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CIRCUIT CONTROLLING MEANS

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This invention relates to circuit controlling means, and more particularly to means for controlling a circuit to an electrically operated device whereby the circuit to the latter may be closed manually and opened automatically after a predetermined interval of time.

It is the common practice to provide automatic circuit breakers operable after an interval of time for opening the circuits to electrically operated devices such as toasters and the like, but such circuit breaking devices usually are rather complicated and expensive to manufacture.

An important object of the present invention is to provide simple electrically operated means which is manually operable for closing a circuit to an electrically operated device and is automatically operative after an interval of time for opening the circuit to the device.

A further object is to provide a holding circuit adapted to be manually closed for energizing an electrically operated device, and to provide means associated with the holding circuit for breaking the latter after an interval of time.

A further object is to provide a control system of the character referred to having simple and easily operated means for controlling the time of operation of the circuit breaking means.

A further object is to provide a main circuit adapted to be manually closed to energize an electrically operated device and to provide a shunt circuit associated therewith and operating as a holding circuit to maintain the main circuit closed for a given interval of time.

A further object is to provide a system of the character referred to having circuit breaking means including a thermal element through which current is adapted to pass when the main circuit is closed and operative to open the main circuit after the lapse of a predetermined interval of time.

A further object is to provide simple means associated with the thermal element for determining the length of time during which the main circuit will remain closed.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown several embodiments of the invention. In this showing, 55

Figure 1 is a diagrammatic view of one form of system, and,

Figure 2 is a similar view of a modified system.

Referring to Figure 1, the numeral 10 designates a source of current having one terminal connected to a wire 11 which leads to one terminal of an electrically operated device 12, such as an electric toaster or the like. The other terminal of the device 12 is connected by a wire 13 to a stationary contact 14. 60

The other terminal of the source is connected to one end of a wire 15, and the opposite end of this wire is electrically connected to the armature 16 of an electro-magnet 17 having a coil 18 thereon. Means is provided for manually closing the circuit to the device 12, including wires 19 and 20 connected respectively to the wires 13 and 15. A push button 21 is connected to the wire 20 and is adapted to close a circuit to the device 12 upon depression into engagement with a stationary contact 22 connected to the wire 19. 65

Energization of the electro-magnet 17 attracts the armature 16 into engagement with the contact 14, at which time a circuit will be closed through the device 12 independently of the manually operable switch 21. A holding circuit is provided for retaining the armature 16 in engagement with the contact 14 upon the operation and releasing of the switch 21. The holding circuit includes a thermally operated device 23 having a core 24, and a heating coil 25 surrounds the core 24. It will be apparent that the core 24 is of the standard type which is adapted to be anchored at one end whereby the opposite end will alter its position under the influence of temperature changes. 70

One end of the coil 25 is connected to the core 24 as at 26, and the opposite end of the coil is connected to the magnet coil 18 by a lead wire 27. As viewed in Figure 1, the lower end of the core 24 is anchored and the other end free, and the latter end of the coil 100

is provided with a contact 28. This contact normally engages a second contact 29 carried by a preferably resilient arm 30, and this arm, in turn, is connected by a wire 31 to the wire 11 previously described.

As the thermal device becomes heated, the free end thereof moves to the left, as viewed in Figure 1, and is followed by the lower end of the arm 30, thus retaining the engagement between the contacts 28 and 29. A screw 32 is threaded in any suitable support 33 and is provided with a preferably knurled operating head 34. The inner end of the screw 32 is arranged in the path of the arm 30 to limit the movement thereof, as will be apparent.

The lower end of the coil 18 is connected to the wire 13 by a wire 35, thus completing a shunt circuit which will always be closed when the circuit through the device 12 is closed, provided the contacts 28 and 29 are in engagement with each other.

