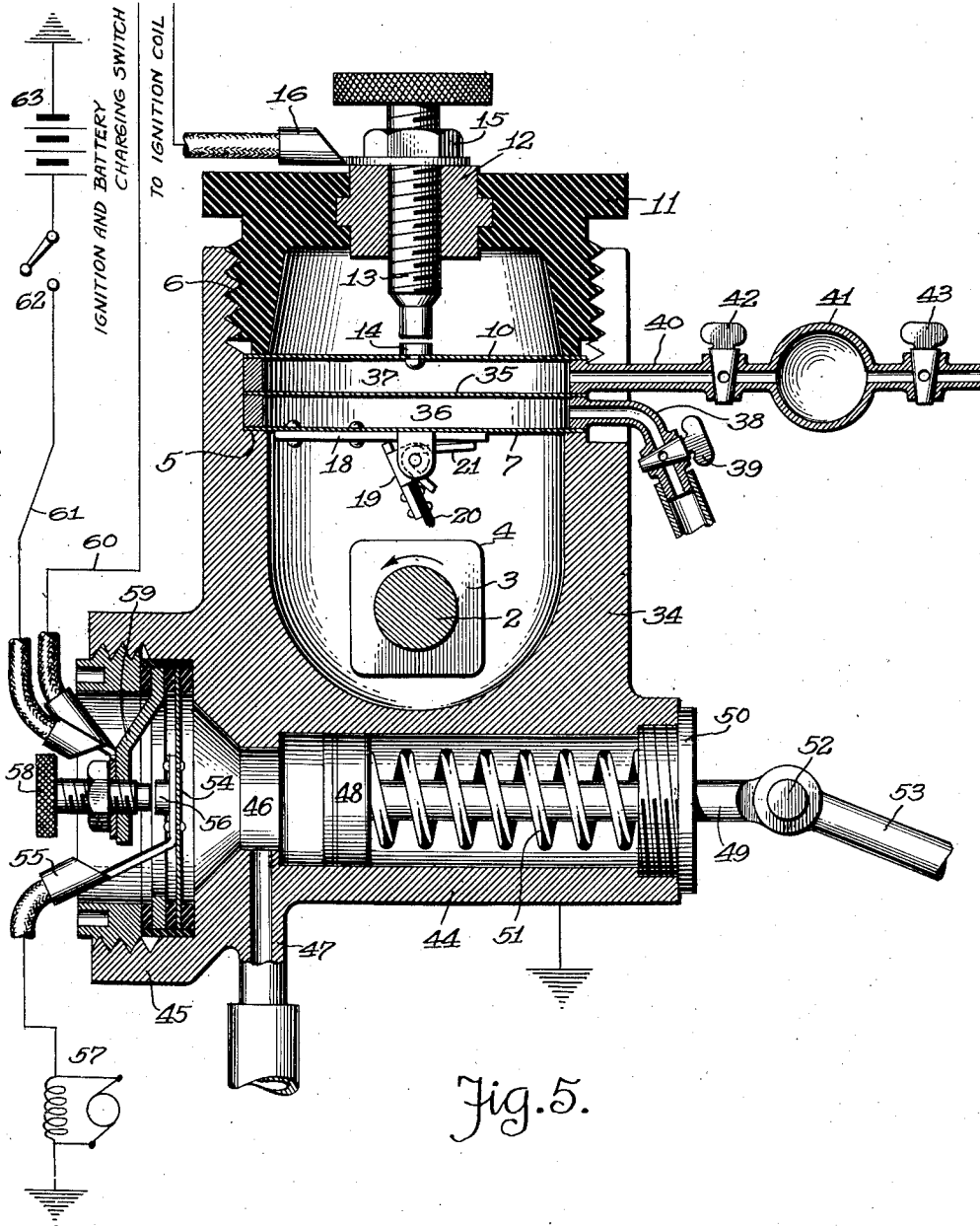


Fig. 5.

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UNITED STATES PATENT OFFICE.

CLAUDE A. BOWLUS, OF BIRMINGHAM, MICHIGAN.

IGNITION DEVICE.

Application filed April 21, 1921. Serial No. 463,214.

To all whom it may concern:

Be it known that I, CLAUDE A. BOWLUS, a citizen of the United States of America, residing at Birmingham, in the county of Oakland and State of Michigan, have invented certain new and useful Improvements in Ignition Devices, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an ignition device that may be used as a circuit breaker, cut-out, spark advance, or an electrical control apparatus.

