Feb. 14, 1933. L. K. MARSHALL 1,897,316

THERMOSTATIC SWITCH

Original Filed March 26, 1923 2 Sheets-Sheet 1

Fig. 1

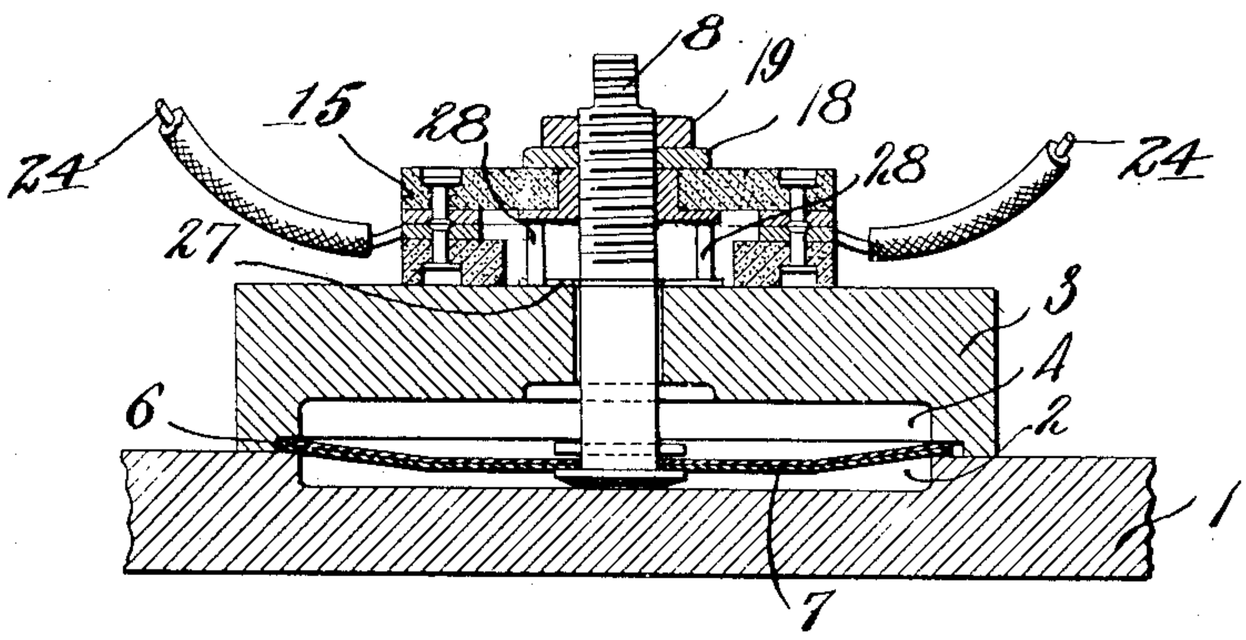

Fig. 2

