E. B. CROCKER.

HYDROSTATIC CIRCUIT CLOSER.

APPLICATION FILED MAY 7, 1918.

1,370,193.

Patented Mar. 1, 1921.

2 SHEETS—SHEET 1.

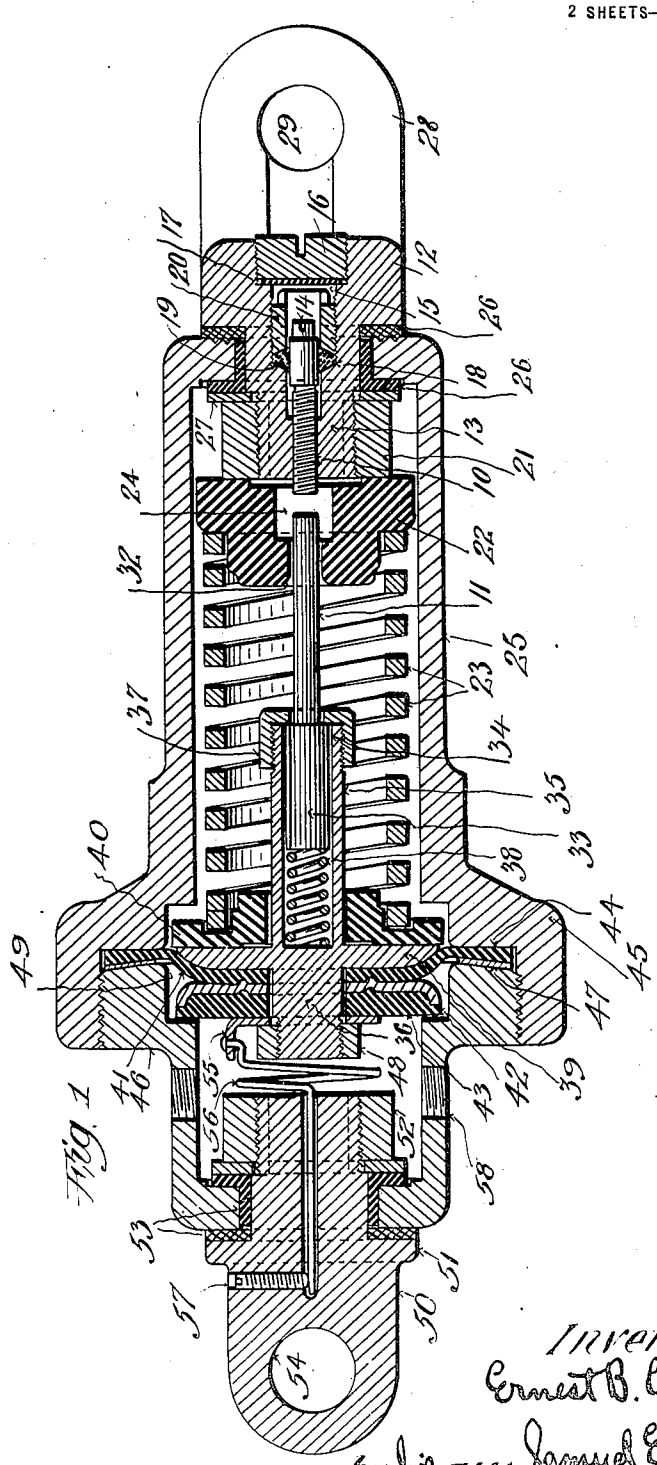


Fig. 1

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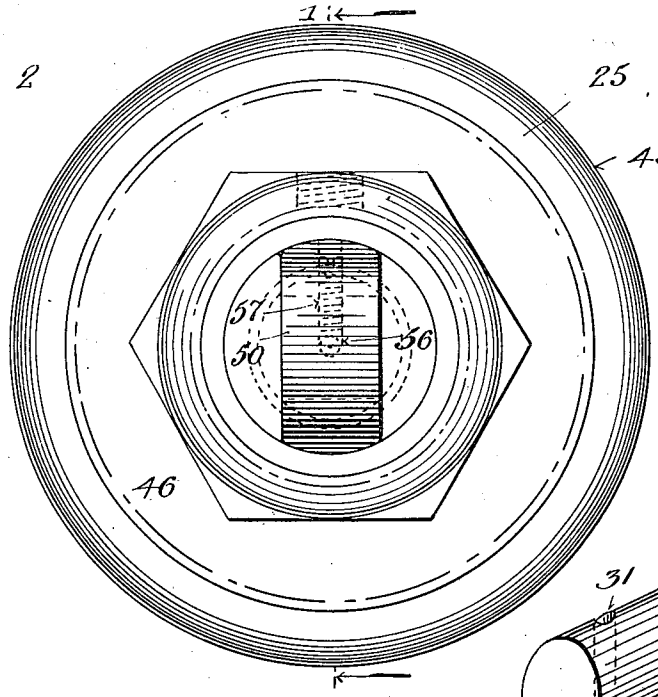
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2 SHEETS—SHEET 2.