In the use of an internal combustion engine as the power plant of an automobile or similar vehicle, an ignition system is necessary and ordinarily includes a commutator or timer mechanically driven to control sparking in the engine cylinders. To facilitate starting the engine, the sparking is often manually advanced or accomplished by a governor. With all ignition systems there must be some way of regulating the spark to insure detonation when the explosive mixture is under proper compression.

My invention aims to utilize the flexure of diaphragms for effecting a make and break of an electric circuit, and in order to advance or retard the make or the break of the circuit I employ a fluid, as air, or a liquid, as oil. This is brought about by arranging the diaphragms to form walls of a chamber in which the fluid or liquid is maintained in such quantities or under such conditions as to provide a flexible interposed medium regulating the flexure of one diaphragm by the other. By properly proportioning the flexibility of the interposed medium relative to the flexibility of the diaphragms, and also taking into consideration the force used to flex the diaphragms, I am able to positively advance or retard,—to an infinitesimal degree,—the spark or work to be performed by the making and breaking of an electric circuit.

In carrying my invention into effect, as outlined above, I provide a chamber having for two of its walls opposed diaphragms. One of the diaphragms has a contact movable relative to a stationary contact and the other diaphragm is actuated by an external force, as a cam impinging against a one way trip member carried by the diaphragm. The chamber between the diaphragms contain a fluid or liquid which may be retained in the chamber, under varying conditions, so that

it will function with a defined relation to the rotative speed of the cam. By providing a restricted, variable or "bleeding" outlet for the fluid or liquid I may easily control the cooperation of the diaphragms for shifting the movable contact relative to the stationary contact. This may be considered my invention in its simple form, and with such as a foundation it may be built on to afford an automatic spark advancement or retardation and a control of other electrically operated devices.

As set forth in the beginning, a mechanically operated governor has been employed to automatically advance and retard a spark. In lieu of such means, I may employ a liquid or fluid under pressure. The electrical device is mounted for adjustment relative to the cam on flexing element and also relative to a yieldable abutment. By interposing the liquid or fluid between said abutment and the device, the latter may be adjusted. As an instance of motive liquid is the water or oil from a pressure pump driven by the engine,—and the exhaust of the engine may be cited as a motive fluid. Either of these forces may be utilized, in synchronism with the advancement or retardation of a spark, for operating a switch or control device. By associating a diaphragm actuated switch with the device and arranging the switch diaphragm so that it opposes the aforementioned abutment, the motive liquid or fluid closes the switch and thus cut in other devices for operation during operation of the engine.

My invention, from a structural standpoint, may be characterized in the following particulars.

First, there is a commutator or timer casing containing a rotatable cam adapted to flex a diaphragm provided with a one-way trip or flexing device which positively prevents ignition after a "back fire" of an engine.

Second, the commutator or timing casing may be bodily movable relative to the cam so that the casing may be shifted to advance or retard the spark.

Third, diaphragm switches have parts thereof compactly assembled in the commutator or timer casing and easy access may be readily had to the switches.

Fourth, a bellows diaphragm may form part of a commutator or timer.

Other characteristics of my invention will

hereinafter appear as the construction is considered, and reference will now be had to the drawings, wherein

Figure 1 is a vertical sectional view of the electrical device;

Fig. 2 is a front elevation of a trip or one-way member forming part of the device;

Fig. 3 is a side elevation of a modified form of trip or one-way member;

Fig. 4 is a vertical sectional view of a portion of the electrical device, illustrating a bellows diaphragm, and

Fig. 5 is a similar view showing another type of electrical device.

Reference will first be had to Figs. 1 and 2 showing the simple form of electrical device, and the reference numeral 1 denotes a casing into which extends a cam shaft 2 which may be driven, directly or indirectly, from a suitable source of power. On the casing 2 is a cam 3 having a plurality of rises 4.

The outer or open end of the casing 1 is provided with an annular seat 5 and the inner walls of the casing are screw-threaded, as at 6. On the annular seat 5 is an inner diaphragm 7 retained on said seat by a ring or spacing member 8 provided with a side aperture or opening 9, and seated on the spacing member 8 is an outer diaphragm 10 which is retained on the spacing member 8 by a cap or plug 11 screwed in the outer end of the casing 1. The cap or plug 11 may be made of insulation material and centrally of said cap or plug is a bushing 12 provided with an adjustable contact member 13 which is axially of the casing 1 and extends in proximity to the outer diaphragm 10 which is provided with a central contact member 14 adapted to engage the contact member 13. The contact member 13 is normally stationary, but it may be manually adjusted relative to the contact 14 and fixed in an adjusted position by a jam nut 15, said nut serving to hold a terminal 16 in engagement with the contact member 13. The terminal 16 may be connected to a suitable source of electrical energy and the casing 1 may be grounded or included in the same electrical circuit as the source of electrical energy, so that the contact members 13 and 14 may serve as a switch or circuit breaker.

