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CONTROL DEVICE FOR AN ELECTRIC CIRCUIT

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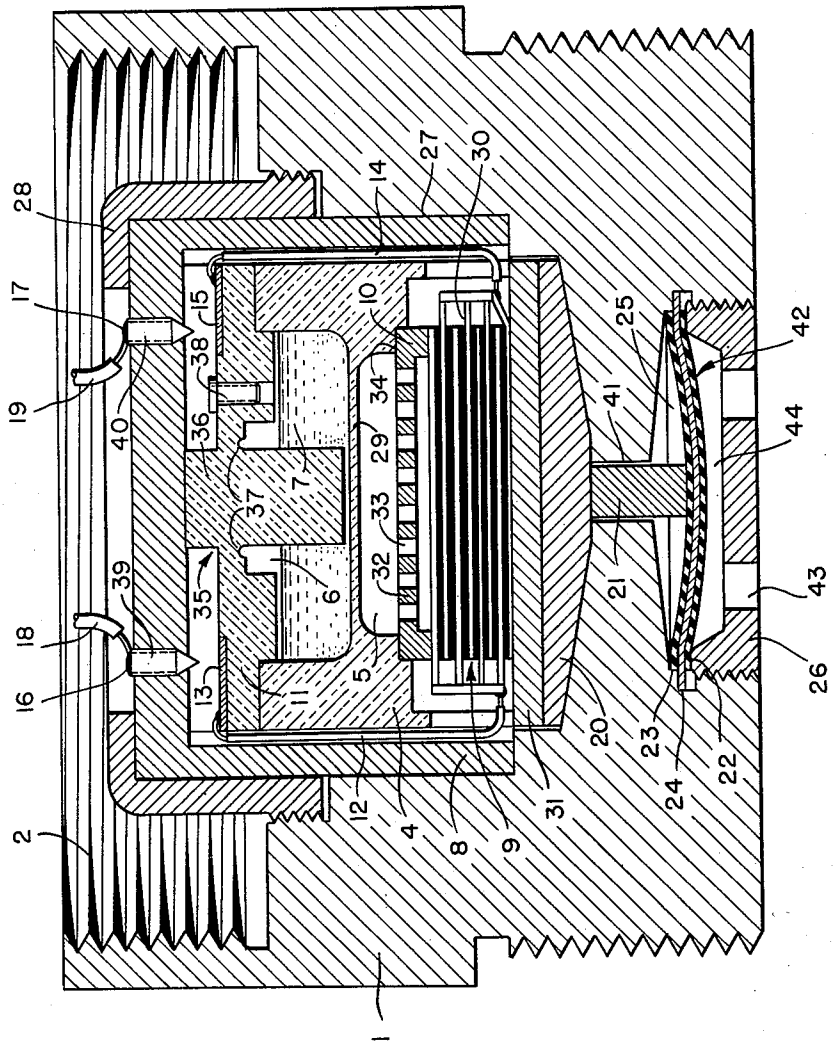

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CONTROL DEVICE FOR AN ELECTRIC CIRCUIT

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This invention relates to a control device for controlling an electric circuit, more particularly to a control device for controlling the ignition or detonator circuit for the explosive charge of projectiles, bombs, mines and the like.

One of the objects of the present invention is to provide a control device of the general type, above referred to, which is simple and reliable in operation.

Another object of the invention is to provide a novel and improved control device which permits control of the aforesaid circuit from a remote point.

Another object of the invention is to provide means for actuating the control device by a fluid under pressure such as gas either developed within the projectile, bomb, mine and the like itself or fed to the control device from an outside source.

Another object of the invention is to provide a control device of the general type, above referred to, in which an electro-chemical battery, such as a storage battery, is employed to energize the circuit to be controlled, and which comprises means by which the battery is normally inoperative and is rendered operative for the aforesaid purpose only at the moment control of the circuit is desired. This has the advantage that the control device can be stored for an indefinite period of time. As is well known, electro-chemical batteries, whether of the primary or the secondary type, in a condition operative for the delivery of current cannot be stored for a long period of time without loosing their efficiency. Obviously, the possibility of storing the control device for an indefinite period of time is of great importance for the use in explosive devices such as projectiles, bombs, mines, etc.

