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1,946,894

ELECTRICAL CURRENT RESPONSIVE DEVICE

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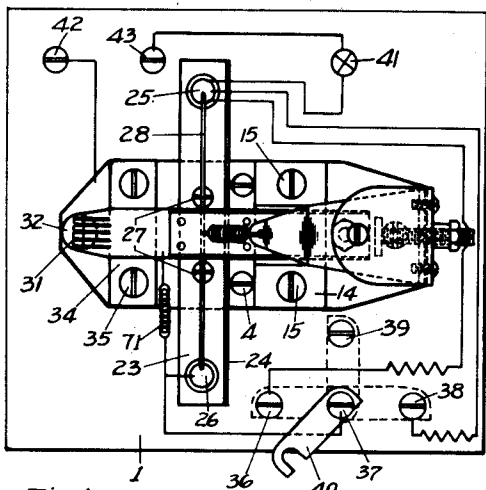


Fig. 1

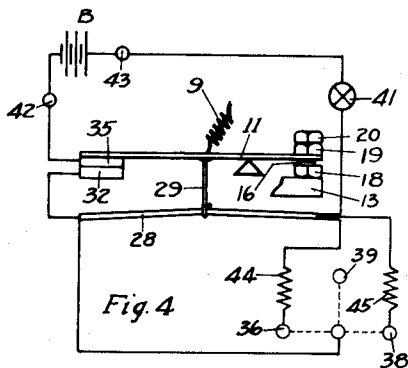


Fig. 4

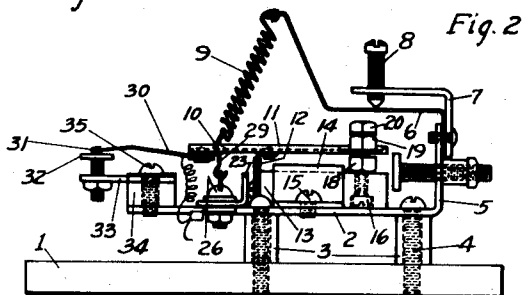


Fig. 2

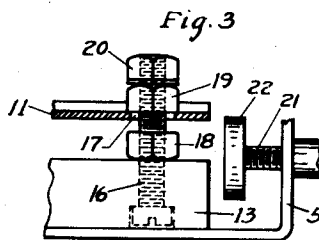


Fig. 3

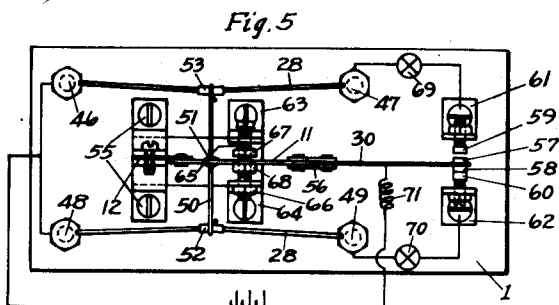


Fig. 5

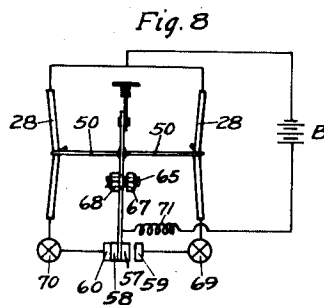


Fig. 8

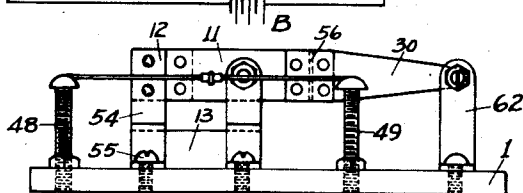


Fig. 6

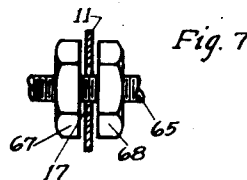


Fig. 7

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ELECTRICAL CURRENT RESPONSIVE
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15 Claims. (Cl. 200—113)

This invention relates to an electrical current responsive device which has various fields of usefulness as will be apparent from the description which follows.

One of the objects of my invention is to provide an electrical current responsive device which has relatively few moving parts, and one which has a wide range of adjustment, thereby extending its range of usefulness.

