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DEVICE FOR CONTROLLING CONSUMER CIRCUITS BY MEANS OF AT LEAST ONE MEASURING INSTRUMENT CARRYING SMALL CURRENTS

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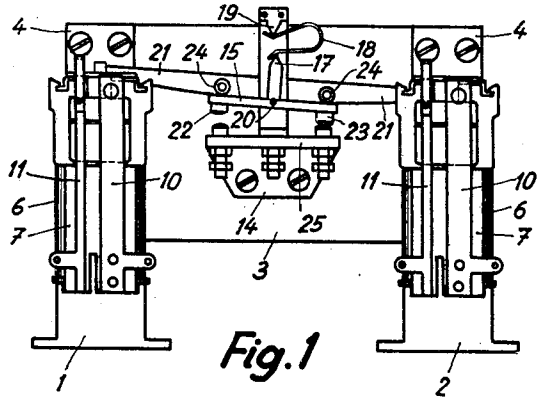


Fig. 1

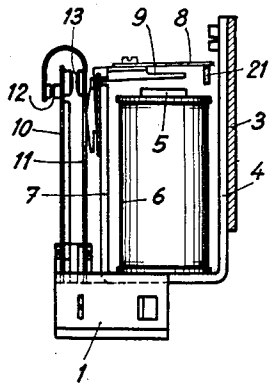


Fig. 3

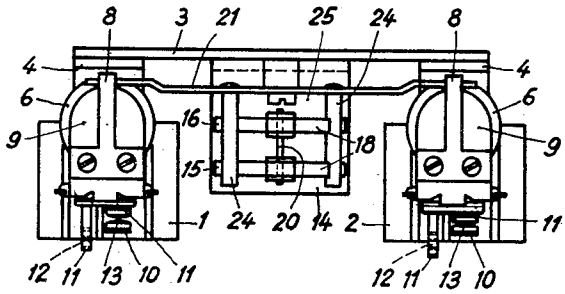


Fig. 2

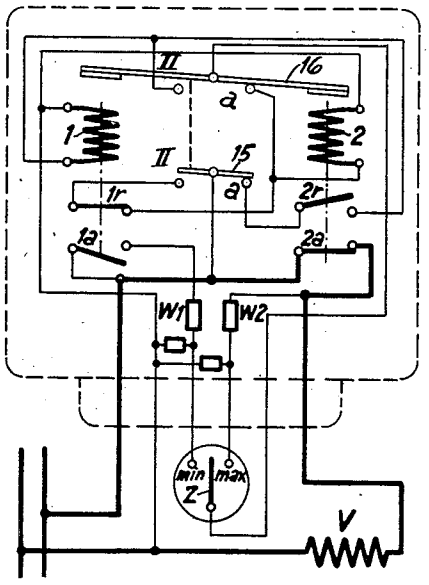


Fig. 4

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## DEVICE FOR CONTROLLING CONSUMER CIRCUITS BY MEANS OF AT LEAST ONE MEASURING INSTRUMENT CARRYING SMALL CURRENTS

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7 Claims. (Cl. 175—320)

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This invention relates to a device for controlling consumer circuits by means of at least one measuring instrument carrying small currents.

There have already been devices for controlling consumer circuits carrying great energy the sensitive part of which is an instrument, mostly a measuring instrument, the movable portion of which is mechanically speaking very weak and which, in spite of this, are used for closing and opening contacts. Therefore, the energy carried by these instruments must be very small. In spite of this, the contact surfaces are worn very rapidly, especially if the opening and closing frequency is great. For such regulating purposes, the contacts have been combined with relays in such a way that the circuit necessary for energising the latter has been closed by the contacts, while the deenergising of them has been obtained by a self-holding contact of the relays, arranged in parallel with the contacts. Even under this favorable condition, there was still a current parallel to the bridging contact, which was less dangerous on opening the contacts indeed, but in spite of this, resulted in a great wear and tear of these sensitive parts of the regulating device.

The device according to the invention is characterised in that it comprises two relays having armatures held in working position by means of remanence, these relays operating alternately groups of contacts mechanically coupled with their armatures, so that the measuring instrument carries only the current necessary for nullifying the remanence. This allows the energy carried by these instruments to be reduced to a minimum and to reverse these instruments currentless.

Other objects and features will be apparent as the following description proceeds, reference being had to the accompanying drawing illustrating by way of example one embodiment of my invention, and wherein:

Fig. 1 is an elevation of the controlling device,

Fig. 2 is a top view,

Fig. 3 a partly sectional side view, and

Fig. 4 is a wiring diagram of the device which is operated by alternating current.

Two equal relays 1 and 2 are fixed to a base plate 3 by means of their magnet yokes 4. The cores 5 are riveted to the yokes and carry the field coils 6.

A double-armed tipping armature 8 is mounted on the outer leg 7 of each of the magnet yokes 4. The horizontal leg of the armatures 8 carries

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an iron piece 9, while the other leg leans against contact springs 10 and 11 holding the armature in the normal or rest position shown in Fig. 3. In this position the back or rest contact 12 is closed and the operating contact 13 opened. Both contacts belong to the relay. The conditions as regards the spring pressure and the magnetic properties of the iron piece 9 are such that the armature, when attracted, remains in this position (working position) owing to remanence, and holds the working contact 13 closed and the back contact 12 opened, until a demagnetising current traverses the coil and nullifies the remanence.

