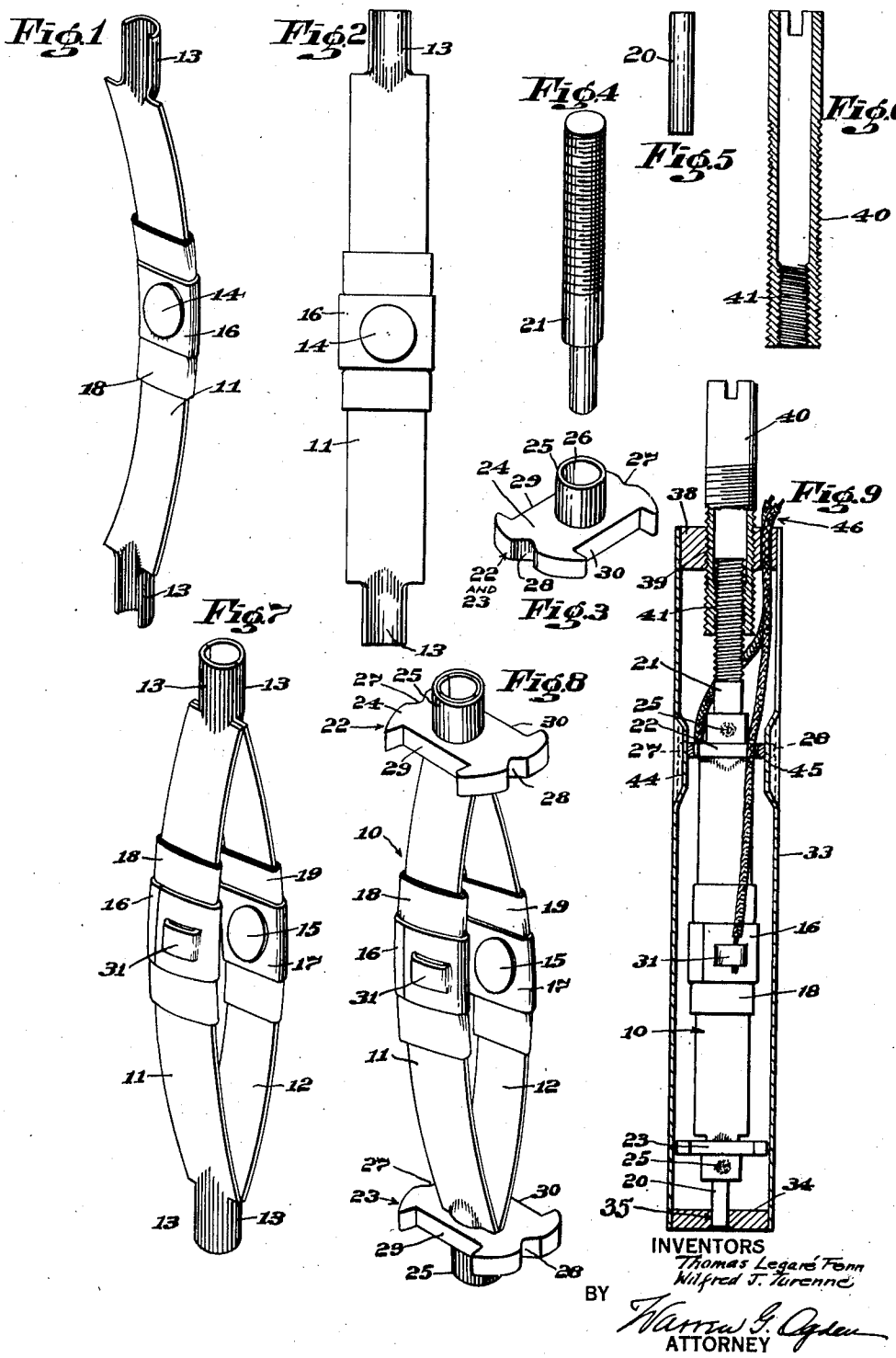
Jan. 2, 1940. T. L. FENN ET AL 2,185,433

SWITCH

Filed July 2, 1938



Patented Jan. 2, 1940 2,185,433

UNITED STATES PATENT OFFICE

2,185,433

SWITCH

Thomas Legaré Fenn, Newton, and Wilfred J. Turenne, Ashland, Mass.

Application July 2, 1938, Serial No. 217,296

11 Claims. (Cl. 200—137)

This invention relates to switches and more particularly to thermostatic switches for opening and closing electric circuits in accordance with thermal changes, especially thermal changes occurring externally of or otherwise affecting a device associated with, or containing, the switch. In another aspect the invention relates to a form of switch which is completely assembled outside of the container or other device with which the switch is to be operatively associated and thus constitutes a finished article of manufacture, which may be handled as a unitary article when placing it in the device which forms its casing or otherwise assembling it in operative position.

