Sept. 18, 1934. C. J. MARTIN 1,974,188

CIRCUIT MAKING AND BREAKING DEVICE

Filed April 4, 1932

Fig. 1

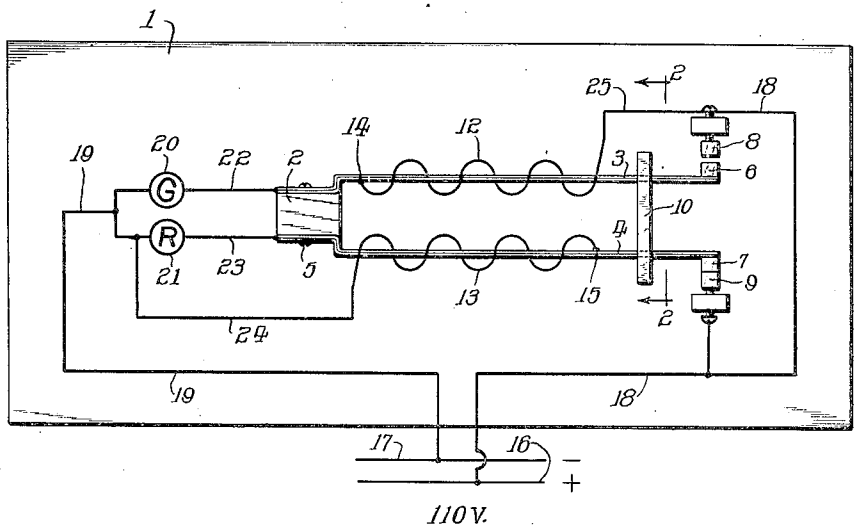
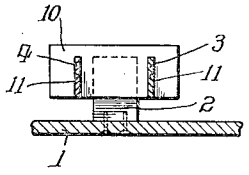


Fig. 2



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Patented Sept. 18, 1934

1,974,188

UNITED STATES PATENT OFFICE

1,974,188

CIRCUIT MAKING AND BREAKING DEVICE

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Application April 4, 1932, Serial No. 602,981

11 Claims. (Cl. 175—320)

The invention relates to improvements in circuit making and breaking devices and the general aim of the invention is to provide a simple, efficient and rugged, yet sensitive, device of this nature for periodically interrupting electrical circuits.

An object of the invention resides in the provision of a new and improved circuit making and breaking device by which a plurality of circuits may be alternately established and interrupted at regularly spaced intervals.

Another object of the invention is to provide a circuit making and breaking device for alternately establishing a pair of circuits, such as the alternate circuits in a two lamp flasher system, which device recurrently establishes the circuits for uniformly regular periods of time.

More particularly stated, an object of the invention is to provide a control device for periodically and alternately establishing a pair of circuits and which embodies a pair of thermal responsive elements included as a part of a novel control circuit by which the recurrent movements of the elements are effected with uniformity.

Another object of the invention is to provide in a device of this character embodying a pair of thermostatic elements, a novel means for positively insuring conjoint movement of said elements.

Other objects and advantages will become apparent from the following description and from the accompanying drawing, in which:

Figure 1 is a view showing an exemplary structural and circuit arrangement of a device embodying the invention.

Fig. 2 is a transverse section through the thermal responsive elements taken as indicated by the line 2—2 of Fig. 1.

With reference to the somewhat diagrammatic illustration of structure which has been chosen merely for the purpose of disclosure of the invention, the device embodies a suitable base 1 having a standard 2 of insulating material mounted thereon. The standard supports a pair of thermal responsive elements, such as the bimetallic elements 3 and 4, which are of conventional construction and are secured to the standard in any suitable manner as by means of the screw 5. The thermostatic elements 3 and 4 are electrically independent. The free or unsupported ends of the elements 3 and 4 carry contacts 6 and 7, respectively, which contacts are arranged in the swinging movements of the elements to move into engagement with one or the other of the stationary contacts 8 or 9, respectively. The stationary contacts 8 and 9 are mounted on the base 1 and it is preferred that said contacts be supported in any well-known manner for adjustment toward and away from the movable contact opposed thereto.