Fig. 2



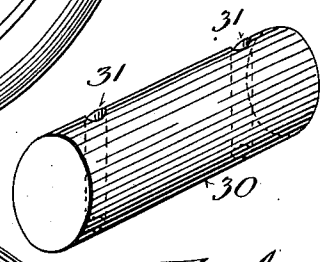
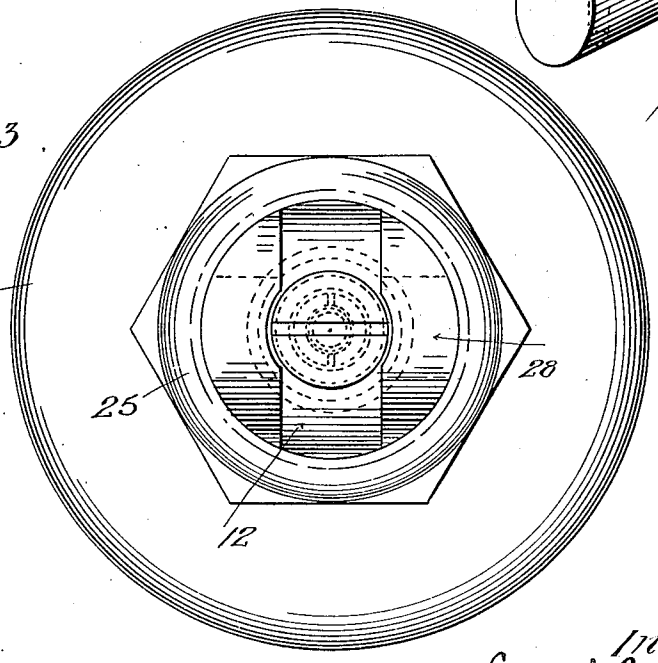


Fig. 4

Fig. 3



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UNITED STATES PATENT OFFICE.

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HYDROSTATIC CIRCUIT-CLOSER.

1,370,193. Specification of Letters Patent. Patented Mar. 1, 1921.

Application filed May 7, 1918. Serial No. 233,185.

To all whom it may concern:

Be it known that I, ERNEST B. CROCKER, a citizen of the United States, residing at Bridgeport, county of Fairfield, State of Connecticut, have made a certain new and useful Invention in Hydrostatic Circuit-Closers, of which the following is a specification.

This invention relates to hydrostatic circuit controlling devices.

The object of the invention is to provide a structure for automatically controlling an electric circuit, which is actuated by variation in hydrostatic or other pressure to which the device is subjected.

A further object of the invention is to provide a circuit controlling device of the character referred to which is simple in structure, efficient in operation, economical to manufacture, and easily assembled and applied, and which is strong, durable and sturdy.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

In the drawings,—

Figure 1 is a view in central longitudinal section on the line 1, 1, Fig. 2, looking in the direction of the arrows, showing a structure of automatic, pressure controlled circuit closer, embodying the principles of my invention.

Fig. 2 is a view in end elevation looking toward the bottom of the device as viewed in Fig. 1.

Fig. 3 is a view similar to Fig. 2 looking toward the top of the device as viewed in Fig. 1.

Fig. 4 is a detached detail view of the shackle or clevis pin for coupling up the device.

In the operation of electrically actuated apparatus and devices of various kinds and natures, it is desirable to effect the control of the circuits of said apparatus and devices through pressure medium, whereby the circuits may be maintained normally open, or normally closed, as the case may be, and controlled so as to close, or to open, when a predetermined degree of the operating pressure medium is attained. For example, in the case of certain types of depth bombs, mines, and the like, where the explosion is effected by an electric current, the circuit is maintained open under normal conditions, in order to secure safety while transporting and handling the bomb or mine, and is automatically closed when the bomb or mine attains a depth sufficient to impose a predetermined hydrostatic pressure on the circuit controlling device.

