

March 24, 1925.

1,530,730

H. L. LEEB

ELECTRIC SWITCH

Filed Sept. 17, 1921

Fig. 1.

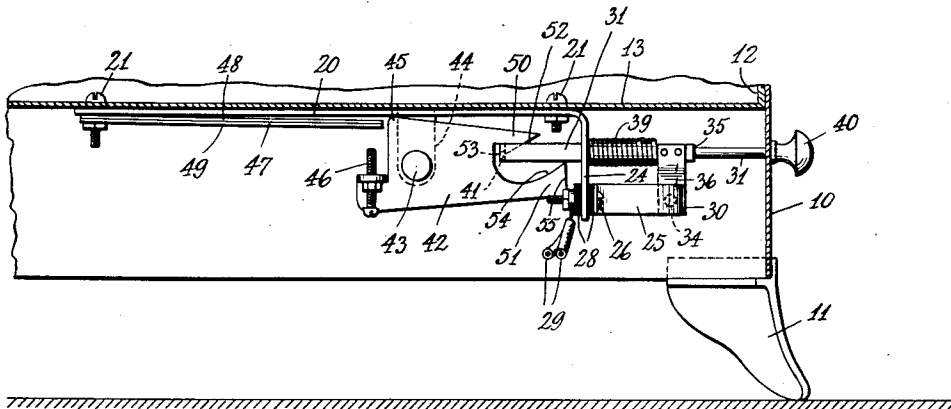


Fig. 2.

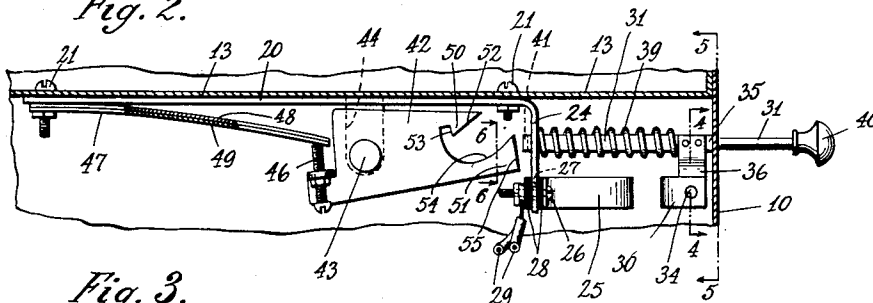


Fig. 3.

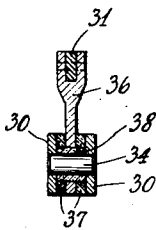
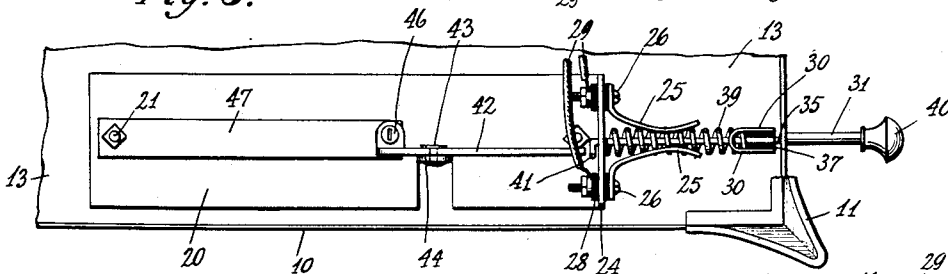


Fig. 4.

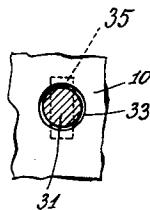
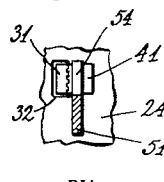


Fig. 5.

Fig. 6.



BY

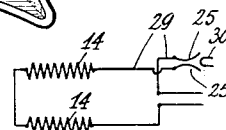


Fig. 7.

INVENTOR.

Henry L. Leeb

Robert W. Byrly
his ATTORNEY.

Patented Mar. 24, 1925.

1,530,730

UNITED STATES PATENT OFFICE.

HENRY L. LEEB, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO THE PROMETHEUS ELECTRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRIC SWITCH.

Application filed September 17, 1921. Serial No. 501,295.

To all whom it may concern:

Be it known that I, HENRY L. LEEB, a citizen of the United States, residing at South Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electric Switches, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to electric switches, and particularly to safety switches for electric heating devices.

An object of the invention is to provide a thermostatically operated cut-out switch in the heating circuit of an electric heating device to prevent overheating of the device or any particular part thereof.

A further object of the invention is to permit reclosing the circuit, after it has been thermostatically opened, without the replacing of any part of the apparatus.

A still further object of the invention is to prevent closing the circuit while the temperature exceeds the safety limit, thus eliminating arcing at the switch contacts.