The elements 3 and 4 are connected together for conjoint movement in such a manner that a definite spaced relationship between the contact points 6 and 7 is positively maintained. While the elements may be rigidly connected, it has been found that a rigid connection limits the extent of swinging movement of the elements inasmuch as, in swinging from one extreme to the other, one element will have a longitudinal movement relative to the other, which, when the elements are rigidly connected, produces a strain in the assembly tending to vary the distance between the contacts 6 and 7. It is, therefore, preferred that a flexible connection be provided between the elements which, while definitely maintaining the contacts 6 and 7 in a predetermined spaced relationship, will otherwise allow the elements to shift with respect to each other as bending occurs. To this end (see Fig. 2), a plate 10 of insulating material has a pair of spaced slots 11 therein arranged rather snugly to receive the elements 3 and 4. The width of the portion of the plate between the slots, of course, determines the distance to be maintained between the contacts 6 and 7. The slots are so fashioned that either element may have slight movement relative to the plate as bending of the elements occurs. Hence, the bending strains in the elements cannot be transmitted through the plate to interfere with the normal free bending of each other and thereby disrupt the spaced relationship of the elements.

Each element 3 and 4 has a high resistance heating coil 12, 13, respectively, wound thereon and one end of each coil is connected, as at 14, 15, respectively, to the thermostatic element with which it is associated.

In describing the circuit arrangement of the present embodiment, it will be considered that the circuits which are alternately and recurrently established include the lamps of a flasher system. It will be understood, however, that instrumentalities other than lamps can be readily actuated. The positive and negative sides of a suitable source of current are respectively designated 16 and 17. A lead 18 connects the positive side 16 of the source with both of the stationary contacts 8 and 9. A lead 19 connects the negative side 17 of the source with one side of the two lamps 20 and 21. For convenience in

distinguishing between the two lamps 20 and 21, it will be considered that the lamp 20 is green and the lamp 21 is red. A lead 22 connects the other side of the green lamp 20 with the thermostatic element 3 and a similar lead 23 connects the other side of the red lamp 21 with the thermostatic element 4. A wire 24 connects the lead 19 with that end of the heating coil 13 which is not connected with the thermostatic element 4, whereby to provide a shunt circuit through the heating coil 13 around the red lamp 21. A wire 25 connects the end of the heating coil 12 which is not connected to the thermostatic element 3 with the lead 18.

From the foregoing it will be apparent that, if the contacts 6 and 8 are in engagement, a circuit for lighting the green lamp will be established from the positive side 16 of the source through lead 18, contacts 8 and 6, thermostatic element 3, wire 22, green lamp 20, and lead 19 to the negative side 17 of the source. When contacts 7 and 9 are engaged, a circuit through the red lamp is established as follows: From the positive side 16 of the source through lead 18, contacts 9 and 7, thermostatic element 4, lead 23, red lamp 21 and lead 19 to the negative side 17 of the source.

The circuits through the heating coils 12 and 13 are control circuits for producing a periodic swing of the thermostatic elements 3 and 4 between the fixed contacts 8 and 9 whereby a recurrent and alternate establishment of each lamp circuit for a definite period of time is effected. It will be seen that the heating coil 12 is in series with the green lamp 20 and that the heating coil 13 is in shunt or parallel with the red lamp 21. When the device is first assembled, the thermostatic elements 3 and 4 are placed under an initial tension whereby one circuit is normally established. As illustrated, the tension of the thermostatic elements 3 and 4 normally maintains the contacts 7 and 9 in engagement to establish the red lamp circuit. Therefore, when the device is first connected with the source of current, the red lamp will be lighted through the circuit which has been previously described. Simultaneously, current passes through the shunt circuit around the red lamp 21 to heat the coil 13, this circuit being as follows: From the positive side 16 of the source through the lead 18, contacts 9 and 7, thermostatic element 4, connection 15, heating coil 13, wire 24 and lead 19 to the negative side 17 of the source. The heating coil 12 is at the same time established in a heating circuit in the following manner: From the positive side 16 of the source, through the lead 18, wire 25, heating coil 12, connection 14, thermostatic element 3, lead 22, green lamp 20 and lead 19 to the negative side 17 of the source. The resistance offered by the heating coil 12 is sufficient to prevent the green lamp 20 from being lighted at this time.