Other and further objects, features and advantages of the invention will be pointed out hereinafter and set forth in the appended claims forming part of the application.

In the single figure of the accompanying drawing a sectional fragmentary view of a projectile, such as a rocket, equipped with a control device according to the invention is shown by way of illustration and not by way of limitation.

Referring now to the figure in detail, the illustrated embodiment of the invention is shown as being mounted in a substantially cylindrical body 1. This body is provided with several axially aligned bores of varying diameter. Body 1 may be visualized as part of the rocket. For this purpose, the widest bore 2 is provided for an internal thread which serves to receive the

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war head of the rocket carrying the explosive charge. The lower portion 3 of body 1 (always as seen in the drawing) has an outer thread with which body 1 is screwed into the housing of the rocket.

The control device proper comprises a stationary member 8 shown as a sleeve closed on one end. Sleeve 8 is fitted in a bore 27 and secured to body 1 by a bracket 28 threaded into the body 1. Within the spaced defined by sleeve 8, and guided by the side wall of the sleeve, a movable member 4 is fitted. This movable member is shown as a substantially cylindrical element in which are formed two chambers 5 and 6 separated by a comparatively thin partition wall 29 made of fragile material. Chamber 5 houses a source of current generally designated by 9, in form of a battery either of the primary or the secondary type. The battery is shown as a storage battery formed by a plurality of horizontally stacked electrode plates 30. Respective plate terminals are interconnected. One set of terminals is connected by a wire 12 to a contact plate 13 and the other set of terminals is connected by a wire 14 to a contact plate 15. Plates 30 rest upon a support plate 31 slidably fitted in a bore of body 1 and supported by a second plate 20 also axially slidably fitted in the bore for plate 31. A pressure plate 32 having a plurality of spaced holes 33 is fitted between the uppermost electrode and a shoulder 34 of cylinder 4 for holding the electrodes in position.

When the control device is in the illustrated inactive or rest position, space 5 in which the electrode plates 30 are housed is dry. As a result, plates 30 can be stored for an indefinite period of time in a chemical condition ready for the delivery of current without undergoing any change. It is well known that a charged storage battery filled with electrolyte deteriorates in a comparatively short time. The same is true for so-called dry cell batteries.

An electrolyte 7 for the battery, such as diluted sulphuric acid is kept in the upper chamber 6. Of course, precautions must be taken to prevent a corrosion of the walls of chamber 6. These walls may be lined with ceramic or any other suitable material. The entire cylinder 4 or at least wall 29 thereof may be made of ceramic material.

A control member generally designated by 35 serves to close chamber 6. This control member is shown as comprising a cylindrical center portion 36 from which radially extends a flange

portion 11 integral with cylinder 36, as shown, or fixed thereto by any suitable means. The upper end of cylinder 36 abuts against the closed end of sleeve 8 and the lower end of the cylinder faces wall 29 closely adjacent thereto or slightly touching wall 29. The outer rim of flange 11 abuts against the face wall of cylinder 4 thereby holding the entire assembly in the illustrated position. Flange 11 includes a weakened portion indicated as a fracture initiating annular groove 37 near cylinder 36 the purpose of which will be more fully explained hereinafter.

A filler screw 38 serves to fill chamber 6 with electrolyte.

Contact plates 13 and 15 are secured to the upper face wall of flange 11 and cooperate with contact pins 39 and 40. These contact pins are connected to wires 18 and 19 which should be visualized as leading to the circuit to be controlled, such as a detonator circuit. Inasmuch as this control circuit is presumed to be of conventional design, it is believed that a detailed description or illustration thereof is not necessary for the understanding of the invention.

As will be noted contacts 13, 39 and 15, 40 respectively are disengaged from each other when the control device is in the illustrated position.