Between the relays 1 and 2 two equal rockers 15 and 16 are mounted on a bracket 14 of insulating material by means of a shaft 20. Each rocker carries a knife edge 17 against which the one end of a leaf spring 18 bears, while the other end of this spring leans against the knife edge 19 fixed to the bracket 14. The position of the shaft 20 with regard to the knife edges 17 and 19 is chosen so that a dead center position of the rockers cannot occur. Therefore, the rockers are either inclined to the right or to the left.

The rockers 15 and 16 are mechanically coupled together by means of two bars 24 fixed to an arm 21. Therefore, they can only move together and their position is determined by the armature 8 because the arm 21 extends at both ends below the armatures.

Each rocker carries two contacts of two pairs of contacts 22, 23, the two other contacts of the pairs being screwed to the plate 25 of the bracket 14. Therefore, movement of the rockers causes alternate closing of two contacts pairs lying behind each other. The manner of action of the illustrated controller will now be described with reference to the diagram of Fig. 4:

Let us assume that the installation is currentless and the rockers 15, 16 in the position II shown in full lines. The two rocker contacts 15*a* and 16*a* and the working contact 2*a* belonging to the relay 2 are closed. The armature of the relay 2 is attracted and held by remanence. Consequently, also the contact 1*r* is closed and the contacts 1*a* and 2*r* are open. When the installation is fed, the thermostat heater V is traversed by current through the circuit closed by contact 2*a* first. When the maximum temperature of the thermostat controlled by the measuring instrument is reached, the contact stud Z closes an electric circuit through 2*a*, $W_2$, Z max., 16*a*, relay 2 and the remanence of the relay 2 is nullified. Thus the measuring instrument controls

the temperature of the medium heated to maintain the temperature within prescribed limits. The resistances $W_1$ and $W_2$ constitute, together with the unnumbered resistances which are connected to them in series, voltage dividers which reduce the line voltage to such an extent that it is just sufficient for cancelling the remanence. Compared with the series resistors, this has the advantage that the switching capacity of the contacts of the instruments is reduced in accordance with the proportion of the voltage divider. The armature is released and the contacts 2*r* and 2*a* reversed. 2*a* breaks the load circuit and 2*r* closes the energizing circuit of the relay 1 through 15*a*. The relay 1 is energised and reverses the rockers 15, 16, so that the feed current of the relay 1 is interrupted at the same time and the demagnetizing circuit of the relay 1 prepared through the contact 1*a* closed by the attraction of the relay 1. Owing to remanence, the armature of the relay 1 remains in attracted position so that on the temperature having brought the stud Z to the minimum contact, the relay releases the armature, whereby the contacts 1*a* and 1*r* are reversed, and the feed circuit of the relay 2 is closed, which causes reversing of the rockers 15, 16 and their return to the position shown in full lines again. Now, the demagnetising circuit of the relay 2 is prepared again, so that on the maximum temperature being reached, the armature of this relay takes the normal position again and the cycle may begin anew.

From the above it may be understood that the contacts of the measuring instrument carry only the very small current necessary for nullifying the remanence, while opening the contacts always takes place currentless. Conditions may easily be obtained, at which the current necessary for nullifying the remanence is small enough to allow an absolutely safe working of supersensitive contacts. Therefore, the illustrated controller provides for the possibility of using measuring instruments for regulating purposes, the contacts of which carry a very small energy, without necessitating very expensive amplifying means.

While I have shown and described one embodiment of my invention, I wish it to be understood that I do not wish to unnecessarily limit the scope of my invention, but reserve the right to make such modifications and rearrangements of the several parts as may come within the purview of the accompanying claims.

What I claim is:

1. In a device for controlling the flow of current in an electrical load, an electrical circuit, a control switch, a pair of relays each comprising a core, a winding, an armature and contacts movable by said armature, contacts of at least one of said relays being connected to control the flow of current in said electrical circuit, a pair of tumbler switches having each two fixed contacts and being both operably connected with said relay armatures so as to be both movable from one operative position to another by energizing either of said relays while the other is deenergized, means including contacts of said relays connected to said fixed contacts of one of said tumbler switches for momentarily supplying energizing current alternatively to said relays, said last mentioned tumbler switch being moved by the armature of the energized relay to interrupt the energizing current and to prepare a circuit for energizing the other relay, the armature of the momentarily energized relay being thereafter held in energized position by residual magnetism, and means including a low voltage supply, contacts of said relays, the other of said tumbler switches and said control switch for supplying current to deenergize the previously energized relay and thereby release the armature of said last mentioned relay.