The red lamp circuit is established during the initial heating of the thermostatic elements 3 and 4 to overcome the normal tension of the elements and subsequently to cause the elements to move in a direction which will break the engagement of contacts 7 and 9 to interrupt the red lamp circuit, and to bring contacts 6 and 8 into engagement to establish the green lamp circuit. When the red lamp circuit is broken, the heating circuit through coil 13 is likewise interrupted so that the thermostatic element 4 begins to cool.

A short lag, however, occurs before a reverse bending of the thermostatic element 4 commences, and, inasmuch as the circuit through the heating coil 12 remains established after the contacts 7 and 9 are separated, movement of the thermostatic elements continues to bring the contacts 6 and 8 into engagement. As this engagement occurs, the green lamp circuit is established through the thermostatic element 3. Inasmuch as the resistance offered to the flow of current by the thermostatic element 3 is much less than the resistance offered by the heating coil 12, the current will shunt around said heating coil, thereby allowing the coil and element 3 to cool. The lag which occurs before the element 3 commences to bend in a reverse direction opposes the reverse bending force which is now exerted by the element 4 for a short period of time during which the green lamp circuit is established.

When the thermostatic element 3 cools, the elements swing in a reverse direction separating contacts 6 and 8 and interrupting the green lamp circuit. As interruption of the circuit occurs, the heating element 12 is once more energized to heat the thermostatic element 3. There is, however, another lag before the effect of the heating coil on the element 3 will be sufficient to cause the element to exert a force in opposition to the force exerted by the cooling of element 4. Thus, the two elements will continue to swing until contacts 7 and 9 are engaged to reestablish the red lamp circuit and simultaneously the circuit through the heating coil 13. Still another lag occurs as the element 4 heats sufficiently to again effect separation of contacts 7 and 9 during which time the red lamp circuit is established. As the contacts 7 and 9 are reestablished, one cycle of operation is completed and other cycles will follow in succession as the heating coils 12 and 13 are caused to heat or are allowed to cool by the alternate engagement of contacts 7 and 9 or 6 and 8. The circuits are, therefore, so arranged that the heating coils are, throughout one cycle of operation, caused simultaneously to heat and are allowed simultaneously to cool and have intermediate periods during which the heating effect of one coil on an element is placed in opposition to the force exerted by the cooling of the other element. The lags which occur before the elements respond to a change in either heating or cooling are for periods of substantially equal duration and, hence, are balanced against each other to produce pauses at each end of the movement of the elements which are of equal duration and which thereby equalize the periods when the circuits are alternately established. In consequence, an equilibrium is attained wherein the red and green lamp circuits are recurrently and alternately established for the same periods of time.

It will be evident from the foregoing that a novel device has been provided which is efficient in operation, simple and sturdy in construction, which will periodically and successively energize a plurality of circuits, and may be manufactured and sold at a low cost. The flexibility of the connection between the thermostatic elements 3 and 4 while maintaining the contacts 6 and 7 in a definite spaced relationship throughout the entire swinging movement of the elements does not permit any external strain to be imposed on the elements and thereby insures the periodic regularity with which the circuits are alternately established. The rapidity with which the alternate circuits are periodically established may be

readily varied by adjustment of the stationary contacts 8 and 9.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and have herein described in detail the preferred embodiment, but it is to be understood that I have not thereby intended to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

I claim as my invention:

1. In an electrical device of the character described, the combination of a plurality of contacts, a plurality of thermal responsive devices arranged for engagement with said contacts, and means for connecting said devices for conjoint movement toward and away from engagement with said contacts with the same definite spaced relationship along the direction of such movement and throughout the range of said movement, said means for connecting the devices being otherwise free thereof to permit relative movement of the devices in other directions.