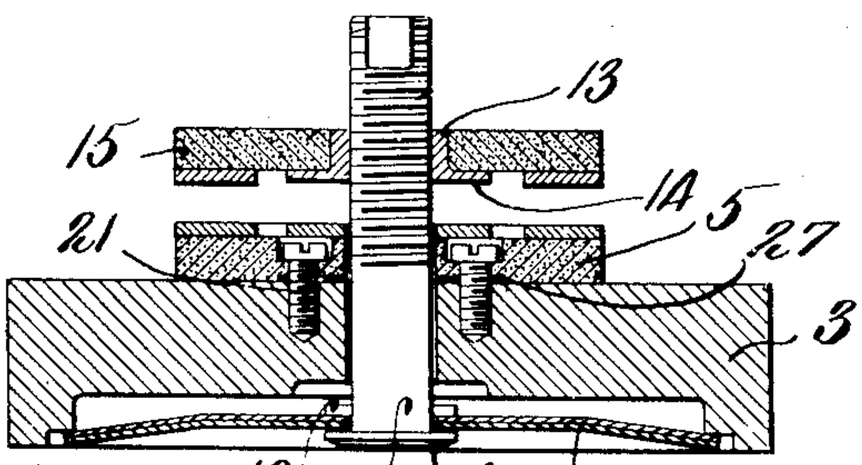

Fig. 3

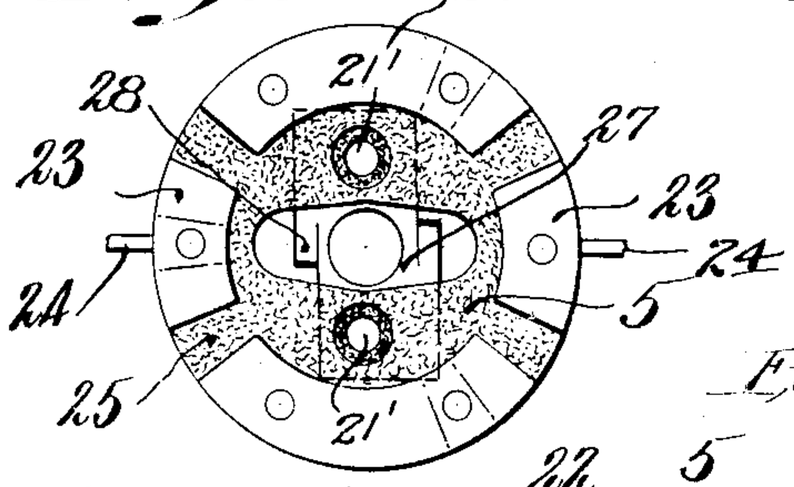

Fig. 4

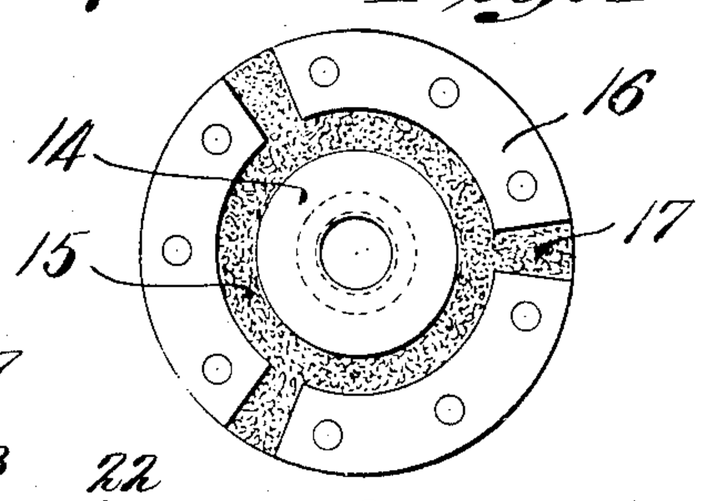

Fig. 7

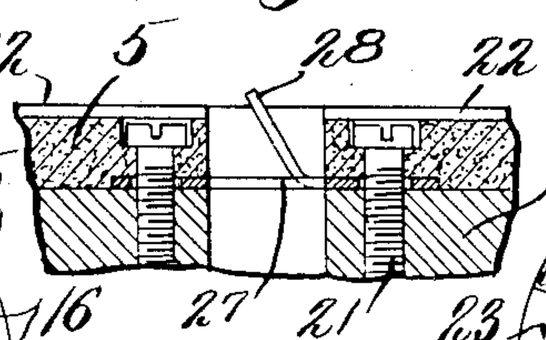