The system illustrated in Figure 2 is similar in construction and identical in operation to the system previously described. In the modified form of control circuit, a source of current 36 has one terminal connected by a wire 37 to the electrically operated device 38, this device in turn being connected by a wire 39 to the core 40 of an electro-magnet 41. This magnet is provided with the usual coil 42.

The electro-magnet 41, when energized, attracts an armature 43 which forms electrical connection with the core 40. The armature 43 is connected by a wire 44 to the other terminal of the source 36.

The circuit through the device 38 is adapted to be initially closed by a manually controlled switch 45 movable into engagement with a contact 46, and the switch and contact are connected to the wires 44 and 39 by wires 47 and 48 respectively.

One end of the coil 42 is connected to the wire 39 by a lead wire 49, while the opposite end of the magnet coil is connected by a wire 50 to a heating coil 51 surrounding a core 52. The coil 51 and core 52 constitute a thermally operated device 53 which may be identical with the thermally operated device 23 previously described.

The other end of the coil 51 is connected to the core 52 as at 54, and the free end of the core 52 is provided with a contact 55 adapted to engage a contact 56 carried by a resilient arm 57. A wire 58 connects the arm 57 to the wire 37, as shown.

A screw 59 is threaded in a suitable support 60 and is provided at its outer end with a preferably knurled head 61. The screw 59 is arranged in the path of the arm 57 and is adapted to limit the movement thereof.

The operation of the system shown in Figure 1 is as follows:

Upon depression of the switch 21, a circuit through the device 12 is adapted to be closed.

Current flows from the source 10 through wires 15 and 20, the manually controlled switch 21 and contact 22, wires 19 and 13, through the device 12, and thence back to the source through wire 11. It will be obvious that the shunt circuit, under such circumstances, also will be closed, the contacts 28 and 29 normally being in engagement with each other. Under such circumstances, the electro-magnet 17 will be energized, thus attracting the armature 16 to close the circuit between the wires 15 and 13, independently of the switch 21. Thus the shunt circuit acts as a holding circuit to retain the armature 16 in attracted position after the switch 21 is opened.

It will be apparent from the foregoing that the main circuit to the device 12 will remain closed as long as the shunt circuit is closed, and thus the device 12 will continue to operate. However, the current passing through the shunt circuit gradually heats the thermally operated device, and the free end of the core 24 will thus gradually move toward the left. The arm 30 is resilient and tends to follow the movement of the free end of the core 24, and thus the contacts 28 and 29 will remain in engagement for a substantial length of time.

As soon as the arm 30 contacts with the screw 32, the movement of the arm 30 will be arrested, and further movement of the core 24 will cause the shunt circuit to be broken between the contacts 28 and 29. Thus the electro-magnet 17 will be deenergized and the armature 16 will drop, thus breaking the main and shunt circuits. Accordingly the device 12 will be deenergized and the operation thereof will cease, while the thermally operated device will gradually cool and assume its normal position. The shunt circuit will not again be energized, however, since the main circuit will be broken both at the contact 14 and switch 21. The device 12 thus will remain inoperative until the switch 21 is again depressed.

The point at which the shunt circuit will be initially broken is determined of course by the position of the screw 32. By moving the screw inwardly the time interval during which the circuits will remain closed will be reduced, while if it is desired to operate the device 12 over a longer interval of time, the screw 32 may be moved outwardly away from the arm 30.

The operation of the system shown in Figure 2 is similar to the operation of the system previously described and need not be referred to in detail. In the modified form of the system, the wire 39 is directly connected to the core 40 instead of to a separate contact 14 as employed in the system illustrated in Figure 1. Depression of the switch 45 closes a circuit between wires 47 and 48, thence through wire 39, the device 38, and back to

the source through wire 37. The shunt circuit also will be energized since the ends of this circuit are connected respectively to the wires 37 and 39, and thus the electro-magnet 41 will be energized to attract its armature 43.