2. In a device for controlling the flow of current in an electrical load, an electrical circuit, a controlling switch, a pair of relays having armatures held in working position by residual magnetism, said electrical circuit comprising one contact of one of said relays, a pair of tumbler switches having each two fixed contacts, a voltage reducing network interconnected with said electrical circuit and said controlling switch, said voltage reducing network, said controlling switch, one of said tumbler switches and each of said relay windings being connected each to one of said fixed contacts and forming a pair of demagnetizing circuits for alternately demagnetizing one of said relays, a second of said tumbler switches, one contact of each of said relays connected to the fixed contacts of said second tumbler switch and each one of said relay windings forming a pair of energizing circuits for energizing each of said relays after release of the other.

3. In a device for controlling the flow of current in an electrical load, an electrical circuit, a controlling switch, a pair of relays each provided with a winding, an armature held in working position by means of residual magnetism, a back contact and an operating contact, said electrical circuit comprising one of said operating contacts, a pair of tumbler switches in operable connection with said armatures having each two fixed contacts, a pair of voltage reducing networks interconnected with said electrical circuit by being connected each with one of said operating contacts respectively, the operating contact of one relay, the said voltage reducing network connected to it, said controlling switch, a first of said tumbler switches and the relay winding of that same relay forming a circuit carrying a small demagnetizing current, a second of said tumbler switches, the back contact of one of said relays and the relay winding of the other of said relays forming an energizing circuit, energizing one of said relays after release of the said relays.

4. In a device for controlling the flow of current in an electrical load, an electrical circuit, a controlling switch, a pair of relays electrically connected to the contacts of said controlling switch, each of said relays being provided with a winding, an armature held in working position by means of residual magnetism, a back contact and an operating contact, a pair of tumbler switches in operable connection with said armatures each having two fixed contacts and two movable contacts, the first of said tumbler switches interconnecting alternately one of said relay windings and the controlling switch, the second of said tumbler switches interconnecting alternately one of said back contacts and the said electrical circuit, a pair of voltage dividers each being interconnected with the said electrical circuit by being connected with the operating contact of one of said relays and each having a tap alternately interconnectable with the said first tumbler switch by the said controlling switch, the winding of one relay being interconnected with the said electrical circuit by the back contact of the other relay and the second tumbler switch, whereby an energizing circuit is formed for each relay when the other relay releases, and a demagnetizing circuit for a relay is formed by the operating contact of the same relay, said voltage divider, said

controlling switch and the first of said tumbler switches, said electrical circuit comprising one of said operating contacts.

5. In a device for controlling the flow of current in an electrical load, an electric circuit, a controlling switch having two fixed contacts and a controllable contact member, a pair of relays electrically connected to the contacts of said controlling switch, each of said relays being provided with a winding and an armature held in working position by means of residual magnetism, and with a back contact and an operating contact, a pair of tumbler switches each comprising a pair of fixed contacts and a rocker in operable connection with said armatures and having a contact at each end engageable respectively with said fixed contacts, each fixed contact of the first of said tumbler switches being connected to one of the said relay windings and the rocker of said first tumbler switch being connected to said controllable contact member, and the fixed contacts of the second of said tumbler switches being connected each to one of said back contacts, the rocker of said second tumbler switch being connected to said electrical circuit, a pair of voltage dividers connected to one of said operating contacts and each formed by two resistances with a tap between said resistances, the said fixed contacts of said controlling switch being connected respectively to said taps, said back contacts of one relay being connected to the said relay winding of the other relay, an energizing circuit being formed by each back contact of one of said relays and the second tumbler switch for the other relay, and a demagnetizing circuit for each relay being formed by the operating contact of that same relay, the said voltage divider which is connected to it, the said controlling switch and the first of said tumbler switches, one of the said operating contacts being connected into the said electrical circuit for controlling it.

6. In a device for controlling the flow of current in an electrical load, an electrical circuit, a pair of relays having each a winding, an armature held in working position by residual magnetism, a back contact and an operating contact controlled by said armature, a pair of alternating switches having each two fixed contacts and a contact member operably connected to said armatures, a controlling switch, a low voltage supply, an energizing circuit for each relay comprising the back contact of one of said relays, one of said alternating switches and the winding of the other relay connected in series, and a deenergizing circuit for each relay comprising the operating contact of one of said relays, said low voltage supply, said controlling switch, the other of said alternating switches and the winding of that same relay connected in series, one of said operating contacts controlling said electrical circuit.

7. In a device for controlling the flow of current in an electrical load, an electrical circuit, a pair of relays having each a winding, an armature held in working position by residual magnetism, a back contact and an operating contact, said back contact and said operating contact being controlled by said armature, a pair of alternating switches having each two fixed contacts and a contact member operably connected with said armatures so as to be in one operative position or another according to whether the one or the other of said relays is energized, a controlling switch having two fixed contacts and a controllable contact member, a pair of voltage dividers each having a tap respectively connected with one of said fixed contacts of said controlling switch, an energizing circuit for each relay comprising the back contact of one of said relays, one of said alternating switches and the winding of the other relay connected in series, and a deenergizing circuit for each relay comprising the operating contact of one of said relays, one of said voltage dividers, said controlling switch, the other of said alternating switches and the winding of that same relay connected in series, one of said operating contacts being connected into the said electrical circuit for controlling it.



THEOPHIL BUSER.


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