Fig. 5

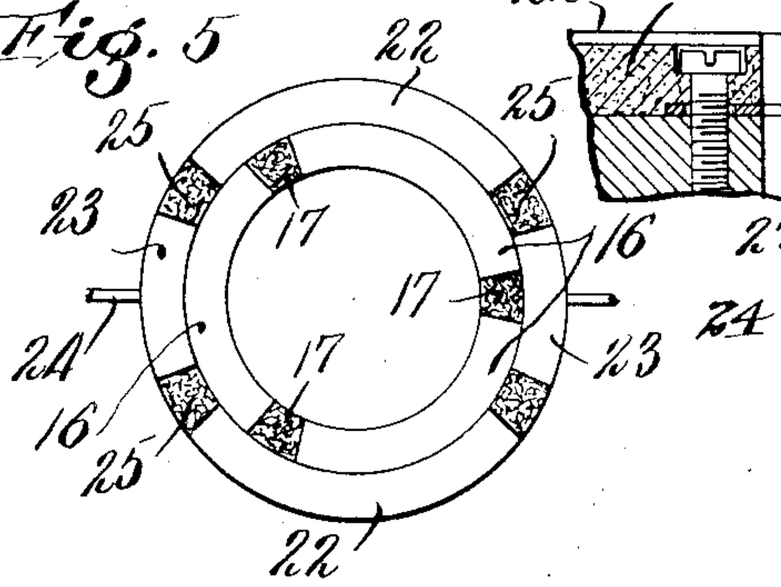

Fig. 6

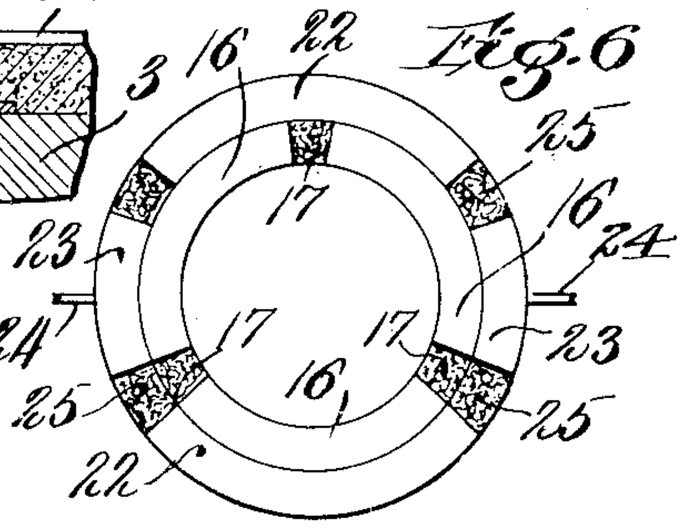

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Fig. 8