The diaphragms 7 and 10 are disposed in parallelism and cooperate with the spacing member 8 in providing a chamber 17 in communication with the side aperture 9 of the spacing member. The diaphragms 7 and 10 form flexible or expansible walls of the chamber, and the inner face of the diaphragm 7 is provided with a bracket or bearing 18 for a pivoted one-way trip or diaphragm actuating member 19 having a cam place 20 adapted to be engaged by the rises 4 of the cam 3. The cam seat 20 may

be made of fiber or other insulation material, and the trip member 19 is normally maintained at a right angle to the diaphragm 7 by the bracket 18 and the expansive force of a spring 21 mounted in the bracket 18. When the cam 3 is revolved in a clockwise direction, as indicated by the arrow on said cam, there is a rigid connection between the cam place 20, the bracket 18 and the diaphragm 7 which causes the diaphragm 7 to be intermittently flexed by the cam 3, but should the cam 3 revolve in a counter-clockwise direction, then the member 19 may yield and prevent flexing of the diaphragm 7. This form of diaphragm actuating member obviates the necessity of using a one-way clutch in connection with the cam 3 and should an engine back fire the diaphragm 7 remains dormant until the driven cam shaft 2 is driven in a proper direction.

At the side of the casing 1 is a boss or side connection 22 communicating with the side aperture 9 of the spacing member 8, and mounted in the boss 22 is a chamber or chamber supporting member 23, which has been shown as provided with a sight chamber 24 in which may be placed a fluid or a liquid. In case of a fluid, as air, the chamber 24 may be hermetically sealed, and when a liquid is used the liquid will flow by gravity into the diaphragm chamber 17. In either instance, the flow of fluid or liquid from one chamber to the other is regulated by a valve 25 between said chambers, and said valve may be of the plug, needle or any type that may be set to regulate the time required for fluid or liquid to flow from one chamber to the other. The valve 25 may be closed to entrap fluid or liquid within the diaphragm chamber 17 and the contents of said chamber will constitute an interposed yieldable medium or body which will permit of the actuation of the inner diaphragm 7 being transmitted to the outer diaphragm 10, and atmospheric pressure may be maintained within the cap or plug 11 by having a loose connection between the casing 1 and said cap or plug or a suitable aperture may be provided so as to permit of the diaphragm 10 being flexed towards the cap or plug.

Considering the operation of this form of electrical device, it is apparent that when the diaphragm chamber 17 is filled that any flexure of the inner diaphragm 7 towards the outer diaphragm 10 will cause the diaphragms to move in synchronism and thus shift the contact member 14 towards the contact member 15. If the degree of flexure afforded by the cam 3 is sufficient, the contact member 14 will be carried into engagement with the contact member 13 to establish an electrical circuit. If the chamber 17 is not completely filled or the valve 25 adjusted

so that the contents of the diaphragm chamber may flow therefrom, the flexing of the diaphragm 10 by the diaphragm 7 will be retarded, and it is through the medium of the yieldable body within the diaphragm chamber 17 that I may advance or retard the make or the break of an electrical circuit including the contact members 13 and 14. In Fig. 3 of the drawings, I show a modified form of trip or diaphragm actuating member, and instead of pivoting the members between the ends of the brackets 18, I may provide the bracket with a notched oscillatory member 26 to be engaged by the cam 3. The oscillatory member 26 is held normally in position, relative to the brackets 18, so that rotation of the cam 3 in one direction will cause the oscillatory member to be elevated and in turn flex the diaphragm 7, and rotation of the cam 3 in an opposite direction causes the rise of the cam to enter the notch of the oscillatory member 23, and oscillate said member without effecting flexure of the diaphragm 7.

In lieu of the flat diaphragm 10, I may provide a bellows 27, as shown in Fig. 4, which will cooperate with the inner diaphragm 7 in providing a large diaphragm chamber 28, and this diaphragm chamber may communicate with a tube or connection 29 having branches 30 and 31, provided with valves 32 and 33 respectively. The branch 30 of the tube 29 may communicate with the atmosphere and the branch 31 may communicate with the intake manifold of an internal combustion engine or any source of gas or fluid under pressure, and in functional relation with the rotative speed of the cam which flexes the diaphragm 7.