The aforementioned support plate 20 abuts against one end of a pin 21 axially slidable in a bore 41 of body 1. The lower end of pin 21 abuts against a deflection member generally designated by 42. This deflection member comprises a flexible disc 24, sheathed on both sides by linings 22 and 23. The deflection member 42 is fitted in a bore 25 of body 1 in which it is secured by a screw member 26. This screw member is provided with a plurality of spaced bores 43 through which fluid under pressure may be admitted into a space 44 to act upon deflection member 42. As will be noted, the deflection member is convexly curved toward openings 43 and bore 25 provides sufficient space for deflecting member 42 into a concave position relative to openings 43. The operational fluid may be gas under pressure developed within the rocket itself or fed through openings 43 from an outside source.

The operation of the control device, as hereinbefore described, is as follows:

Let it be assumed that the entire assembly is in the illustrated position and that the explosive charge of the rocket shall be set off by energizing the detonator circuit. Then, gas under pressure is directed through openings 43 against deflection member 42. If this gas pressure is strong enough, the deflection member will be deflected into its concave position thereby exerting an upward pressure upon pin 21, plates 20 and 31 and cylinder 4 with the electrode plates housed therein. Obviously, control member 35 cannot yield. As a result, flange 11 will break, usually along groove 37. Cylinder 4 and the associated parts will now move upwardly with the result that contact plates 13 and 15 come in engagement with contact pins 39 and 40. Furthermore, the lower end of cylinder 36 which is held stationary will press against the thin wall 29, thereby fracturing the same. The electrolyte 7 will now flow through openings 33 of plate 32 and come in contact with electrode plates 30. Consequently, the battery 9 becomes operative for the delivery of current and can energize the detonator circuit through wires 18 and 19.

It will be evident from the previous description that it would also be possible to provide a

permanent connection between contacts 13, 39 and 15, 40 respectively since no current can flow as long as the electrolyte is separated from the electrodes. However, the illustrated arrangement is the preferred one due to its greater safety. It will be apparent that to energize the detonator circuit, two conditions must be fulfilled, to wit: the contacts must be moved into engagement and the chamber for the electrolyte must be broken. It is most unlikely that both these conditions will be accidentally satisfied. However, if a permanent contact connection would be provided a fracture of the electrolyte chamber alone would set off the charge.

It will further be apparent that a passage between the two chambers can be established by other means than fracturing wall 29, for instance cylinder 36 may open a strong valve. However, again fracturing of a wall appears to be the safest method.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A control device for controlling an electric circuit, comprising a stationarily mounted member, contact means included in said circuit to be controlled and supported on said member, a movable support member movably mounted relative to said stationarily supported member, movable contact means mounted for movement in unison with the movable member, a source of current connected with said movable contact means, rigid retaining means abutting against the stationary member and against the movable member for rigidly retaining the latter in a position in which said two contact means are disengaged from each other, said retaining means being arranged to fracture in response to a predetermined pressure applied to the same, and fluid inlet means for admitting a flow of fluid under pressure into the device, the said flow of pressure fluid being applied to said movable member so as to cause a fracture of the retaining means and to move the movable member into a position in which said two contact means are in engagement with each other for connecting said source of current to said stationary contact means.

2. A control device as defined in claim 1, wherein said retaining means comprise a rigid member between the stationary member and the movable member holding the said members spaced apart in the contact disengaging position and including a weakened portion designed to fracture by said fluid pressure for permitting movement of the movable member into the said contact engaging position, the said rigid member supporting the movable contact means.

3. A control device as defined in claim 1, in combination with a stationarily mounted deflection member, one side of said deflection member being in movement transmitting engagement with said movable member, the other side of the deflection member communicating with said fluid inlet means, whereby the aforesaid fluid pressure causes deflection of the deflection member resulting in movement of the movable member

upon a fracture of said retaining means, by the pressure exerted by the movable member.

4. A control device as defined in claim 3, wherein the said deflection member is in form of a disc which is normally biased into a position convexly curved toward the fluid inlet means and flexible into a concave position relative to the fluid inlet means by the pressure of said fluid.