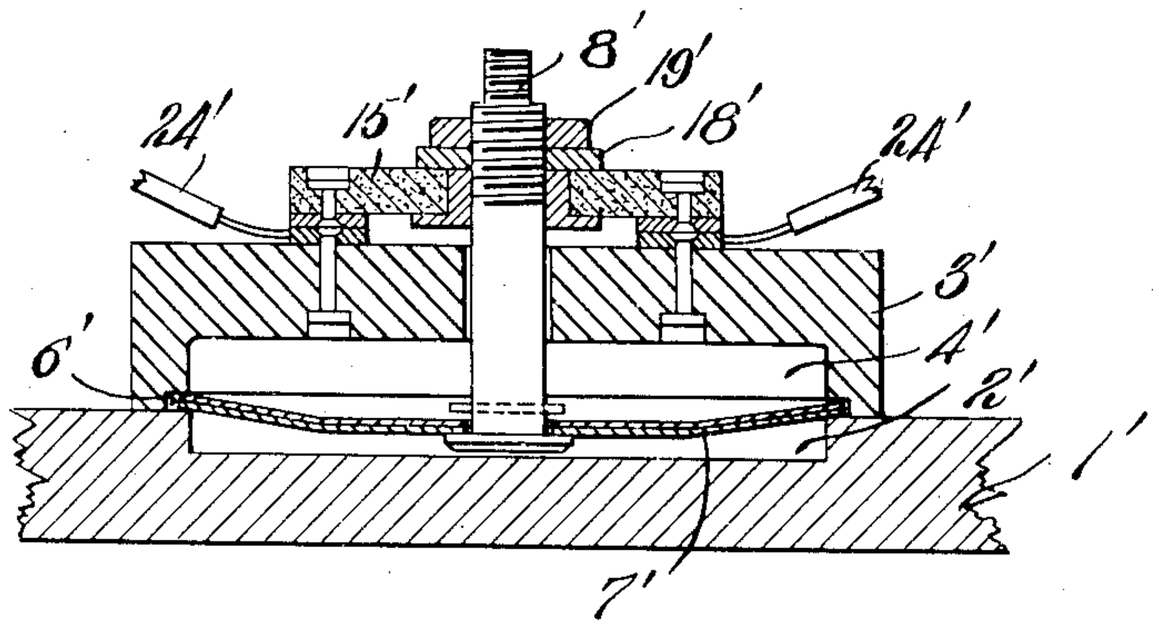


Fig. 9.

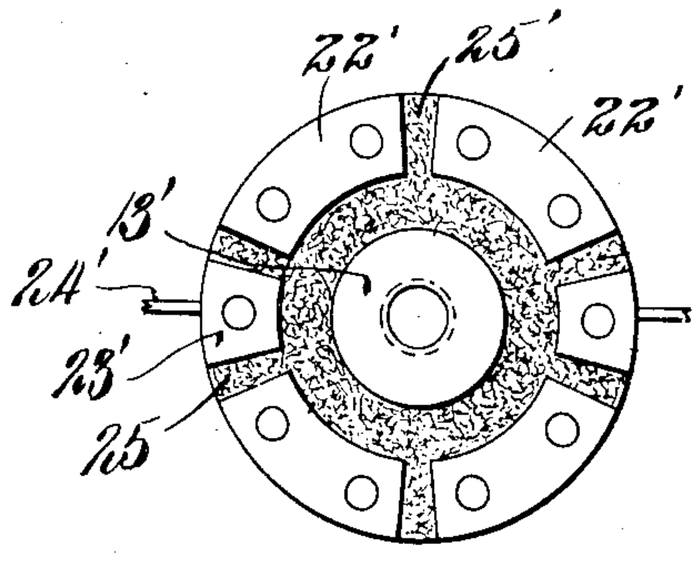


Fig. 10.

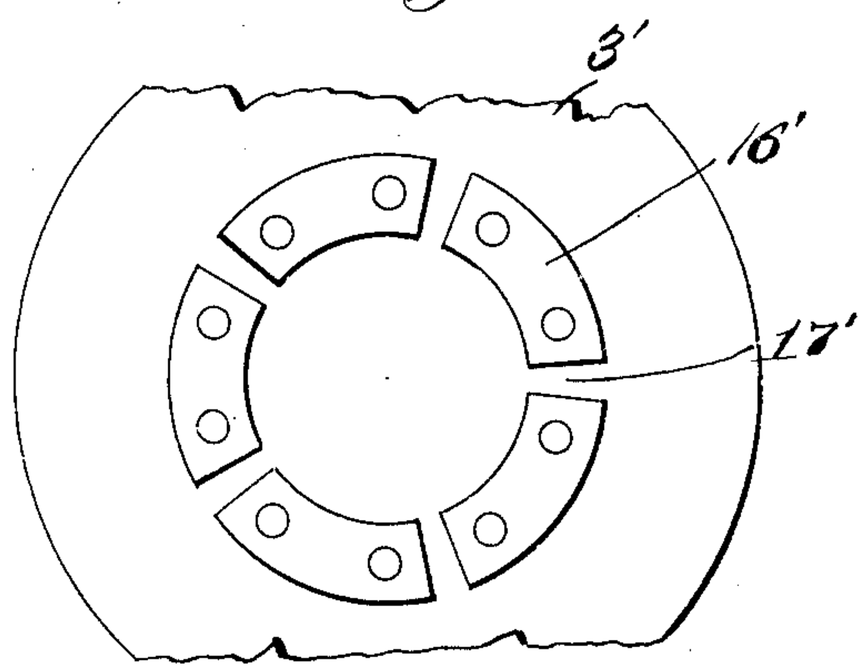


Fig. 11.