Reference will now be had to Fig. 5 showing an electrical device which may control two electrical circuits and permit of the make and break of one of these circuits being advanced or retarded. The device comprises a casing containing the driven cam 3, the inner diaphragm 7 adapted to be flexed by the cam, the outer diaphragm 10, contact members 13 and 14, and other parts previously referred to. In this construction, I provide an intermediate diaphragm 35 which cooperates with the diaphragms 7 and 10 in providing diaphragm chambers 36 and 37. The diaphragm chamber 36 communicates with a connection 38 provided with a valve 39 and this connection may be attached to the intake manifold of an internal combustion engine so as to supply the chamber 36 with a gas or fluid, under pressure, and since the gas or fluid is taken from the intake manifold of the engine, it will bear a certain functional relation to the speed of the cam shaft 2 within the casing 34.

The diaphragm chamber 37 communicates with a connection 40 having a chamber 41 and valves 42 and 43. The valve 42 may be

regulated, similar to the valve 25 of the simple form of the construction, so that the fluid or liquid used in the diaphragm chamber 37 may govern the flexure of the outer diaphragm 10 when the intermediate diaphragm 35 is flexed and the flexure of the intermediate diaphragm 35 will be governed by the gas or fluid within the chamber 36 when the inner diaphragm 7 is flexed by the cam 3. It is through the medium of the interposed yieldable body that ultimate flexure of the outer diaphragm 10 may be controlled or set to an infinitesimal degree.

That portion of the casing 34 adjacent the cam shaft 32 is provided with a cylinder 44 communicating with a housing 45. Communication between the cylinder 44 and the housing 45 is established by a restricted portion 46 communicating with a connection 47 and this connection may communicate with an oil or water pump, or the exhaust manifold of an engine, so that fluid or liquid may be supplied to the cylinder 44 and the housing 45 to serve as a motive fluid or liquid.

In the cylinder 44 is a piston 48 having a rod 49 extending through a plug or cap 50 in the outer end of the cylinder 44 and within this cylinder about the rod 49 is a coiled expansion spring 51 which retains the piston 48 normally at the inner end of the cylinder 44. The outer end of the piston rod 49 is pivotally connected, as at 52, to a rod 53, and this rod may be fixed to a suitable support or extended to a suitable place of adjustment. Assuming that the rod 53 is fixed relative to the casing 34 and that the motive fluid enters the cylinder 44 it will encounter the piston 48, serving as an abutment, and bodily shift the casing 34 about the driven cam shaft 2 as an axis, thereby advancing the spark which may be established by virtue of the contact members 13 and 14 completing and breaking an electric circuit.

The expansive force of the spring 51 between the piston 48 and the plug 50 will shift the casing 34 in an opposite direction from that of the motive fluid or liquid and the spark will be retarded.

In the housing 45, opposing the piston or abutment 48 is a diaphragm 54 adapted to be flexed by the motive fluid or liquid. Connected to the diaphragm 54 is a terminal 55 having a contact member 56 axially of the housing 45 and the terminal 55 may be in circuit with an electric generator 57 employed for charging batteries for performing other duties.

The contact member 56 is adapted to engage a contact member 58 supported by a bracket 59 suitably mounted within the housing 45. As shown, the bracket 59 is insulated from the housing 45 and the diaphragm 54, and connected to the contact

member 58 are terminals 60 and 61. The terminal 60 may cooperate with the terminal 16 in serving an ignition coil, and the terminal 61 may lead to a switch 62, a battery 63 and be included in the generator circuit which charges the battery.

As a matter of good construction the diaphragm 54 may be sandwiched between washers of insulation and the bracket 59 may be cut and stamped out of a metallic disk also sandwiched between washers of insulation, and all of the washers may be retained within the housing 45 by a retaining ring screwed into the housing. The retaining ring will provide clearance for the bracket 59 and the contact member 58 with the terminals properly connected to the contact members 58 and 56.

From the foregoing it will be observed that the device shown in Fig. 5 may be automatically operated for advancing or retarding the spark when the rod 53 is fixed, and the device may be manually actuated for the same purpose by shifting the rod 53. It is through the medium of this rod that the charging circuit of the generator may be opened and closed, and of course the diaphragms 7, 35 and 10 may be functioning in the meantime. It is obvious that the decrease in pressure between the diaphragms 7 and 35 will permit the contact member 14 to open relative to the contact member 13, and an increased pressure will close the circuit including said contact members. It is now apparent that the pressure in the diaphragm chamber 36 will control the making and breaking of the circuit during the flexing of the diaphragm 7, and that further control is possible through the liquid or fluid in the diaphragm chamber 37. With all these controlling means it is possible to regulate to the minutest degree the making and breaking of a circuit, and while the electrical devices have been primarily designed for the ignition and other circuits of an internal combustion engine, forming part of the power plant of an automobile or similar vehicle, yet it is to be understood that the device may be used for other purposes.