It is among the special purposes of my present invention to provide a circuit controlling device which is simple in structure and efficient in operation for effecting the desired control of an electric circuit, whether to open or to close the same, by the action of pressure medium, hydrostatic or otherwise, applied thereto when a predetermined degree of pressure is attained, and while I have shown and will describe my invention as applied to a device for automatically closing an electric circuit when the predetermined degree of pressure is attained, and which is designed to employ hydrostatic pressure as the controlling medium, I wish it to be understood that my invention is not to be limited or restricted in these respects.

In the structure shown as illustrative of the principles of my invention reference numerals 10, 11, designate, respectively, the terminals of an electric circuit. These terminals are disposed in longitudinal line with each other with their adjacent ends or contact points juxtaposed in proximity to each other. The terminals 10, 11, may be of any suitable or desired structure, shape or form. In the particular embodiment illustrated in the drawings, the terminal 10 is exteriorly screw threaded for a portion of its length so as to be screwed into a central longitudinal threaded opening through the inner end portion 13 in a terminal head or block 12. By turning up or backing off the circuit terminal 10, the distance of separation of the contact point thereof from that of the terminal 11, is adjusted to any desired requirement. The outer end of the terminal 10 is constructed, as at 14, to receive a tool by means of which said terminal may be screwed up or backed off, for insertion, removal or adjustment. This outer end of the terminal 10 extends into an enlarged central chamber 15 formed centrally in the outer portion of

terminal head 12 as an enlargement of the threaded opening which receives the terminal 10. A threaded plug 16 closes the outer end of the chamber 15, a suitable bushing 17 of hard rubber or other suitable material being interposed between the inner end of plug 16 and the adjacent wall surface of the terminal head, thereby forming an efficient tight joint to prevent access therethrough of water, moisture, or other substance which might impair the efficiency of the device or cause danger of short circuiting. For like reasons the terminal 10 is also suitably packed with a packing ring 18, held by means of a sleeve bushing 20, against a shoulder 19 formed in the bore of the central opening of the terminal head through which the terminal 10 extends. The bushing 20 is exteriorly threaded to be screwed into threads tapped in a portion of the interior wall surface of the chamber 15. The inner end portion 13 of the terminal head 12 is exteriorly threaded to receive a nut 21, against the inner end of which abuts a block 22, preferably of hard rubber, or other suitable insulating material, said block being held in its abutment against the inner end of bushing 21, by means of a compression spring 23. The insulating block 22 is formed with a central passage therethrough, a portion of which passage is enlarged into a chamber 24 into which, from opposite directions extend the opposed proximate ends or contact points of the terminal members 10, 11. The terminal head 12, at its inner end, projects through an opening in the end wall of an inclosing casing 25, and must be efficiently insulated from said casing. The washers 26, of hard rubber, or other suitable insulating material, serve this purpose, and also the purpose of providing a dust and water proof joint. The nut 21 at the inner end of the terminal head 12, affords means for tightly securing the terminal head 12 in the end of the casing 25, a washer 27 being interposed between said nut and the flange of the insulating washer 26. The terminal head 12 at its extreme outer end is provided with suitable ears 28 formed with transverse openings 29, as shown, to receive a clevis pin or bolt 30, designed to be held in place by cotter pins received in holes 31, or otherwise. This structure affords means for connecting the circuit leads to the circuit controlling device.