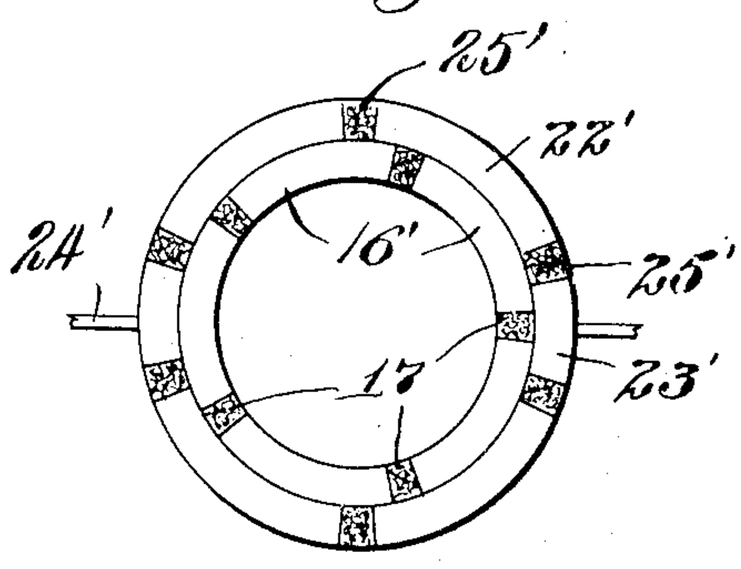
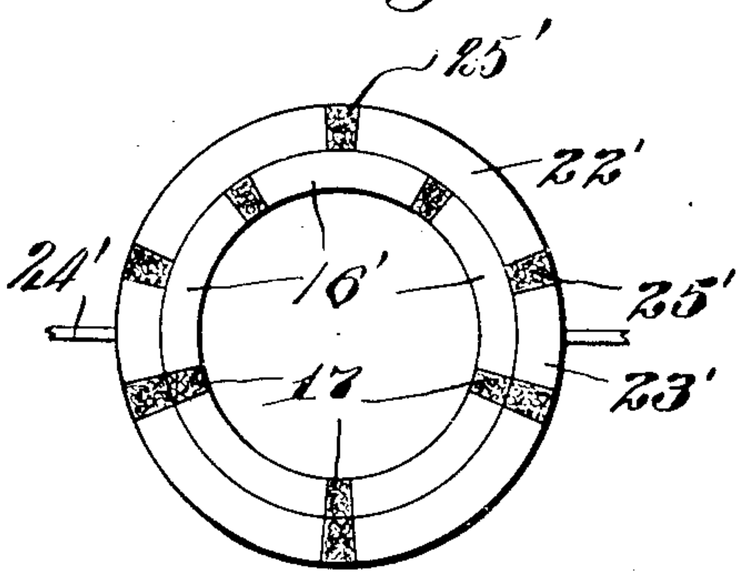


Fig. 12.



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Patented Feb. 14, 1933 1,897,316

UNITED STATES PATENT OFFICE

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THERMOSTATIC SWITCH

Application filed March 26, 1923, Serial No. 627,855. Renewed June 27, 1932.

This invention relates to switches, and with regard to certain more specific features, to thermally actuated switches.

Among the several objects of the present invention are the provision of an electrical switch which will interrupt a substantial current with little or no sparking, which will maintain its contact surfaces clear and bright, which is simple in construction and reliable in operation, and more particularly, the provision of a thermostatic switch which is sufficiently compact to be incorporated within an electric flat-iron or other device where the space is restricted, and which is efficient and durable under temperatures such as produced in flat-irons and the like.

In one aspect the invention consists in simultaneously breaking a circuit at a sufficient number of points in series to keep the potential across each break substantially within the critical arcing range for the material constituting the contacts. Silver has a critical arcing voltage of approximately eighteen volts, that is, up to approximately eighteen volts. A silver-contact switch will break a current without sustaining arcing irrespective of the magnitude of the current, provided the voltage is below the critical arcing voltage. Likewise other materials have critical arcing voltages and by correlating the contact material with the number of breaks in series a current of any voltage and any amperage can be interrupted without undue arcing. Other aspects of the invention will be evident from the following description and the appended claims.