A general object of the invention is to bring about a form of switch for a thermally controlled instrument which may act as a safety device in an electric circuit and wherein the construction is such that the switch will maintain a closed circuit while a series of operations, which it controls, are being performed correctly but will open in case of trouble, such as an improper operation of the apparatus, and thus stop the operation by breaking the circuit. However, while the switch has special utility as a safety device, it is not limited to that specific field but is capable of many other uses, for example, as a control switch for refrigerators or for air conditioning where a maintenance of uniform low temperature conditions is a requisite.

In the preferred embodiment of the invention the switch unit takes the form of two opposed leaf springs bearing electrical contacts effectively connected together at their ends and bowed away from one another between their ends. A switch in this form can be constructed and sold as a unitary article of manufacture to those who desire to assemble it with electrically controlled apparatus. A feature of the switch unit resides in a form of construction which facilitates mounting the unit within a tube or other housing and providing for adjustment to vary the degree of temperature at which the unit becomes effective to perform its safety or other function.

To the accomplishment of this object and such others as may hereinafter appear, as will readily be understood by those skilled in the art, the invention comprises the features and combinations of parts hereinafter described and then particularly pointed out in the appended claims.

In the accompanying drawing,

Figure 1 is a perspective view of one of the metallic springs forming the switch unit as shaped for assembly with a like spring;

Fig. 2 is an elevational view showing the inner face of the spring shown in Fig. 1;

Fig. 3 is a perspective view of a device for holding the two springs in assembled position, formed to also serve as an anti-twist flange when the switch unit is located in a housing.

Figs. 4 and 5 are views of the two elements secured, one at each end of the switch unit, for mounting and centralizing the unit within a housing;

Fig. 6 is a sectional view of a screw for adjusting the tension of the switch when assembled in operative position;

Fig. 7 is a perspective view of two of the springs of Fig. 1 placed face to face ready to receive the binding devices upon their tubular extensions;

Fig. 8 is a perspective view of the switch unit ready to be placed with the addition of two head pieces for producing a unitary-self contained article; and

Fig. 9 is a view, in cross-section, of a tubular housing with the switch unit installed and with an adjusting screw in place.

In the embodiment of the invention shown in the drawing for illustrative purposes, 10 (Fig. 8) indicates, in general, the improved switch unit which, in the form shown, includes a pair of leaf springs 11 and 12, rigidly connnected together at their ends and bowing outwardly away from one another intermediate their ends. The springs 11 and 12 are substantially identical and prior to assembly (Figs. 1 and 2) each consists of a single strip of flexible metal having a low coefficient of expansion, such as invar. The springs between their ends have a concave bow-like shape and a thickness and width capable of giving the desired degree of stiffness. At their ends the springs are pressed, or otherwise formed into semi-cylindrical, concavo-convex, straight extensions 13 (shown best in Fig. 1). The two semi-cylindrical extensions at the opposite ends of each spring have their axes in alignment and their concavo sides at the concaved face of the bowed spring.

Substantially halfway between the ends of each spring 11 and 12 is an electrical contact or switch point indicated by 14 and 15. As shown, each contact is attached to a metallic clip 16 or 17, the latter being insulated from the springs by mica or other suitable insulating material 18 and 19. The clips 16 and 17 may be tightly crimped around the springs with the mica insulation intervening, the contact being on the concave face of each bowed spring.

During the assembly of the switch unit the

springs 11 and 12 are first brought into the position shown in Fig. 7, wherein the concave faces of the springs oppose one another, the concavo sides of the semi-cylindrical extensions 13 likewise opposing one another and forming tubular extensions or stems. Obviously the cross-section of the extensions may be square, diamond-shaped, oval or of other form that may be equally divided without departing from the scope of this invention, the tubular form being herein disclosed because it is the cheapest to manufacture. The rod-like mounting elements 20 and 21 (Figs. 4 and 5) are dimensioned to slip within these extensions.

A simple and inexpensive means has been devised for binding the two switch springs together so that the assembly may be handled as a unitary article while securing the mounting rods in said extensions. The means for maintaining the two springs in the relation illustrated by Fig. 7 consists essentially of a tubular member dimensioned to telescope over the tubular extension and bind its two sections, and thereby the springs, together. This member fits tightly and effects a rigid assembly. For convenience the binding member is formed as a part of an element functioning to prevent torsional twisting of the switch unit when in use and it will be so described.