The cooperating terminal 11 extends at one end through a somewhat enlarged opening 32 in block 22, into the chamber 24. At its other end the terminal 11 is enlarged as at 33 to form a shoulder 34. The enlarged portion 33 is received within a tubular extension 35 of a plunger 36. A cap 37 applied to the end of the tubular member 35 engages the shoulder 34 to retain the terminal member 11, or the enlarged portion 33 thereof, within the tubular extension 35. A spring 38 disposed within the tubular extension 35 and between the bottom wall thereof and the end of the enlarged portion 33 of the terminal serves to yieldingly maintain the terminal member projected to its fullest extent from the casing 35 with the shoulder 34 against the cap 37. In the operation of the device when the plunger 36 is moved in a direction to carry the terminal 11 toward and into contact with terminal 10 to complete the electric circuit the spring 38 will permit the terminal 11 to yield in case excessive pressure is applied to shift the plunger 36. The plunger member 36 constitutes a part of a diaphragm device which consists of a circular flange portion 39 of plunger member 36, a block 40 of insulating material, a rubber diaphragm 41, a wear-plate 42, and a disk 43 of suitable insulating material. The insulating block 40 bears against one side surface of the circular flange 39 of the diaphragm plunger member 36 and surrounds the tubular extension 35 and receives the bearing of the spring 23 above referred to, the tension of said spring serving to yieldingly maintain the separation of the blocks 22 and 40 but permitting the movement of block 40 toward block 22. The rubber diaphragm 41 is clamped at its peripheral edge against a shoulder 44 formed in an enlarged portion 45 of casing 25 by means of a dome or cap 46 having threaded engagement with the enlarged portion 45 of the casing. A wear-plate or washer 47 is interposed between the clamping surface of the dome or cap 46 and the peripheral edge portion of the rubber diaphragm 41 to prevent ruffling up of the rubber diaphragm when the dome or cap is screwed home into clamping relation. The bearing plate 42 is interposed between the insulating disk 43 and the rubber diaphragm 41, these parts being clamped together and against the peripheral flange portion 39 of plunger member 36 by means of a nut 48 threaded onto the end of the plunger member 36. The insulating member 43, wear-plate 42, diaphragm 41, and peripheral flange portion 39, work within an enlarged chamber 49 formed by the enlarged portion 45 of the casing and cap or dome 46, said chamber constituting in effect a cylinder within which the plunger, diaphragm, washer, and wear-plate operate as a diaphragm piston. A terminal plug 50 has a portion thereof to extend through an opening in the end wall of the dome or cap 46 and is shouldered as at 51 to bear against the exterior wall surface of said dome or cap, and is held in assembled position by means of a nut 52 screwed upon the inner end of the terminal plug. This terminal plug must be efficiently insulated from the dome or cap 46. To this end insulating col-

lars or washers 53 are interposed between said terminal plug and the adjacent wall surfaces of the dome or cap. The exterior portion of the terminal plug 50 is constructed to receive the circuit lead. The perforation 54 affords means for this purpose. The circuit connection between the plunger portion 36 and the terminal plug 50 may be established and maintained in any suitable or convenient manner. A simple arrangement for this purpose is shown wherein a conducting collar 55 is clamped to the plunger member 36 by the nut 48 and one end of a flexible conductor member 56 is connected to the washer 55. The other end of the flexible conductor member 56 extends into a channel formed in the terminal plug 50 and is held therein in any convenient way, as for example, by means of set screw 57. Where the circuit control device is to be operated by a pressure medium, the pressure medium is permitted access to the interior of the dome or cap 46 and to one side of the diaphragm piston or plunger, as for example, through the openings 58. For illustration, if the circuit control device is to be employed in connection with a depth bomb the openings 58 in the cap or dome 46 permits ingress of water which acts upon the plunger diaphragm to cause the same to be shifted in a direction to carry the terminal 11 toward terminal 10. The tension of spring 23 is so regulated that when the desired degree of hydrostatic or other pressure is attained, that is, when the control device reaches a predetermined depth in water, the ends of the terminals 10, 11, are brought into contact with each other, thereby completing the circuit through the device. The movement of the diaphragm piston is yieldingly resisted by the spring 23. In case of excess of pressure being imposed upon the piston diaphragm the spring 38, as above explained, permits the terminal 11 to yield. The flexible conductor section 56 permits the movement of the piston diaphragm relatively to the terminal plug 50.

It will be observed that every precaution is taken to prevent shortcircuiting by efficiently insulating the various parts of the device which carry the current. An exceedingly simple, strong, sturdy, and durable structure is provided, which is composed of parts which are capable of being easily manufactured and rapidly assembled.

It will be understood that while in some uses, the parts 50 and 28 may be provided with an insulating coating or covering, in the present illustration, such insulation is not necessary as the current employed is not of sufficiently high potential. In the present illustration the device has been used with very low voltage currents, and has demonstrated that short circuiting between the respective terminals through salt or sea water, in which the same is immersed, is not effected.

While I have shown and described a specific structure embodying the principles of my invention, I wish it to be understood that many variations and changes in the details of the various parts might readily occur to persons skilled in the art and still fall within the spirit and scope of my invention, I do not desire therefore to be limited or restricted to the exact details shown and described.