For the purpose of illustration, two embodiments of the invention are shown in the accompanying drawings in which:—

Fig. 1 is an axial section showing the switch in closed position;

Fig. 2 is a similar section, taken at right-angles to that of Fig. 1 with parts omitted, showing the switch in open position;

Figs. 3 and 4 are face views of the lower and upper switch elements respectively;

Figs. 5 and 6 are diagrams showing different angular relationships of the switch elements;

Fig. 7 is an enlarged detail section of certain portions of Fig. 2;

Fig. 8 is a section through a slightly different embodiment of the invention;

Figs. 9 and 10 are face views of the upper and lower switch elements respectively of this second embodiment of the invention; and

Figs. 11 and 12 are diagrams showing different angular relationships of the switch elements of Figs. 9 and 10.

The particular embodiment of the invention chosen for the purpose of illustration comprises, in general, a base 3, a thermostatic member or disk 7 such as disclosed in Patent No. 1,448,240, granted March 13, 1923, and upper and lower switch elements mounted on the disk and base respectively so as to contact with each other when the disk is cupped downwardly (Fig. 1) and to be separated when the disk is cupped upwardly (Fig. 2). A portion of the bottom of a flat-iron is represented at 1 with a recess 2 to accommodate the disk 7 when cupped downwardly. It is to be understood that the thermostatic member or disk 7 may be any form of composite sheet comprising two or more layers of metal or the like of different thermal coefficients of expansion united together, so that a change of temperature causes stresses tending to cause change of shape of the sheet.

The lower switch element (Fig. 3) comprises a disk 5 of insulation material carrying on its upper margin an annular row of contacts 22 and 23 separated by gaps 25, the contacts 23 having connections 24 to the circuit to be controlled by the switch. The disk 5 is fastened to the base 3 by screws 21.

The upper switch element (Fig. 4) comprises an insulation disk 15 having an axial collar 13 provided with an under flange 14 and carrying on its lower margin an annular row of contacts 16 separated by gaps 17. This element is connected to the thermostatic disk 7 by an axial post 8 which is threaded into the collar 13 and locked by a nut 19 bearing on a washer 18. The post 8 may be rotatably connected to the disk 7 by providing a head 9 on the lower end of the post and

a pin 10 extending through the post above the disk.

To equalize wear on the contacts and to keep the contacts clean and bright, the upper element may be positively rotated a slight amount at each operation of the switch by providing between base 3 and disk 5 a plate 27 with upturned lips 28 extending through the central opening in disk 5 obliquely into engagement with flange 14 on collar 13, the lips being flexible and rotating the upper element as they are flexed downwardly at the end of the downward movement of the upper element. As shown in Fig. 3 the plate 27 has openings 21′ to receive the screws 21.

As disclosed in the aforesaid patent the thermostatic disk abruptly snaps from the upwardly cupped position shown in Fig. 2 to the downwardly cupped position shown in Fig. 1 when the temperature increases to a predetermined value and when the temperature has decreased to a predetermined value it abruptly snaps back, the resiliency of the thermostatic disk holding the upper element firmly against the lower element.

The contacts on the switch elements are relatively distributed so that in any angular position of the rotatable element the circuit between the leads 24 is closed when the two elements are engaged as shown in Fig. 1 and so that when the elements are disengaged the circuit is simultaneously broken at a plurality of points in series. With the contacts 22, 23 and 16 distributed as shown in the drawings the circuit is closed in one way in certain angular positions of the rotatable element (Fig. 5) and in another way in other angular positions of the rotatable element (Fig. 6). In the manner illustrated in Fig. 5 two paths are provided, half the current flowing through the upper semi-circle of contacts and the other half flowing through the lower semi-circle. In this way each branch is interrupted at four points when the switch opens viz., at 23—16, 16—22, 22—16 and 16—23. In the manner illustrated in Fig. 6 only one of the aforesaid paths (the upper semi-circle of contacts) is closed when the elements are engaged, but when the elements disengage this path is simultaneously opened at four points in series as before.