2. In an electrical device of the character described, the combination of a pair of fixed contacts, a pair of thermostatic elements arranged for heat induced swinging movement into engagement with said contacts to establish electrical circuits, and a member interposed between said elements and connecting them in definitely maintained spaced relationship for conjoint movement into alternate engagement with one or the other of said contacts, said relationship being the same throughout the range of movement and said elements being movable along their length relative to the interposed member during the swinging movement.

3. An electrical device for recurrently and periodically energizing electrical mechanisms comprising, in combination, a pair of thermal responsive elements mounted in substantial parallelism, a pair of circuits for energizing said mechanisms including contacts alternately controlled by said elements, other circuits including heating means for actuating said elements and controlled by the opening and closing of said contacts, and means connecting said elements for conjoint movement in controlling said contacts, said means being arranged to maintain the same definite spaced relationship between said elements during movement while permitting relative shifting movement therebetween in other directions.

4. An electrical device for recurrently and periodically energizing electrical mechanisms comprising, in combination, a pair of thermal responsive elements, a pair of circuits for energizing said mechanisms including contacts alternately controlled by said elements, a heating circuit for each element including a heating resistance associated with the element, one of said heating circuits being connected in parallel with one of the electrical mechanisms, the other of said heating circuits being a shunt circuit around the contacts controlled by the element with which said heating circuit is associated, and means connecting said elements for conjoint movement to open and close said contacts.

5. An electrical device for recurrently and periodically energizing a plurality of electrical circuits including a pair of thermally responsive circuit controlling elements, and a heating circuit for each element, one of said heating circuits being operatively connected with a source of current when one circuit is closed and the other of said heating circuits being operatively connected with a source of current when the other circuit is open.

6. A device for controlling the recurrent, alternate and regularly periodic energization of two electrical instrumentalities comprising a pair of thermal responsive devices, a pair of circuits each including one of said instrumentalities and arranged to be energized by the heat induced movement of said devices, and heating circuits including means associated with said devices for heating the same, said heating circuits being controlled by the movement of said devices, one of said circuits being in parallel with one of said instrumentalities and the other in series with the other of said instrumentalities.

7. A device for controlling the recurrent, alternate and regularly periodic energization of two electrical instrumentalities comprising a pair of thermostatic elements, a pair of circuits each including one of said elements and one of said instrumentalities, a pair of contacts each associated with one of said elements and arranged to be opened and closed by the movement of the elements, a pair of heating circuits having high resistance units therein disposed adjacent to said elements, one of said heating circuits being connected in series with one of the instrumentalities and in parallel with the associated element, and the other heating circuit being connected in parallel with the other of said instrumentalities.

8. In a thermal responsive device, the combination of a pair of thermal responsive elements and a heating circuit associated with each element, one circuit being connected in parallel and the other in series with respect to the element associated therewith.

9. In a thermal responsive device, the combination of a pair of circuit controlling thermal responsive elements, heating circuits associated with said elements and operatively controlled by the movement of said elements, and make and break means for each of said heating circuits operatively controlled by the movements of said elements for periods of simultaneous energization and deenergization separated by periods in which one circuit is energized and the other deenergized.

10. In a device of the character described, the combination of a thermal responsive element having a heating circuit in series therewith, and a second and similar element connected with said first mentioned element for conjoint movement and having a heating circuit in shunt therewith, and circuit make and break means for said series and shunt circuits controlled by the movement of said elements to simultaneously energize and deenergize said circuits during certain periods in a cycle of said movement and at other periods to energize one circuit and deenergize the other.

11. In a thermal responsive device, the combination of a pair of heat responsive elements connected for substantially conjoint movement and mounted for heat induced movement in the same direction, and circuits controlled by said elements in the movement thereof including means for heating each element.

CURTIS J. MARTIN.