The operation described takes place substantially instantaneously, and accordingly it is not necessary to hold the switch 45 in closed position. When this switch is released, the main circuit will be retained because of the energization of the electro-magnet 41 through the shunt circuit. Thus the device 38 will continue to operate until movement of the arm 57 is arrested by the screw 59. At this point in the operation of the system, further movement of the core 52 breaks the shunt circuit between the contacts 55 and 56, thus deenergizing the electro-magnet 41 and dropping the armature 43. Under such circumstances both the main and shunt circuits will be opened and will remain open until the switch 45 is again depressed.

It is to be understood that the forms of the invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims. I claim:

1. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a holding circuit for said main circuit adapted to retain the latter closed after actuation of said switch, and means operable by current passing through said holding circuit for opening said main circuit after a predetermined length of time.

2. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a holding circuit for said main circuit adapted to retain the latter closed after actuation of said switch, and thermally operated means controlled by current passing through said holding circuit for opening said main circuit after a predetermined length of time.

3. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a holding circuit for said main circuit adapted to retain the latter closed after actuation of said switch, said holding circuit including a heating coil, and a thermal element adapted to be heated by said coil and operable after a predetermined length of time for opening said main circuit.

4. In an electrical control circuit, an electrically operated device and a source of cur-

rent therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a shunt circuit including in part said main circuit and including a holding device for retaining said main circuit closed after actuation of said switch, and means operable by current passing through said shunt circuit for opening said main circuit after a predetermined length of time.

5. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a shunt circuit including in part said main circuit and including a holding device for retaining said main circuit closed after actuation of said switch, and thermally operated means controlled by current passing through said shunt circuit for opening said main circuit after a predetermined length of time.

6. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a holding circuit for said main circuit adapted to retain the latter closed after actuation of said switch, said holding circuit including a heating coil, a thermal element adapted to be heated by said coil and having one end anchored and the other end free to partake of movement under the influence of temperature changes, a switch element in said holding circuit normally contacting with the free end of said thermal element and movable therewith as the temperature of said element increases, and means for limiting the movement of said switch element to disconnect it from said thermal element.

7. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a holding circuit for said main circuit adapted to retain the latter closed after actuation of said switch, said holding circuit including a heating coil, a thermal element adapted to be heated by said coil and having one end anchored and the other end free to partake of movement under the influence of temperature changes, a switch element in said holding circuit normally contacting with the free end of said thermal element and movable therewith as the temperature of said element increases, a member arranged in the path of movement of said switch element to disconnect it from said thermal element, and means for supporting said member for adjusting the position thereof.

8. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said

source and said device, a manually controlled switch in said circuit, a shunt circuit including in part said main circuit and including a holding device for retaining said main circuit closed after actuation of said switch, said shunt circuit including a heating coil, a thermal element adapted to be heated by said coil and having one end anchored and the other end free to partake of movement under the influence of temperature changes, a switch element in said holding circuit biased toward the free end of said thermal element and normally contacting therewith, said switch element being movable with said thermal element as the temperature thereof increases, and means for limiting the movement of said switch element to disconnect it from said thermal element.

9. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a shunt circuit including in part said main circuit and including a holding device for retaining said main circuit closed after actuation of said switch, said shunt circuit including a heating coil, a thermal element adapted to be heated by said coil and having one end anchored and the other end free to partake of movement under the influence of temperature changes, a switch element in said holding circuit biased toward the free end of said thermal element and normally contacting therewith, said switch element being movable with said thermal element as the temperature thereof increases, and an adjustably supported member arranged in the path of movement of said switch element to disconnect it from said thermal element.

10. In an electrical control circuit, an electrically operated device and a source of current therefor, a main circuit including said source and said device, a manually controlled switch in said circuit, a holding circuit, an electro-magnet in said holding circuit having an armature operable upon energization of said electro-magnet for holding said main circuit closed independently of said switch, and means operable by current passing through said holding circuit for opening said main circuit a predetermined length of time after said switch is closed.

In testimony whereof I affix my signature.

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