By interconnecting the movable switch element and the thermostatic disk through the intermediate base or support 3, the combined switch and thermostat may be installed and removed as a unit; and by arranging the annular rows of contacts concentric with the disk the contacts may shift angularly with relation to each other without affecting the operative relationship between the thermostatic disk and the movable element or between the thermostatic disk and its peripheral abutment (the base 3). The disk 7 may rotate on the abutment 3 to permit the rotation of the movable switch element, and/or on the swivel connection with post 8 formed by head 9 and pin 10. It is clear that the upper switch element would tend to shift without the spring lips 28 but these lips make the angular movement uniform and positive.

The modification illustrated in Figs. 8 to 12 is similar to that shown in Figs. 1 to 7, and corresponding parts are correspondingly designated. In this modification the base 3′ is made of insulation material and the lower contacting elements are mounted directly thereon instead of on the intermediate disk 5 as in Figs. 1 to 7; the mechanism 27—28 for angularly shifting the upper switch element is omitted; the upper switch element has four contacts 22′ instead of the two contacts 22 in Figs. 1 to 7; and the lower switch element has five contacts 16′ instead of the three contacts 16. With the increased number of contacts each of two parallel paths are simultaneously broken at six points in series (23′—16′, 16′—22′, 22′—16′, 16′—22′, 22′—16′, and 16′—23′) in certain relative angular positions of the upper switch element (Fig. 11) and in other angular positions a single path is simultaneously broken at six points in series (Fig. 12). By making the contacts 16′, 22′ and 23′ of silver, whose critical arcing voltage is approximately 18 volts, the voltage across each break is approximately the critical voltage when employed in a 110 volt circuit. For other line potentials the contacts may be made of different materials or varied in number to keep the voltage across each break substantially within the critical voltage.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. An electrical switch comprising two superposed disks of insulating material, one of the disks being rotatable relatively to the other disk, interengaging rows of contacts mounted concentrically upon the opposed faces of said disks, two of the contacts constituting circuit termini and the contacts of the respective rows being spaced to close circuit between said termini at a plurality of points in series in each angular position of the rotatable disk.

2. An electrical switch comprising two members carrying interengageable sets of contacts, two of the contacts constituting circuit termini and the contacts of the respective

sets being dissimilarly spaced in annular rows so that the interengaging contacts of the respective sets close circuit between said two contacts at a plurality of points.

3. An electrical switch comprising two superposed disks of insulating material, one of the disks being rotatable relatively to the other disk, interengaging rows of contacts mounted concentrically upon the opposed faces of said disks, two of the contacts constituting circuit termini and the contacts of the respective rows being spaced to close circuit between said termini at a plurality of points in series in each angular position of the rotatable disk, and means for disengaging said rows in any angular position of said rotatable disk.

4. A thermostatic switch comprising two superposed annular rows of contacts, one row being fast on a support rotatable about the axis of the row, two of the contacts constituting circuit termini, the contacts of the respective rows being distributed to close circuit between said termini at a plurality of points in series in each angular position of said rotatable row, and a thermostatic element for moving one of said rows out of engagement with the other row, the parts being correlated to permit rotation of the rotatable row without affecting the operative relation between said element and the movable row.

5. A thermostatic switch comprising a support, two superposed members, one of which is a disk movable both axially and circumferentially relatively to the other, interengaging rows of contacts mounted concentrically upon the opposed faces of said members, two of the contacts constituting circuit termini and the contacts of the respective row being distributed to close circuit between said termini at a plurality of points in series in each circumferential position of said movable disk, and a thermostatic disk kinematically interposed between said movable disk and said support to move the latter axially in any of its circumferential positions.

