

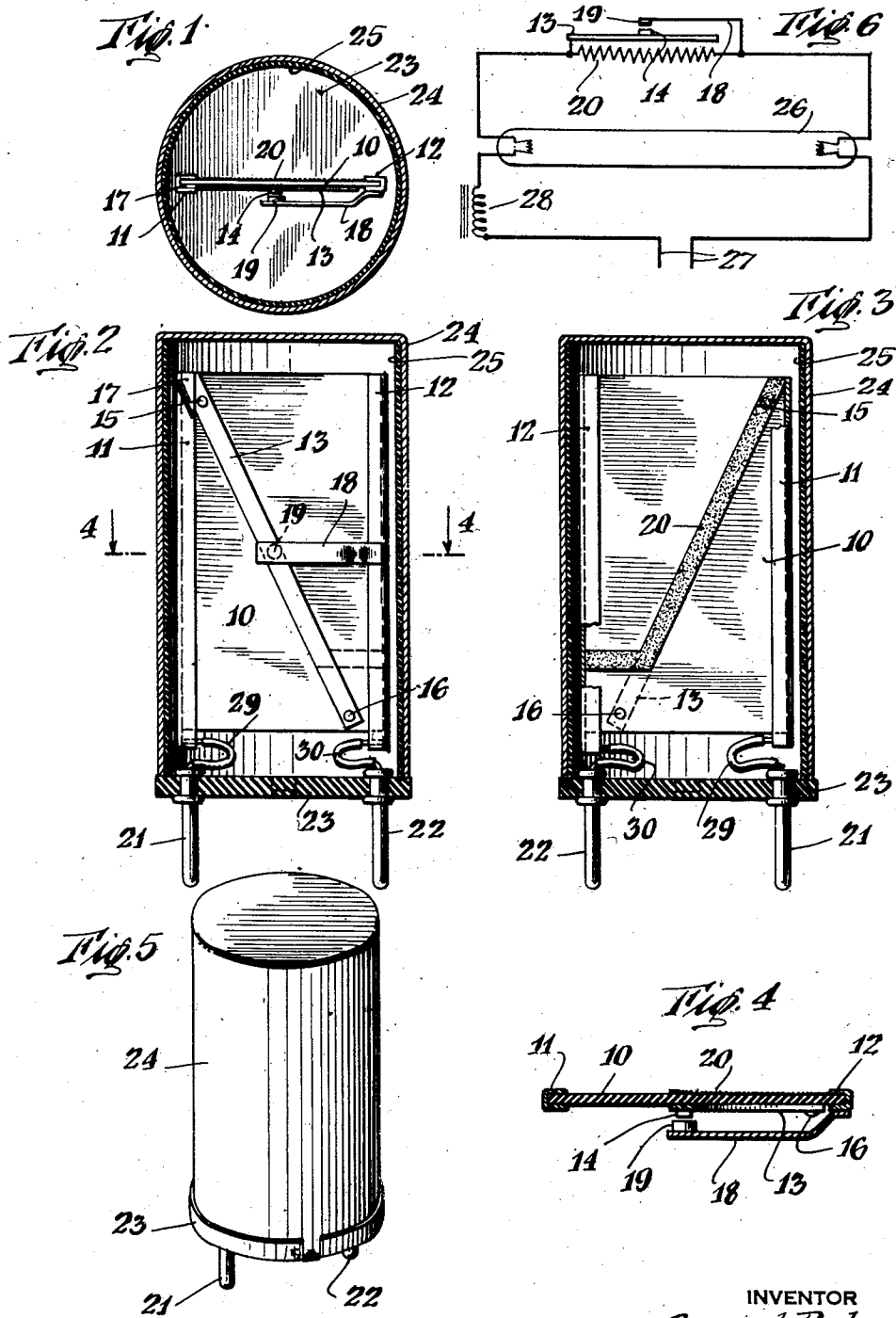
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THERMOSTATIC SWITCH

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THERMOSTATIC SWITCH

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6 Claims. (Cl. 200—122)

This invention relates to a thermostatic switch for starting fluorescent lamps.

An object of the invention is to improve thermostatic switches and parts thereof.

Another object is to improve the starting switches for fluorescent lamps and the like.