I desire to point out another advantage gained by my electrical device when used in connection with an automobile having an ignition coil supplied by a battery. It often occurs that the manually control switch of the battery is left closed and consequently current from the battery continues to flow and drain the battery. In my device the pressure of fluid or liquid will maintain the diaphragm switch closed, but since the fluid or liquid may be cut off, by a cessation in the operation of the automobile engine, or the pressure of the fluid or liquid reduced in the diaphragm chamber, the diaphragm switch will be opened, thereby resulting in a positive protection against drain of the

battery. This feature of my invention accomplishes the purpose of a delayed action switch, resistance coil, or the complicated and expensive mechanism usually provided for the same purpose in other systems.

What I claim is:—

1. In an electric circuit controlling device, the combination of contact members adapted to engage each other, a chamber having flexible walls one of which supports one of said contact members, a body in said chamber controlling the flexibility of the chamber walls, and means active against the other chamber wall and effective through said body for flexing the chamber wall provided with a contact member to control the circuit including both of said contact members.

2. In an electric circuit controlling device, a chamber having flexible walls, circuit making and breaking means at one of said walls controlled by the flexing of the wall, a yieldable body between said walls, and power means active against the other chamber wall and effective through said body for flexing the first mentioned wall.

3. In an electric circuit controlling device, circuit making and breaking means, power means, and normally sealed pneumatic means interposed between said power means and said circuit making and breaking means by which said power means may be utilized for making and breaking a circuit.

4. An electric circuit controlling device as in claim 3, characterized by said interposed means including a trip member which yields against a reverse operation of said power means without effecting the pneumatic characteristic of said means.

5. In an electric circuit controlling device, contact members, a diaphragm supporting one of said contacts and adapted to move it relative to the other contact member, a driven cam, and means including a one way trip member actuated by said cam for flexing said diaphragm and effecting a make and break of said contact members.

6. In an ignition system, the combination with an internal combustion engine supplied with motive fluid and adapted to drive a cam, of a chamber adapted to receive the motive fluid, said chamber having walls adapted to be flexed by the motive fluid in functional relation to the speed of the driven cam, a circuit controlled by one of the walls of said chamber, and means actuated by said cam for flexing the other wall of said chamber.

7. The combination set forth in claim 6, wherein the circuit includes a fixed contact member and a contact member carried by one of the walls of said chamber.

8. In an ignition system, a circuit breaker, engine driven means adapted to operate said circuit breaker, a chamber interposed be-

tween said circuit breaker and said engine driven means and by which movement is imparted to said circuit breaker from said engine driven means, and a non-conductive fluid body in said chamber in functional relation to the engine driven means and adapted to regulate the movement imparted to said circuit breaker.

9. An ignition system as in claim 8 characterized by said circuit breaker including a stationary contact and a contact carried by a wall of said chamber and adapted to be moved thereby.

10. A device of the type described comprising circuit breakers, means for operating one of said circuit breakers, and means adapted to simultaneously operate the other circuit breaker and bodily move said circuit breaker to either advance or retard the action of the first mentioned circuit breaker.

11. A device as in claim 10 characterized by said circuit breakers being disposed in a casing supported by the first mentioned means.

12. A device as in claim 10 characterized by the last mentioned means being a fluid under pressure for advancing the action of the circuit breaker, and a spring for retarding the action of the circuit breaker.

13. A device of the type described comprising a casing, circuit breakers in said casing, operating means for one of said circuit breakers and supporting said casing,

the other circuit breaker providing an abutment in said casing, an adjustable abutment in said casing, and means adapted to be interposed between the abutments in said casing to operate the circuit breaker having an abutment and adjust said casing relative to said operating means.

14. A device as in claim 13 characterized by said operating means including a cam flexed diaphragm.

15. A device as in claim 13 characterized by the last mentioned means being a fluid under pressure.

16. An ignition system for an internal combustion engine, said system including a generator and battery circuit, a circuit breaker for such circuit, a spark circuit, a timer for such circuit, engine operated means for said timer, means utilizing the fluid exhaust of the engine for operating the circuit breaker of the generator and battery circuit, and means utilizing the fluid intake of the engine for regulating the action of said timer, said circuit breaker and timer being constructively arranged so that bodily movement of said circuit breaker may either advance or retard the action of said timer.

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

CLAUDE A. BOWLUS.

Witnesses:

KARL H. BUTLER,
ANNA M. DORR.