6. An electrical switch comprising two superposed disks of insulating material, one of the disks being rotatable relatively to the other disk, interengaging rows of contacts mounted concentrically upon the opposed faces of said disks, two of the contacts constituting circuit termini and the contacts of the respective rows being spaced to close circuit between said termini at a plurality of points in series in each angular position of the rotatable disk, and means for disengaging said rows in any angular position of said rotatable disk, the number of points being sufficient to reduce the potential at each point to that of the critical arcing voltage of the contacts.

7. A thermostatically controlled system comprising a thermostatic member having two positions of stable equilibrium with an intermediate position of unstable equilibrium, means remote from said member adapted to be operated directly by linear motions, and means effecting a linear motion of said means operable by said member.

8. A thermostatically controlled switch comprising a thermostatic member adapted to change its position abruptly after preliminary distortions due to temperature variations, electrical switching means comprising sets of cooperating contacts so connected that the voltage broken at any one set of contacts is below the arcing voltage of the contact material, and substantially inelastic means for transmitting the impulse from said member upon any movement thereof to said switching means for operating the same.

9. An electric switch comprising two relatively movable members, each member carrying a plurality of spaced contacts, the contacts of one member cooperating with the contacts of the other member to form circuit making and breaking means, the contacts on each member being so arranged that whatever the relative position of said member, there will always be a conductive path through certain of said cooperating contacts, when said members are in contact with each other.

10. An electric switch comprising two relatively rotatable members, each carrying a plurality of spaced contacts, the members also being relatively movable to each other so that said members may be in contact or out of contact, the contacts of one member cooperating with the contacts of the other member to form switching means, said contacts being so arranged that whatever the relative position of said member, there will always be a conductive path through certain of said cooperating contacts, when said members are in contact with each other.

11. An electric switch comprising two members, each member carrying spaced contact segments, the segments of one member cooperating with the segments of the other member to form a number of circuit making and breaking means, all the segments on only one member being equal in extent whereby said number of making and breaking means is always equal.

12. A thermostatically controlled switch comprising a thermostatic member having two positions of stable equilibrium with an intermediate position of unstable equilibrium, electric switching means comprising two members, each carrying a plurality of circularly spaced contacts, one of said members being fixed, means for operatively connecting said thermostatic member with the other of said contact carrying members, said connecting means allowing relative motion between itself and said other contact carrying member.

13. A thermostatically controlled system comprising a thermostatic member, means remote from said member, and means for transmitting two different motions to said remote means as a result of the change in said thermostatic member when exposed to temperature variations.

14. A thermostatically controlled system comprising a thermostatic member, means remote from said member, means connecting said remote means and a system for transmitting an impulse from said member to said remote means, and means actuated by said member for transmitting an additional impulse to said remote means.

15. A thermostatically controlled system comprising a thermostatic member, means remote from said member, means for transmitting an impulse from said member to said remote means, and separate means actuated by said member for causing relative motion between said remote means and said member.

16. A thermostatically controlled system comprising a thermostatic element, an electric switch, means operatively connecting said element and said switch, said switch comprising two members, each member carrying spaced contact segments, the segments of one member cooperating with the segments of the other member to form a number of circuit making and breaking means, all the segments on only one member being equal in extent whereby said number of making and breaking means is always equal.

17. A thermostatically controlled system comprising a thermostatic member, electrical switching means comprising at least three cooperating electrical contacts adapted to effect a series connection, said member having two positions of stable equilibrium with an intermediate position of unstable equilibrium, and means operatively connecting said member and said switching means adapted to effect linear motion of at least one of said contacts upon change of position of said member, thereby to make and break said series connection.

18. A thermostatically controlled system comprising a thermostatic element, an electric switch, means operatively connecting said element and said switch, said switch comprising two relatively movable members, each member carrying a plurality of spaced contacts, the contacts of one member cooperating with the contacts of the other member to form circuit making and breaking means, the contacts on each member being so arranged that whatever the relative position of said member, there will always be a conductive path through certain of said cooperating contacts, when said members are in contact with each other.

Signed by me at Cambridge, Massachusetts, this 23rd day of March, 1923.

LAURENCE K. MARSHALL.