Another object of my invention is to provide a device of the character described which consumes an extremely small amount of energy and is therefore particularly adapted for use wherein the source of current supply is more or less limited; for example, in street or railway signal flashers where primary batteries are the source of current.

Another object of my invention is to provide a device of the character described which has a relatively quick movement or snap action.

A further object of my invention is to provide an electrical device which is responsive not only to direct current, but to alternating current as well, of an extremely wide range of frequency.

These and other objects will be apparent to one skilled in the use of devices of this character, after a study of the specification taken in connection with the annexed drawing, wherein:

Figure 1 is a plan-view of one form of my electrical current responsive device, this view also showing the electrical connections between the different parts.

Figure 2 is a side elevation of Figure 1.

Figure 3 is a view of one of the detail parts of the device on an enlarged scale from that shown in Figures 1 and 2.

Figure 4 is a diagrammatic illustration of the circuit connections of the device.

Figure 5 is a plan-view of another form of my device arranged for a special purpose to be hereinafter pointed out.

Figure 6 is a side elevation of the device shown in Figure 5.

Figure 7 is an enlarged view of the detail parts of the device shown in Figures 5 and 6, while

Figure 8 is a diagram of the circuit connections of the device shown in Figure 5.

Referring now to the details wherein like numbers refer to corresponding parts in the various views, 1 is a base of any suitable material, preferably of insulating character, on which is mounted a bracket 2 by means of collars 3 and screws 4. One end of the bracket 2 has an upwardly turned arm 5 to which is attached a spring 6 and an L-shaped bracket 7 carrying a tension-

ing screw 8, one end of which engages the spring 6 to adjust the tension thereof. To the free end of the spring 6, is attached a spiral spring 9, the other end of which is fastened at 10 to an armature 11 in a manner to be later referred to.

The armature 11 is fastened by means of a spring-hinge 12 of magnetic material, such as spring steel, to one end of a permanent magnet 13. The magnet 13 is fastened to the bracket 2 by means of a clamp 14 held to the bracket 2 by means of screws 15. The end of the magnet 13 opposite the spring-hinge 12, carries a screw 16 made of magnetic material such as steel, and the screw passes through a clearance hole 17 in the end of the armature 11. The screw 16 carries steel nuts 18 and 19, and a lock-nut 20, whereby the armature 11 may oscillate between the nuts 18 and 19, it being understood that the nut 18 is locked against the magnet 13 so as to hold the screw 16 securely in permanent fixed position.

The upturned end 5 of the bracket 2 carries an adjusting device in the form of a screw 21 which has a relatively large head 22 of magnetic material, and this head can be adjusted so as to shunt more or less of the magnetic flux in the magnet 13 away from the screw 6 to the armature 11 for the purpose which will be hereinafter pointed out.

The bracket 2 carries a support member 23 which is preferably an angular piece whereby the flange 24 adds a considerable amount of rigidity to the support member 23, on the outer ends of which are attached two studs 25 and 26. The support member 23 is fastened near its central part by means of a pair of screws 27 to the bracket 2, thereby leaving the ends of the support member 23 free to allow an expansion of the support member 23 for reasons which will be hereinafter explained.

Stretched between the studs 25 and 26, is an element 28 preferably in the form of a wire having a high co-efficient of expansion. Furthermore, the wire 28 and the support 23 are preferably made of the same material, so that there is the same relative change between the two parts for changes in temperature. At the central point of the element 28, there is attached an anchor 29 shown in the form of a hook member which may be a continuation of the spring 9, and which passes through a hole in the armature 10, and after it has centered itself, the hook 29 and spring 9 are soldered to the armature at the point 10.

Attached to the free end of the armature 11, is a resilient contact finger 30, the ends of which

are preferably slitted at 31 so as to insure a good contact of considerable area with an adjustable contact device 32 which is carried by an arm 33 supported on an insulator 34 fastened to the bracket 2 by any suitable means as by screws 35.