In carrying out the invention I provide an electric heating device with a switch having fixed and movable contact members connected to control the heating current, a spring tending to separate the contact members, and thermostatic means adapted to retain the contact members in engagement when the temperature of a specified part of the device is below a predetermined safety limit and automatically to release the movable contact member when the temperature exceeds this limit.

In order to permit re-closing of the circuit without replacing any part of the apparatus, I provide a latch to retain the contact members in engagement and a thermostatic strip composed of layers of metals of different coefficients of expansion to trip the latch. One end of the strip is secured with its high expansion layer inward against a part of the device affected by the heat of the electric heating elements while the other end of the strip is free to swing outwardly as the temperature rises and is positioned to trip the latch when the temperature exceeds a predetermined limit.

The invention in its most complete form includes also a thermostatically operated stop which prevents moving the contact

members into engagement while the temperature is above a predetermined maximum. This feature has proved of great practical value since it eliminates injury to the contact members by arcing caused by attempts to close the switch before the temperature of the device has fallen below the safety limit so that the latch will retain the contact members in engagement.

In order that the invention may clearly be understood I will describe in detail the specific embodiment of it shown in the accompanying drawings which illustrate the application of the safety switch to an electrically heated sterilizer. In the drawings:—

Fig. 1 is a side elevation of the switch in closed position showing a portion of the sterilizer in section;

Fig. 2 is a view similar to Fig. 1 showing the switch in open position;

Fig. 3 is a bottom view of the switch and a portion of the sterilizer showing the switch in open position as in Fig. 2;

Fig. 4 is a transverse section of the movable contact member and its support taken on the line 4—4 of Fig. 2;

Fig. 5 is a transverse section on the line 5—5 of Fig. 2 showing the actuator rod and a portion of the sterilizer casing;

Fig. 6 is a transverse section on the line 6—6 of Fig. 2 showing the actuator rod and parts of the controlling member and the supporting plate; and

Fig. 7 is a diagram of the electric connections.

The sterilizer to which the switch is applied has an outer casing 10 supported upon feet 11. In the upper part of the casing is a tank 12 for the water to be heated. Below the bottom 13 of the tank 12 and within the lower portion of the casing 10 are located electrical heating elements 14 (Fig. 7) for heating the tank. The safety switch is secured to the bottom of the tank at any convenient point either at one side of, or between, the heating elements.

The framework of the safety switch consists of a supporting plate 20 which is secured to the outside of the bottom 13 of the tank 12 by bolts 21. One end portion 24 of the supporting plate 20 is bent outwardly from the bottom 13. Fixed contact members 25 are mounted on the portion 24 of the plate near its lower end by means of

bolts 26 which are insulated from the supporting plate by sleeves 27 and washers 28 of insulating material. The fixed contact members 25 are connected in circuit with the heating elements 14 by means of wires 29. A movable contact member 30 is mounted upon the actuator 31 which, in the form shown, comprises a rod or plunger slidably mounted in a hole 32 in the portion 24 of the plate 20, and a hole 33 in the sterilizer casing 10.

The right hand portion of the actuator 31 is round as is the hole 33, while the left hand portion of the actuator is flat and the hole 32 is elongated. The end of the flattened portion provides a shoulder 35 which limits the outward movement of the actuator by engagement with the casing 10. The movable contact member 30 is U-shaped and is secured by means of a rivet 34 to a short bar 36 depending from the actuator. The contact member 30 is insulated from the bar 36 by washers 37 and a sleeve 38 of insulating material. The actuator 31 is normally thrust outwardly, bringing the movable contact member 30 out of engagement with the fixed contact members 25, by a compression spring 39 which reacts between the portion 24 of the supporting plate and the bar 36.

The outer end of the actuator may be provided with a push button 40 while its inner end is bent at right angles to form a catch 41.

A thermostatically operated controlling member 42 is provided to control the movements of the actuator 31. In the form illustrated the member 42 is a flat lever fulcrumed upon a rivet 43 secured to a downwardly bent portion 44 of the supporting plate 20. The flat lever 42 is in line with the catch 41 of the actuator while just out of line with the body of the actuator.

The outer end of the lever 42 is the heavier so that the lever normally occupies the position illustrated in Fig. 1, in which it is retained by contact with the supporting plate 20 at 45. At the inner end of the lever 42 is an adjustable contact screw 46, through which the lever is actuated by a thermostatic strip 47 secured near one of its ends to the lower side of the supporting plate 20 by means of one of the bolts 21.