Having now set forth the objects and nature of my invention, and a structure embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is:—

1. In a circuit controlling device, a casing, terminal plugs mounted in the opposite ends of said casing but insulated therefrom, a circuit terminal adjustably mounted in one of said plugs, a diaphragm piston also mounted in said casing and insulated therefrom, a coöperating circuit terminal carried thereby, flexible conductor connections between said diaphragm piston and the other of said terminal plugs, and means to impose the action of a pressure medium upon said diaphragm piston.

2. In a circuit controlling device, a casing formed in alined separable members, a circuit terminal mounted in one of said members but insulated therefrom, a coöperating terminal mounted in the other of said members and insulated therefrom, said circuit terminals being arranged in alinement with each other, a diaphragm connected to one of said terminals and adapted to operate under the influence of pressure when applied thereto to move said alined terminal into contact with the other, means for resisting the movement of said diaphragm, and a flexible conductor connection with the circuit terminal carried by the diaphragm.

3. In a circuit controlling device, a casing formed in alined separable members, a circuit terminal mounted in one of said members but insulated therefrom, a coöperating terminal mounted in the other of said members and insulated therefrom, said circuit terminals being arranged in alinement with each other, a diaphragm, one of said terminals being yieldingly connected to said diaphragm and adapted to be moved toward and from the other circuit terminal when said diaphragm is subjected to the action of pressure applied thereto, and a flexible conductor connected to the yieldingly mounted circuit terminal.

4. In a circuit controlling device, a casing, terminal plugs mounted therein but insulated therefrom, one of said plugs having a central longitudinal bore therethrough, a circuit terminal adjustably mounted in said

bore, pressure controlled devices also arranged within said casing, a coöperating circuit terminal yieldingly connected to said pressure controlled devices and arranged in line with said adjustable terminal, a flexible conductor electrically connecting said movable terminal and the other of said terminal plugs, and means for yieldingly resisting the action of said pressure controlled devices.

5. In a circuit controlling device, a casing, terminal plugs mounted in the opposite ends thereof but insulated therefrom, one of said plugs having a central longitudinal bore therethrough, said bore having a shoulder formed therein, a circuit terminal mounted in said bore, a packing washer surrounding said terminal and seated against said shoulder, a bushing to retain said packing in position, a coöperating circuit terminal mounted in said casing for movement toward and from said first mentioned terminal, a flexible conductor connection between said movable terminal and the other of said plugs, and pressure controlled devices for moving said movable terminal.

6. In a circuit controlling device, a casing having openings in the opposite ends thereof, terminal plugs projecting through said openings and having shoulders to fit against the exterior of said casing ends, means for clamping said terminal plugs in said casing, means for insulating said plugs from said casing, a circuit terminal carried by one of said plugs, a coöperating circuit terminal mounted in said casing for movement toward and from said first mentioned terminal, a flexible conductor connection between said movable terminal and the other of said plugs, and pressure controlled devices for moving said movable terminal.

7. In a circuit controlling device, a casing, a dome or cap for one end of said casing, a terminal plug mounted in the other end of said casing but insulated therefrom, a coöperating terminal plug mounted in said dome or cap but insulated therefrom, a circuit terminal carried by one of said plugs, a coöperating circuit terminal mounted in said casing for movement toward and from said first mentioned terminal, flexible conductor connections between said movable terminal and the other of said plugs, and pressure controlled devices for moving said movable terminal.

8. In a circuit controlling device, a casing made in separable sections, one section engaging the other, a circuit terminal carried by one of said casing sections, a movable diaphragm clamped by and between said casing sections, a coöperating circuit terminal yieldingly connected to said diaphragm and arranged in line with the circuit terminal carried by the other section of said casing, and means for yieldingly resisting the movement of said diaphragm.

9. In a circuit controlling device, a casing, terminal plugs mounted in said casing at the opposite ends thereof but insulated from said casing, a plunger diaphragm device arranged within said casing, a spring to resist the movement of said plunger diaphragm, coöperating circuit terminals, one of said terminals carried by one of said plugs, and the other carried by said plunger diaphragm, but yieldingly movable relative thereto, and flexible conductor connections between said plunger diaphragm and the other of said plugs.

In testimony whereof I have hereunto set my hand on this 2nd day of May, A. D. 1918.

ERNEST B. CROCKER.