5. A control device as defined in claim 1, wherein the said source of current comprises an electro-chemical battery and is supported by the movable member for movement in unison therewith.

6. A control device for controlling an electric circuit, comprising a stationary member, a movable member mounted for movement relative to the stationary member and including a chamber, electrodes of an electro-chemical battery housed within said second chamber, the pole terminals of said electrodes being adapted to be connected with said circuit to be controlled, said movable member being shaped and disposed in a rest position relative to the stationary member so as to form a second chamber between the two members adapted to receive therein a liquid electrolyte for the battery, retaining means yieldably retaining the movable member in the aforesaid rest position, fluid inlet means for admitting a flow of fluid under pressure into the device, the said pressure fluid being applied to said movable member for moving the same toward the stationary member, and stationary abutment means engageable with the movable member upon the aforesaid movement thereof and arranged to open upon engagement with the movable member a passageway through said movable member connecting said chamber for the electrolyte with said chamber housing said electrodes, the said passageway providing for a discharge of the electrolyte into said chamber housing the electrodes, thereby rendering the battery operative for a flow of current in the circuit to be controlled.

7. A control device for controlling an electric circuit, comprising a stationary member, a movable member mounted for movement relative to the stationary member and including a chamber, electrodes of an electro-chemical battery housed within said chamber, the pole terminals of said electrodes being adapted to be connected with said circuit to be controlled, said movable member being shaped and disposed in a rest position relative to the stationary member so as to form a second chamber between the two members adapted to receive therein a liquid electrolyte for the battery, a control member positioned between the stationary member and the movable member and abutting against the stationary member, said control member having a yieldable first portion engaging the movable member when the said member is in the rest position for yieldably holding the movable member in the said position and a rigid second portion engageable with the movable member in response to a movement thereof toward the stationary member, said second portion being arranged partially to fracture said movable member upon engagement therewith, thereby opening a passageway between the two chambers upon the aforesaid movement of the movable member, opening of the said passageway providing for discharge of the electrolyte into the chamber housing the electrodes, thereby rendering the battery operative for a flow of current in the circuit to be controlled, and fluid inlet means for admitting a flow of fluid under pressure into said device, the said flow of pressure fluid being applied to said movable member so as to move the same toward the stationary member against the resistance of the said first portion of the control member.

8. A control device as defined in claim 7, wherein said control member includes as yieldable first portion a weakened section for initiating a fracture of said first portion in response to a predetermined pressure exerted upon said first portion by the movable member as a result of fluid pressure applied to the movable member.

9. A control device as defined in claim 8, wherein said movable member is substantially in form of a hollow cylinder including a transverse partition wall separating the said two chambers, and wherein said rigid second portion of the control member is positioned and arranged to engage said wall for fracturing the same in a response to the aforesaid movement of the movable member toward the stationary member, thereby establishing the said passageway between the two chambers.

10. A control device as defined in claim 9, wherein said control member comprises a cylindrical element abutting with one end against said stationary member and facing with the other end said partition wall, said cylindrical element forming the said second portion engageable with the partition wall for fracturing the same, the said first portion being formed by a flange element secured to the cylindrical element radially extending therefrom, said flange member abutting against the movable element in the aforesaid rest position thereof and including said fracture initiating weakened section.

11. A control device as defined in claim 6, wherein a stationarily mounted deflection member is disposed between said fluid inlet means and said movable member, said latter member being operatively coupled with the deflection member for transmitting movements of the latter to the movable member, said fluid inlet means being arranged to direct the flow of fluid under pressure against the deflection member for deflecting the same, thereby causing the aforesaid movement of the movable member.

12. A control device as defined in claim 6, wherein a first contact means is supported on said stationary member and a second contact means is supported on said movable member for movement in unison therewith, the said second contact means being connected with said electrodes of the battery, the two contact means being disengaged one from the other when the movable member is in the aforesaid rest position and engage each other when the movable member is moved toward the stationary member, thereby connecting the electrodes with the contact means on the stationary member, the said latter contact means being arranged to be connected with the circuit to be controlled.