The thermostatic strip 47 is composed of a layer 48 of metal of a relatively high coefficient of expansion, such as brass, and a layer 49 of metal of a relatively low coefficient of expansion, such as steel, the two layers having their adjacent surfaces welded or otherwise secured together. The strip is attached with the layer 48 of high-coefficient metal against the supporting plate 20. As the supporting plate 20 is made of metal or other heat conducting material, as is also the bottom 13 of the tank 12, the strip 47 is always at substantially the same tempera-

ture as the water in the tank 12. The strip 47 remains straight and lies flat against the supporting plate as shown in Fig. 1 when the water in the tank is at low temperature. As the temperature rises the strip bends outwardly from the supporting plate owing to the difference in expansion of the metals of which it consists. The screw 46 may be adjusted so that the thermostatic strip 47 tips the lever to raised or "hot" position shown in Fig. 2, when any desired predetermined temperature is reached. When the device is used in connection with an electric sterilizer as illustrated, the strip is secured to the tank, either at the bottom of the tank as illustrated, or elsewhere below the normal level of the liquid in the tank, and the screw is adjusted so that the strip will bring the lever to the position shown in Fig. 2, when the temperature of the strip rises above the boiling point of the water or other liquid in the tank 12.

The outer end of the lever 42 is formed to provide a latch 50 to retain the actuator 31 in closed circuit position while the temperature is below the safety limit and a stop 51 spaced outwardly from the latch 50 to prevent inward movement of the actuator while the temperature exceeds the safety limit. The latch 50 has an outwardly inclined cam surface 52 and a transverse retaining surface 53. The stop 51 has an inwardly inclined cam surface 54, and a transverse abutment surface 55.

The operation of the switch described is as follows: When the heating device is cool the strip 47 is straight and the lever 42 occupies its normal position as illustrated in Fig. 1. In order to heat the water in the tank 12 the actuator 31 is pushed in from its open-circuit position illustrated in Fig. 2, to its closed-circuit position shown in Fig. 1, bringing the movable contact member 30 into engagement with the fixed contact members 25 closing the heater circuit. In this inward movement of the actuator 31 the catch 41 passes clear of the stop 51, and engages the cam surface 52 of the latch 50, slightly raising the right hand end of the lever 42 until the catch 41 passes completely under the cam surface 52 when the right hand end of the lever 42 falls, leaving the parts in the position illustrated in Fig. 1, with the retaining surface 53 of the latch engaging the catch 41 so as to retain the actuator 31 in closed-circuit position. As the device heats up the strip 47 bends downwardly, but so long as water remains in the tank 12 so that the temperature of the bottom of the tank and strip does not exceed the boiling temperature, the strip 47 does not come into contact with the screw 46. If, however, the water is allowed to boil away, the bottom of the tank heats rapidly and the strip 47 bends out far enough to

press down upon the screw 46 and raise the right hand end of the lever 42 from its normal position to its hot position shown in Fig. 2. This releases the catch 41 from the retaining surface 53 of the latch permitting the spring 39 to move the actuator 31 outwardly breaking the circuit. As the actuator 31 is moved outwardly by the spring 39 the catch 41 encounters the cam surface 54 of the stop 51 momentarily depressing the right hand end of the lever 42 and permitting the catch 41 to pass over the stop 51. The parts then occupy the position illustrated in Figs. 2 and 3. If an attempt is made to push in the actuator while the parts are in this position, the inward movement is arrested by engagement of the catch 41 with the abutment surface 55 of the stop 51, before the movable contact member 30 comes in contact with the fixed contact members 25 or sufficiently near these members to cause arcing. The stop 51 is so positioned that the actuator 31 cannot be pushed in again until the bottom 13 has cooled below the danger point and the lever 42 has reassumed its normal position illustrated in Fig. 1, so that when the actuator is pushed in, it is retained by the latch 50.

While the switch has been described in connection with an electric sterilizer, it should be understood that it may be applied to any electrical heating device whether or not the device is designed for heating a liquid. The thermostatic strip of the switch may be secured to any part of the device which is affected by the heat of the electric heating elements, and the apparatus may be adjusted to release the actuator at any desired limiting temperature. The stop may be arranged so as to prevent the closing of the switch until the temperature has fallen to any desired extent and it is not essential that the latch and the stop be both formed upon a single thermostatically operated member. But in order to secure an important advantage of the invention, hereinbefore explained, the stop should be so arranged as not to permit the closing of the switch until the latch has reassumed a position in which it will hold the switch closed.

What is claimed is:

1. A safety switch for an electric heating device, comprising fixed and movable contact members connected to control the heating current, resilient means tending to separate the contact members and a thermostatically operated latch adapted to retain the contact members in engagement when the temperature of the device is below the predetermined limit and to release the movable contact member when the temperature rises above this limit, and a thermostatically operated stop adapted to prevent moving the movable contact member into engage-

ment with the fixed contact member while the temperature is above said limit.