In order to provide an arrangement for preventing twisting or rotational movement of the switch unit as a whole when assembled within a housing, head pieces 22 and 23 (Fig. 3) are assembled one on each end of the switch in position wherein they telescope over the extensions formed by the parts 13. Each head piece comprises a disc-like body 24 and a preferably, though not necessarily, integrally formed central tubular boss 25, the bore 26 of each boss extending through its respective head and being of a diameter such that the head may be telescoped with a tight fit over either tubular extension of the switch unit. The pins 20 and 21, after insertion within the bosses are then spot welded at the bosses or these parts are otherwise rigidly secured together. The disc-like body or flange 24 of one head piece (or both made alike for economy of manufacture) may be notched at diametrically opposite points 27 and 28 for a purpose hereinafter described. The flanges 24 are also formed with diametrically opposite, relatively wide grooves 29 and 30 which provide clearance for circuit wires entering a switch casing passing to the switch points 14 and 15. The clips 16 and 17 have tongues 31 struck out of the material thereof to which the wires may be attached, as by solder or pressure.

The switch as thus assembled is shown in Fig. 8 and it will be apparent that this assembly either with or without the end pins is in the form of a unit which is self-contained and may be independently handled before embodiment in a thermostat or other device wherein it is useful. When not under tension the inherent bowed shape of the springs maintains the circuit through the contacts 14 and 15 open. If sufficient tension is applied to one or both ends of the unit in a direction tending to separate the ends, the springs will be straightened, eventually causing the contacts to engage and close the circuit.

As an example of a suitable use to which the switch unit may be put, and in order that its mode of operation may be fully understood, it will now be described in connection with a thermostat suitable for use in controlling the operation of an autoclave or the like, it being understood, however, that the description thereof in connection with this particular instrument is for illustrative purposes only.

Fig. 9 of the drawing indicates, in general, a thermostat suitable for use in opening an electrical circuit when the temperature to which the thermostat is subjected falls below a predetermined point. This thermostat comprises a cylindrical casing or tube 33 of brass or other material having a reasonably high coefficient of expansion. The tube 33 may be closed at its lower end by a head 34 bored axially at 35 to receive the lower mounting pin 20 of the enclosed switch unit 10. The upper end of the tubular housing may be closed by a head 36 threaded axially at 39 to receive an adjusting screw 40 (see Fig. 6), the latter being bored axially and threaded internally at 41 to receive the threaded mounting pin 21 at the upper end of the switch unit. At diametrically opposite points the housing 33 may be pressed inwardly to form short longitudinal ribs 44 and 45 which are embraced by the diametrically opposite grooves 27 and 28 formed in the upper reenforcing head 22 of the unit. A single guiding rib may be employed if desired.

The heads 34 and 36 of the tube 33 may conveniently be secured in place by silver soldering, one of the heads being inserted after the switch unit 10 has been slipped within the housing, setting its lower mounting pin 20 in the bore 35 made for its reception. The pin 20 may then be made fast to the housing by silver soldering. The external thread on the adjusting screw 40 and the internal threads 41 therein are provided with differential pitches such that rotational movement of the screw 40 through the head 36 will produce a longitudinal or axial movement of the upper mounting pin 21, the lower pin 20 being fixed, to place the springs 11 and 12 of the unit under a desired tension.

It will be apparent that when the thermostat described above is subjected to the effect of heat the housing 33 will expand, and the switch unit 10 will elongate proportionally drawing the contacts 14 and 15 toward each other. Sufficient expansion of the housing 33 will cause the contacts to engage and close the electrical circuit indicated by 46. By suitable adjustment of the screw 40 on the mounting pin 21 the effect of the expansion of the housing 33 may be varied to bring about a closing of the circuit at any desired temperature.

When using an autoclave, for example for sterilizing surgical instruments, an assembly such as shown in Fig. 9, or any other assembly including the switch unit in an operative manner, may be fastened in a selected location as on the inner panel of the door or in the steam exhaust. A valve in the steam line is mechanically connected to be shut off when the circuit is broken. The switch unit is preliminarily adjusted to open at say 250° F., the temperature required to be maintained for the period required for sterilization. When the flow of steam raises the temperature within the autoclave to that degree the switch contacts close and stay closed unless the temperature, due to difficulty in the steam line perhaps, drops below the critical degree. If that happens before expiration of the time limit for sterilization, the switch casing will contract, the switch will open and the steam will be shut off thus guarding against fail-

ure of the autoclave to perform its function. Thereafter the cycle may be started again and, provided no mishap occurs, the instruments in sterilized condition, are removed from the autoclave when the cycle is ended automatically at the end of the predetermined period.

The method of connection of the springs to their mounting elements is such that variations in tension are directly applied to the springs themselves and effect flexure thereof in the desired direction. It will also be apparent that the method of securing the spring ends to the mounting elements provides at the same time a convenient arrangement for preventing torsional twisting effect on the springs or on the switch unit during the adjustment thereof. The switch assembly as a whole is capable of use as a complete article of manufacture for introduction within a casing of the character described or for assembly in other devices wherein its features are of value.