13. A control device for controlling the detonator circuit of an explosive device of the type described, the said control device comprising a stationarily mounted member, contact means included in said circuit to be controlled and supported on said member, a movable support member movably mounted relative to said stationarily supported member, second contact means movable in unison with the movable member, a source of current connected with said second contact means, retaining means abutting against the stationary member and against the movable member for retaining the latter in a

rest position in which said contact means are disengaged from each other, said retaining means being arranged to fracture in response to a predetermined pressure applied to the same, and fluid inlet means for admitting a flow of fluid under pressure into the device, the said flow of pressure fluid being applied to said movable member so as to fracture the retaining means and to move the movable member into a position in which the two said contact means are in engagement with each other for connecting said source of current to said stationary contact means, said stationary member and said movable member being mounted in a body forming part of the explosive device.

14. A control device for controlling the detonator circuit of an explosive device of the type described, the said control device comprising a stationary member, a movable member mounted for movement relative to the stationary member and including a chamber, electrodes of an electro-chemical battery housed within said chamber, the pole terminals of said electrodes being adapted to be connected with said circuit to be controlled, said movable member being shaped and disposed in a rest position relative to the stationary member so as to form a chamber between the two members adapted to receive therein a liquid electrolyte for the battery, a control member positioned between the stationary member and the movable member and abutting against the stationary member, said control member having a yieldable first portion engaging the movable member when the said member is in the rest position for yieldably holding the movable member in the said position and a rigid second portion engageable with the movable member in response to a movement thereof toward the stationary member, said second portion being arranged partially to fracture said movable member upon engagement therewith for opening a passageway between the two chambers upon the aforesaid movement of the movable member, opening of the said passageway providing for discharge of the electrolyte into the chamber housing the electrodes, thereby rendering the battery operative for a flow of current in the circuit to be controlled, and fluid inlet means for admitting a flow of fluid under pressure into the control device, the said flow of pressure fluid being applied to said movable member so as to move the same toward the stationary member against the resistance of said first portion of the control member, said stationary member and said movable member being mounted in a body forming part of the explosive device, said pressure fluid being a gas developed by the explosive device.

15. A control device as defined in claim 14, wherein said stationary member comprises a sleeve closed on one end, and wherein said movable member is slidably guided within the sleeve, the closed end thereof abutting against the control member.

16. A control device as defined in claim 1, in combination with a deflection member in form of a rounded diaphragm stationarily held along its periphery, the inwardly curved side of the diaphragm being in movement transmitting engagement with said movable member and the outwardly curved side communicating with said fluid inlet means, application of fluid pressure above a predetermined value to said outwardly curved side of the diaphragm causing the same abruptly to reverse its curvature resulting in a contact closing movement of the movable member upon a fracture of the retaining means by the pressure exerted by the movable member.

17. A control device as defined in claim 7, wherein an abutment member is disposed on the side of the diaphragm opposite to the fluid inlet means and positioned so as to limit a further deflection of the diaphragm by fluid pressure upon completion of the contact closing movement of the movable member.

18. A control device as defined in claim 17, wherein the said diaphragm is initially convexly curved toward the fluid inlet means and flexible in a concave position relative to the fluid inlet means by fluid pressure applied to the outwardly curved side of the diaphragm.

19. A control device as defined in claim 7, in combination with a deflection member in form of a rounded diaphragm stationarily held along its periphery, the inwardly curved side of the diaphragm being in movement transmitting engagement with said movable member and the outwardly curved side communicating with said fluid inlet means, application of fluid pressure above a predetermined value to said outwardly curved side of the diaphragm causing the same abruptly to reverse its curvature resulting in a movement of the movable member causing engagement between the movable member and the said rigid portion of the control member effecting a partial fracture of the movable member.

20. A control device as defined in claim 19, wherein an abutment member is disposed on the side of the diaphragm opposite to the fluid inlet means and positioned so as to limit a further deflection of the diaphragm by fluid pressure upon completion of the movement of the movable member effecting a partial fracture of the same.

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