Mounted on the base or support 1, are a plurality of binding posts 36, 37, 38, and 39. The post 37 carries a metal strap or connecting link 40 for a purpose to be later pointed out. The base 1 also carries a signal lamp 41 which may be mounted thereon in any satisfactory manner. Binding posts 42 and 43 are provided for connecting a battery B or other source of suitable current supply thereto.

In the normal position of the device above described, the element 28, through the connection 29 with the armature 11, applies a certain pull or tension on the armature holding it so that the contact spring 35 is in engagement with the contact 32, and the other end of the armature is in magnetic engagement with the nut 19.

Now, in the operation of the device, as current flows from the battery B through the lamp 41 and the element 28, through the contacts 32 and 35, back to the battery, this current heats the element 28, and because of its high co-efficient of expansion, it will expand, and the tension on the connection 29 is reduced, allowing the spring 9 to exert a more effective pull on the armature 11. This pull of the spring 9 is counter-acted by the magnetic pull of the nut 19 against the free end of the armature 11 until finally the tension on the connection 29 is reduced to such a point that the spring 9 suddenly overcomes the magnetic pull just described, and the free end of the armature is snapped downwardly against the nut 18, thereby opening the contacts 32 and 35 with a sudden break, and extinguishing the lamp 41.

After a certain predetermined interval of time, the element 28 contracts and applies tension to the connection 29 and to the spring 9, and to the armature 11. The magnetic pull of the nut 18 on the end of the armature 11 is finally overcome, and the contacts 32 and 35 will close suddenly, whereupon the cycle will be repeated.

By adjusting the magnetic shunt 22 between the end of the magnet 13 and armature 11, the snap-action previously described can be regulated over a considerable range.

It sometimes happens that the lamps 41 installed in devices of this character, have different current capacities. The three most commonly used have $\frac{1}{2}$, $\frac{3}{4}$, and one ampere capacity. When the device is used with a lamp having $\frac{1}{2}$ ampere capacity, the bridge link 40 is connected to the binding post 39 as indicated by dotted lines in Figure 1, and nothing takes place, except as has been described. However, when a lamp is used requiring $\frac{3}{4}$ ampere for proper candle power, the link member 40 is thrown to either one of the binding posts 36 or 38, thereby throwing in either shunt resistance 44 or 45, these resistances being chosen or adjusted to provide a suitable shunt around the element 28, whereby this element will take the same amount of current for the different candle power lamps, so that as these lamps may be changed, the interval of light and darkness produced by the operation of the electrical device will not be materially altered. This I consider to be an important feature in the device arranged for the purpose of controlling signals for regulating street traffic and the like.

In the form shown in Figures 5 and 6, the arrangement is such as to alternately complete a circuit; for example, a flashlight, for any desir-

able purpose, and in which there is no appreciable dark period between the switching of one circuit to the other; or no appreciable silent period if audible signals of different pitch or character are used.

Referring particularly to Figures 5 and 6, the base 1 carries studs 46, 47, 48, and 49. The studs 46 and 47 act to support an element 28 similar to that previously described, and a similar element is supported between the studs 48 and 49. Connected between the central points of the expansion elements 28, is a member 50 which passes through the armature and is soldered or brazed thereto at 51. If the member 50 is metallic, as indicated, it is insulated by the insulators 52 and 53 from the elements 28. The connection of the member 50 with the elements 28 is such as to draw them toward each other or place them under tension.

The armature 11 has a similar spring-mounting 12 as described for the device shown in Figure 1, this spring-mounting being held to a support 54 of magnetic material, which support also clamps over one end of the permanent magnet 13. The support 54 is fastened to the base 1 in any satisfactory manner as by screws 55. To the free end of the armature 11 is fastened a similar spring 30 as used in Figure 1, the fastening means being indicated at 56, the connection being made with insulators so that the spring 30 is insulated from the armature 11. The outer end of the spring 30 carries two contacts 57 and 58, the first being adapted to cooperate with an adjustable contact 59, and the other with an adjustable contact 60 supported by suitable brackets 61 and 62 respectively from the base 1.