Other objects of the invention will be apparent from the following description and accompanying drawing taken in connection with the appended claims.

The invention comprises the features of construction, combination of elements, arrangement of parts, and methods of manufacture and operation referred to above or which will be brought out and exemplified in the disclosure hereinafter set forth, including the illustrations in the drawing.

In the drawing:

Figure 1 is a top view partly in section of a thermostatic switch suitable for starting fluorescent lamps embodying features of the present invention;

Figure 2 is a vertical section thereof;

Figure 3 is another vertical section looking at the opposite side of the active element;

Figure 4 is a section on the line 4—4 of Figure 2;

Figure 5 is an outside perspective view of the complete device; and

Figure 6 shows a circuit in which the device may be employed.

In the present commercial voltage operated fluorescent lamp there is required an automatically operating switch which serves two functions:

1. Heating of the filaments. The fluorescent lamps, having heat filaments for thermionic emission, these must be heated to electron emissive temperature prior to the application of line voltage.

2. Producing a transient starting voltage. The switch must open an inductive circuit so as to provide a transient breakdown voltage for the gas column, which voltage is higher than the applied line voltage.

Various switches are now used which are either magnetically or thermally operated.

This invention relates more particularly to a thermally operating switch which remains over a long period constant in its operating characteristics and is of low cost. It has been developed to overcome some of the limitations in present types of switches.

The switch preferably comprises a heater element of high resistance which is applied to one

side of an insulating layer, preferably a thin sheet of low thermal expansion, such as sheet mica. Adjacent to the opposite side of the sheet is a strip of material having a high coefficient of expansion. The operation is dependent upon the difference in expansion coefficient. Due to low mass and close relation of elements a quick acting device is had, insensitive to external mechanical conditions such as vibration, operation or position.

While a preferred embodiment of the invention is described herein, it is contemplated that considerable variation may be made in the method of procedure and the construction of parts without departing from the spirit of the invention. In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

In order to more specifically describe this invention, reference is made to the accompanying drawing which illustrates a device of this invention. In Figures 1 to 5 are illustrated the complete switch comprising a piece of mica 10 which, by way of example, may have the dimensions $\frac{7}{8}$ " x $1\frac{1}{4}$ " x 5 mil thick. It is mounted on steel channel supports 11 and 12 which clamp it firmly and also make electrical contact with the other elements. A strip of brass or beryllium bronze 13 having a silver contact 14 in the center is riveted at both ends to mica plate 10 by rivets 15 and 16 and the upper end makes electric contact with support 11 at 17. Strip 13 may be 5 mils thick, for example.

Attached to the opposite support post 12 is stationary contact arm 18 carrying contact 19 which is preferably spaced about 6 mils from contact 14 on metal strip 13. The integral heating element comprises a layer of resistance material 20, such as graphite, which is applied from a colloidal solution and baked on. The width of the layer may be about $\frac{1}{8}$ " and its resistance 9500 ohms, for example. One end of the resistance layer 20 is connected to support 11 and the other end to support 12.

Supports 11 and 12 are connected, by flexible leads 29 and 30 to connector prongs 21 and 22, respectively, mounted in Bakelite disc base 23 to form a plug-in unit. The unit fits into a circular aluminum container 24 which has a fibre wall lining 25 to prevent short circuit of supports 11 and 12. The construction provides a compact plug-in unit.

The device may be connected in a fluorescent

lamp circuit as a starting device therefor in the manner shown in Figure 6. As shown in this figure, the tubular fluorescent lamp 26 having filament electrodes in each end thereof is connected to the electric power supply line 27, the thermostatic starting switch described above and an inductive reactance 28 as follows: from one side of the power supply line through reactance 28, one filament electrode of tube 26, the resistance 20 of the thermostatic starting switch and the second filament electrode of tube 26 to the opposite side of the power supply line. The reactance 28 may, by way of example, have a reactance of about 300 ohms.

In operation, when the line voltage is applied current flows through the circuit the parts of which are of relatively low resistance compared to resistance layer 20, and layer 20, therefore, receives practically the full line voltage. This causes it to heat rapidly due to the low mass of the unit and the supporting mica rapidly becomes hot and in turn quickly heats the metal strip 13 which is riveted to it. As the metal strip is heated it expands and moves outwardly away from mica sheet 10 until contact 14 contacts stationary contact 19. The contacts thereby short-circuit the resistor element 20 and allow full line current less drop in reactance 28, to be applied to the filaments in the ends of tube 26 and, being of low mass (20 milligrams), they rapidly heat up to emission temperature.