2. A safety switch for an electric heating device, comprising fixed and movable contact members connected to control the heating current; resilient means tending to separate the contact members; and a thermostatically operated controlling member formed to provide a latch adapted to retain the contact members in engagement when the temperature of the apparatus is below a predetermined limit and to release the movable contact member when the temperature rises above said limit, and a stop adapted to prevent moving the movable contact member into engagement with the fixed contact member while the temperature is above said limit.

3. A safety switch for a heating device having electric heating elements, comprising fixed and movable contact members connected to control the heating current; resilient means tending to move the movable contact member away from the fixed contact member; a controlling member formed to provide a latch adapted to retain the movable contact member in contact with the fixed contact member when the controlling member is in its normal position and to release the movable contact member when the controlling member is in its hot position, and a stop adapted to prevent moving the movable contact member into engagement with the fixed contact member when the controlling member is in its hot position; and a thermostatic strip having one of its ends secured to a part of the apparatus affected by the heat of the heating elements and its other end free to bend outwardly and positioned to engage said controlling member and move it from its normal to its hot position when the temperature of the strip rises above a predetermined limit.

4. A safety switch for an electric heating device, comprising fixed and movable contact members connected to control the heating current; a movable actuator to which said movable contact member is secured; resilient means tending to move said actuator into open-circuit position; a catch upon said actuator extending transversely to its line of movement; a thermostatically operated controlling member formed to provide a latch having a cam surface by which said latch may be raised as the actuator is moved into closed-circuit and a retaining surface adapted to engage the catch and retain the actuator in movable closed-circuit position when the temperature of the device is below a predetermined limit and to release the catch when the temperature rises above said limit, and a stop having a cam surface permitting the catch to pass the stop when it is released by the latch and an abutment surface adapted to engage

the catch and prevent moving the actuator into closed circuit position while the temperature is above said limit.

5 5. A safety switch for a heating device
having electric heating elements, comprising
fixed contact members connected in the heat-
ing circuit; a movable contact member
adapted to close the circuit by engagement
with said fixed contact members; a longitu-
10 dinally movable plunger on which said mov-
able contact member is mounted; a spring
tending to move said plunger into open-cir-
cuit position; a transverse catch upon said
plunger; a flat lever located at one side of
15 the axis of said plunger and parallel thereto
and in a line with the said catch, one end
of said lever being formed to provide a
latch having an inclined surface by means of
which the lever may be raised from its nor-
20 mal position when the plunger is pushed
into closed-circuit position, and a retaining
surface adapted to engage said catch and
retain the plunger in closed-circuit position
when the lever is in its normal position, and
25 a stop having an abutment surface posi-
tioned to permit said actuator to be moved
into closed-circuit position when the lever
is in its normal position and to prevent such
movement of the plunger when the lever is
30 in raised position and an inclined surface
permitting the catch to pass when the plun-
ger is moved into open-circuit position; and
a thermostatic strip having one of its ends
secured to a portion of the apparatus affected
35 by the heat of the heating elements and hav-
ing its other end free to bend outwardly and
positioned to engage said lever and move it
from normal position to raised position
when the temperature of the strip exceeds a
40 predetermined limit.

6. In a safety switch, the combination of a
switch-contact actuator movable inwardly
to closed-circuit position and outwardly to
open-circuit position, a spring tending to
45 move said actuator outwardly, a catch upon
said actuator extending transversely to its
direction of movement, a controlling mem-
ber movable across the line of movement of

said catch, thermostatic means for moving
said controlling member from its normal po- 50
sition to its hot position when the tempera-
ture of said means rises above a predeter-
mined limit, the end of said controlling
member being formed to provide a latch
55 having an outwardly inclined cam surface
and a transverse retaining surface located in
the line of movement of said catch when the
controlling member is in normal position,
and a stop positioned outwardly from said
60 latch and having an inwardly inclined cam
surface and a transverse abutment surface
located in the line of movement of said
catch when the controlling member is in
hot position.

7. In a safety switch, the combination of 65
a slidably mounted plunger serving as a
switch-contact actuator and movable in-
wardly into closed-circuit position and out-
wardly into open-circuit position, resilient
means tending to move said plunger out- 70
wardly, a transverse catch on said plunger,
a controlling lever located in the line of
movement of said catch, thermostatic means
adapted to engage the inner end of the lever
and move the lever from its normal position 75
to raised position when the temperature of
said means exceeds a predetermined limit,
the outer end of said lever being formed to
provide a latch having an outwardly in- 80
clined cam surface and a transverse retain-
ing surface positioned in the line of move-
ment of said catch when the lever is in nor-
mal position, and a stop located outwardly
from said latch and having a rearwardly in- 85
clined cam surface and a transverse abut-
ment surface located in the line of movement
of said catch when the lever is in raised po-
sition.

In testimony whereof I have hereunto set
my hand in the presence of two subscribing 90
witnesses.

HENRY L. LEEB.

Witnesses:

A. JARECKY,
HILDA M. BECK.