While the particulars of construction herein set forth are well suited to one form of the invention, it is not to be understood that these particulars are essential since they may be variously modified within the skill of the artisan without departing from the true scope of the actual invention as defined by the following claims.

What is claimed as new, is:

1. A switch unit for thermostats or the like comprising a pair of bowed metallic leaf springs arranged with their concave sides opposed, said springs each having a semi-cylindrical concavo-convex extension at each end the concave sides of which face inward in said assembly, whereby said concavo-convex extensions meet in pairs to form tubular extensions at each end of the assembled pair of springs, means co-acting with each said extension to maintain the two springs in the relation described, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

2. A switch unit for thermostats or the like comprising a pair of bowed metallic leaf springs arranged with their concave sides opposed, said springs each having a semi-cylindrical concavo-convex extension at each end the concave sides of which face inward in said assembly, whereby said concavo-convex extensions meet in pairs to form tubular extensions at each end of the assembled pair of springs, a tubular member telescoped over each said extension for binding its two parts together and holding the two springs in the relation described, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

3. A switch unit for thermostats or the like comprising a pair of bowed metallic leaf springs arranged with their concave sides opposed, said springs each having a semi-cylindrical concavo-convex extension at each end the concave sides of which face inward in said assembly, whereby said concavo-convex extensions meet in pairs to form tubular extensions at each end of the assembled pair of springs, a tubular member telescoped over each said extension for binding its two parts together and holding the two springs in the relation described, a guide flange mounted on at least one said extension adapted to prevent torsional twisting of the unit when in use, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

4. A switch unit for thermostats or the like comprising a pair of bowed metallic leaf springs arranged with their concave sides opposed, said springs each having a semi-cylindrical concavo-convex extension at each end the concave sides of which face inward in said assembly, whereby said concavo-convex extensions meet in pairs to form tubular extensions at each end of the assembled pair of springs, a reinforcing head for holding the two parts of said extension together consisting of a short tube having a guiding flange at one end, said tube being of such internal diameter as to receive an extension with a tight fit, one of said heads being fitted on each said extension with its guiding flange adjacent the spring ends, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

5. A switch unit for thermostats or the like comprising a pair of bowed metallic leaf springs arranged with their concave sides opposed, said springs each having a semi-cylindrical concavo-convex extension at each end the concave sides of which face inward in said assembly, whereby said concavo-convex extensions meet in pairs to form tubular extensions at each end of the assembled pair of springs, a tubular member telescoped over each said extension for binding its two parts together and holding the two springs in the relation described, a mounting pin secured within the tubular extension at one end of the unit, and a threaded adjusting rod secured within the tubular extension at the other end of the unit, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

6. A metallic leaf spring for thermostatic switches bowed in one direction substantially throughout its working length and having a short portion at at least one of the ends thereof shaped to form a semi-cylindrical concavo-convex extension the axis thereof extending longitudinally of the spring and with its concavo side at the concaved face of the bowed spring.

7. A metallic leaf spring for thermostatic switches bowed in one direction substantially throughout its working length and having both of its end portions shaped to form aligned extensions of concavo-convex contour.

8. A spring element for thermostatic switches comprising a strip of metal having a low coefficient of expansion bowed in one direction substantially throughout its working length, and having end portions beyond the bowed part thereof in the form of semi-cylindrical concavo-convex extensions, said two extensions being axially aligned.

9. A switch unit for thermostats or the like comprising a pair of metallic leaf springs each bowed intermediate its ends, the bowed portion of each spring having a longitudinal extension at each end thereof and said springs being assembled concaved face to concaved face with the ends of their bowed portions contacting in pairs, said end extensions opposing each other in pairs beyond each pair of contacting ends of said bowed portions, binding means co-acting with each such opposed pair of end extensions for maintaining the bowed portions of the two springs in their assembled relation, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

10. A switch unit according to claim 9 in which said binding means comprises an apertured head

piece at each end of the unit, each head piece being slipped over a pair of end extensions and rigidly maintaining them in their opposed relation.

11. A switch unit for thermostats or the like comprising a pair of metallic leaf springs each bowed intermediate its ends, the bowed portion of each spring having a longitudinal extension at each end thereof and said springs being assembled concaved face to concaved face with the ends of their bowed portions contacting in pairs, said end extensions opposing each other in pairs beyond each pair of contacting ends of said bowed portions, an apertured head piece at each end of the unit, each head piece being slipped over a pair of end extensions and rigidly maintaining them in their opposed relation, each head piece having an outwardly facing socket for receiving a rod-like mounting element in further longitudinal extension beyond each end of the unit, and opposed, normally disengaged electrical contacts associated one with each of said springs on the concaved face thereof.

THOMAS LEGARÉ FENN.
WILFRED J. TURENNE.