The base 1 also carries brackets 63 and 64 of magnetic material, and these brackets engage the magnet 13 at one end to hold this end of the magnet in position on the base. Through the free upstanding ends of brackets 63 and 64, extends a screw 65 of magnetic material such as steel, the screw being clamped to one of the brackets, for example 64, by clamping nut 66. Positioned on the screw 65, which passes through clearance hole 17 on the armature 11, are a pair of steel nuts 67 and 68 corresponding to the nuts 18 and 19 of Figure 3. A lamp or signal 69 is connected between the stud 47 and the bracket 61, and a corresponding lamp or signal 70 is connected between the stud 49 and the bracket 62.

The battery B has one terminal connected to the spring 30 by means of a flexible connection 71 corresponding to the same connection in Figure 1, while the opposite end of the battery B is connected to the studs 46 and 48.

Without the permanent magnet 13, the armature 11 will, on assembly, take a neutral position between the nuts 67 and 68, as indicated in Figure 7, and likewise the contacts 57 and 58 will be spaced apart from the contacts 59 and 60. However, due to the magnet 13 acting through the steel screw 65 and one of the nuts 67 or 68, the armature may be pulled to either side, as illustrated in Figure 5, it being impossible for the armature 11 to stay in a neutral position as indicated in Figures 7, thus holding closed either one of the two circuits through the signals 69 or 70.

Figure 8 illustrates diagrammatically the circuit arrangement through this form of device, the operation of which is very similar to the form shown in Figure 1. To illustrate, I have shown in closed position, in Figure 8, the contacts 58 and 60 so that there is a circuit through the

signal 70 by way of the element 28 from the current source of supply B. Passage of current through the element 28 and the signal 70 causes the element 28 to expand, reducing the pull of this element on that part of the member 50 connected to the armature 11. This allows the tension in the other element 28 to become more effective in its pull to the member 50 through the armature 11, and finally this pull overcomes the magnetic attraction of the nut 68, and the armature 11 with the spring 30 is snapped suddenly over to the nut 67, thereby breaking quickly the contacts 58 and 60, and as quickly closing the contacts 57 and 59, thereby establishing the other circuit through the signal 69, when a similar action takes place as just described for the other circuit containing the signal 70.

The construction of this particular device is such that if the source of current supply is cut off for any reason, or by failure of the battery B, or at the time of renewal of the same, or for any other reason when the current source is re-established, the device is self-starting and it will automatically take up the cycle of operation as above described.

It is to be noted that in the form shown in Figure 5, the two elements 28 are similar and therefore they counter-balance each other with respect to external changes in temperature, so that the device may be moved from a hot to a cold room, or from a cold to a hot box, without affecting the operation of the device; that is to say, no adjustments need be made to take care of changes in temperature surrounding the device. The same is true, as has been explained, for the arrangement shown in Figure 1.

Therefore, it will be seen, from what has been said, that I have provided an electric current-responsive device which is not susceptible to changes in temperature of the atmosphere within which the device may be located, but on the other hand, it only functions or responds to a flow of current through the device.

It will be obvious that certain of the mechanical details may be varied without departing from the spirit of my invention or the scope of the appended claims; for example, if the cross-sectional area of one of the elements 28 in Figure 5 be made different from the other, then the time of functioning of the two signal circuits will be different in time.

Having thus described my invention, what I claim is:

1. An electric current responsive device including; a base, a bracket carried by the base, a magnet fastened to the bracket, a member of magnetic material flexibly attached intermediate its ends to one end of the magnet, a screw of magnetic material fastened by a nut of magnetic material in one end of the magnet and extending through a clearance hole in said member of magnetic material, at least a second nut of magnetic material positioned on said screw on the side of said member opposite to the first-mentioned nut, a contact carried by said member, a cooperating contact carried by said bracket a support carried by the bracket, an element responsive to the passage of current therethrough attached to opposite ends of said support, means for anchoring said element at its center to said member of magnetic material, and a biasing spring carried by an arm on said bracket and having one end attached to said member of magnetic material at least near where said anchoring means is attached thereto.

2. An electric current responsive device as set

forth in claim 1, further characterized in that an adjustable magnetic shunt for said screw is positioned on an upturned part of the bracket adjacent to and spanning the end of the magnet and said mentioned member of magnetic material.