In view of the fact that the heater resistor layer 20 becomes short-circuited when contacts 14 and 19 close, heating of the resistance stops thereby allowing rapid cooling of the mica with the result that the contacts are quickly opened due to contraction of the metal strip 13. This in turn breaks the filament circuit and a surge voltage is produced across the lamp by reactance 28 which causes a current flow to be had between the hot electron emissive filaments.

As the current continues the voltage drops across resistor 20 to about 60 volts. This voltage is insufficient to heat it up to a temperature adequate to cause the strip to expand enough and close contacts. There is a fairly rapid movement of brass strip in operation which is due to the difference in expansion between the mica and brass. Due to the riveting at the ends, a slight tension is had which aids in the rapidity of break.

The thin resistance layer can be obtained in several ways. For example, it can be produced by use of colloidal graphite solution such as a 5% solution derived from commercial aqueous solution known as Aquadag. It can be obtained by mixing micronized graphite (Dixon) with a binder such as a 5% solution of urea formaldehyde resin in butanol xylol solvent. It can also be obtained from a platonic chloride solution. Where inorganic binders are desirable a 10% solution of sodium silicate can be used.

The unit can be completely assembled on the base prior to adjusting the contacts. The flexible leads 29 and 30 prevent any stresses being transferred from the plug-in base to the unit after assembly.

If desired, a small capacitance can be connected across the unit to reduce any radio interference during break of circuit. However, for most applications the shunt effect of the resistor layer is adequate.

While the present invention, as to its objects

and advantages, has been described herein as carried out in specific embodiments thereof, it is not desired to be limited thereby but it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. An electrically operated thermostatic switch comprising a sheet of insulating material, an electric resistance strip on one face thereof and a metal strip secured to the opposite face thereof, means to make electrical connection to the ends of said resistance strip, and a pair of co-operating electric contacts controlled by said metal strip upon thermal expansion and contraction thereof, said contacts being open when said metal strip is cold and closed when it is heated and being connected to opposite ends of said resistance strip to short-circuit said resistance strip upon contact closure.

2. An electrically operated thermostatic fluorescent lamp starting switch comprising a sheet of insulating material, an electric resistance strip on one face thereof and a metal strip secured at its ends to the opposite face thereof, means to make electrical connection to the ends of said resistance strip, said metal strip being connected to one end of said resistance strip and having a first electric contact on its outer face at a point intermediate its ends, a second relatively stationary electric contact secured to the opposite end of said resistance strip and supported in co-operative relation to said first contact to short circuit said resistance upon thermal expansion of said metal strip.

3. An electrically operated thermostatic switch comprising a rectangular sheet of insulating material, a pair of metal channel supports clamping opposite edges of said sheet, a layer of resistance material diagonally on said sheet and connecting said supports, a metal strip riveted at its ends diagonally against the opposite face of said sheet substantially in register with said resistance layer and electrically connected to the first of said supports, said metal strip carrying a first contact at an intermediate point thereon, a second contact and means supporting said second contact in cooperating relation to said first contact and connecting said second contact to the second of said supports whereby to short-circuit said resistance upon thermal expansion of said metal strip.

4. A thermostatic switch comprising a layer of mica, a layer of metal of higher thermal expansion coefficient than said mica secured thereto in face-to-face contact therewith, and a pair of electric contacts controlled by said metal layer upon thermal expansion and contraction thereof.

5. A thermostatic switch comprising a layer of mica, a layer of metal of higher thermal expansion coefficient than said mica riveted thereto in face-to-face contact therewith, and a pair of electric contacts controlled by said metal layer upon thermal expansion and contraction thereof.

6. An electrically operated thermostatic switch comprising a sheet of insulating material, an electric resistance layer on one face thereof, a metal layer secured to the opposite face thereof whereby it may be readily heated by said electric resistance layer, and a pair of electric contacts controlled by said metal layer upon thermal expansion and contraction thereof.

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