3. An electric current responsive device including, a magnet, an element responsive to the passage of current therethrough, a support for said element, a member acting as an armature for said magnet and having an anchorage to the central part of said element, said member being movably attached to one end of said magnet, the other end of the magnet having a polar extension passing through said member near one end thereof, devices of magnetic material on said polar extension for attracting said member, a spring cooperating with said element to actuate said member as described, and circuit contacts opened and closed by said member.

4. An electric current responsive device as set forth in claim 3, further characterized in that an adjustable magnetic shunt is provided for said polar extension for the purpose described, said shunt comprising a magnetic member positioned adjacent to and spanning the free end of said armature and that end of the magnet having the polar extension.

5. An electric current responsive device including a movable member carrying a contact and a stationary contact, means normally biasing said movable member so as to hold said contacts closed, said biasing means including; a magnet having an extended pole passing through but acting on said movable member; and an element attached mechanically and rigidly to said member, said element acting on the passage of current therethrough to cause said member to open said contacts.

6. An electric current responsive device including a movable member carrying a contact and a stationary contact, means normally biasing said movable member so as to hold said contacts closed, said biasing means including; a magnet having an extended pole passing through said movable member and provided with polar adjustable parts for acting on said movable member; and an element attached mechanically to said member, said element acting on the passage of current therethrough to cause said member to open said contacts, and then after an interval to close said contacts.

7. An electric current responsive device including an element acting on the passage of current therethrough to cause movement of a member attached thereto, a movable member acting as an armature to a magnet mechanically and rigidly attached to said element, contacts in an electrical signal circuit operated by said movable member, and a magnet acting on said movable member in conjunction with said element to cause it to move suddenly from one position to another.

8. An electric current responsive device including an element acting on the passage of current therethrough to cause movement of a member attached thereto, a movable member acting as an armature to a magnet mechanically attached to said element, contacts in an electrical signal circuit operated by said movable member, and a magnet acting on said movable member in conjunction with said element to cause it to move suddenly from one position to another, and means for controlling the amount of current passing through said element.

9. An electric current responsive device includ-

ing an element acting on the passage of current therethrough to cause movement of a member attached thereto, a movable member mechanically and rigidly attached to said element, contacts in an electrical signal circuit operated by said movable member, and a magnet having adjustable polar members for acting on both sides of said movable member in conjunction with said element to cause it to move suddenly from one position to another, and means for modifying the action of the magnet on said movable member.

10. An electric current responsive device including, a movable member for actuating a contact, a stationary contact cooperating with the first-mentioned contact to close and open an electrical circuit, an element positioned between two anchorages and rigidly connected under tension at its center to said movable member, said element acting on the passage of normal current therethrough to cause movement of said movable member and operation of said contacts.

11. An electric current responsive device including, a pair of elements stretched between two anchorages, a movable member located between said elements and mechanically connected to said elements so as to tension them toward each other, contacts actuated by said movable member, contacts for cooperation with said first-mentioned contacts to control different electrical circuits, either of said elements responding to passage of current therethrough to allow the other element not at that moment having current therein to operate the movable member.

12. An electric current responsive device as set forth in claim 11, further characterized in that the mechanical connection to said elements is made at their central points and at right angles to said movable member.

13. An electric current responsive device as set forth in claim 11, further characterized in that the mechanical connection to said elements is made at their central points and at right angles to said movable member, and a magnet having polar parts disposed on opposite sides of said movable member to bias it for the purposes described.

14. An electric current responsive device as set forth in claim 11, further characterized in that the two elements are symmetrically arranged in spaced relation, and the movable member is positioned between said elements, while the mechanical connection to the elements is an insulated one and made at the opposite central points of said elements, and a magnet having polar parts disposed on opposite sides of said movable member to bias it for the purpose described.

15. An electric current responsive device as set forth in claim 11, further characterized in that said elements are identical in kind of material but may be of different cross-sectional area, whereby the circuits controlled will function on different time intervals, but the device will still be self-compensating for changes in temperature to which the entire device may be subjected.

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85	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150