

STACKED THERMOSTAT ASSEMBLY

This invention relates to a stacked thermostat assembly which may be used, for example, in an electric iron.

- 5 In an electric iron, the thermostat is generally mounted on a boss in the soleplate. The boss provides a heat sink and is usually positioned centrally or in the forward portion of the soleplate where it is hottest.
- 10 Recent low cost, lightweight plastic irons have required rearrangement of otherwise conventional thermostats. Generally, a forward thermostat location is advantageous in irons which provide
- 15 extra steam capacity by pumping a slug of water into a steam boiler to generate a surge of steam. A typical surge steam iron is disclosed in our US Patent 3 919 793 wherein the main steam emerges from most of the soleplate ports while the surge
- 20 steam is passed through a separate distribution system to emerge from a small number of ports not connected with the main steam system.

- 25 Stacked thermostats are known and used in many other appliances such as cooking appliances, or any other appliance having a heating element and where a thermostat controls the heating element to maintain a selected temperature.

The thermostat should be simple, inexpensive, and reliable. It must also be accurate and have good calibration characteristics while preferably being compact but with a positive "off" position in which
5 the electrical contacts are well separated.

It is known to use cams in a stacked thermostat assembly to position an intermediate stiff blade carrying one of the electrical contacts, the cam
10 allowing an infinite number of temperature settings. In one known arrangement the cam is provided on a rotatable shaft with its follower on a movable blade but this requires extra parts and a relatively
complex construction.

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In accordance with the present invention there is provided a stacked thermostat assembly comprising a lower heat-responsive deformable blade, an intermediate conductive stiff spring blade, and an upper conductive less stiff spring blade, the blades being supported, secured and spaced apart at one end by interposed insulators with electrical contacts on the conductive blades being responsive to movement of the heat-responsive blade transmitted to the upper blade to make and break an electrical circuit controlling the heating of a medium sensed by the thermostat; the assembly further comprising a temperature setting mechanism including a single structural bracket extending over the blades and mounted on and above the supported ends of the blades, the free end of the extended portion of the bracket being enlarged and formed with a bore providing an elongate bearing guide for a control shaft disposed over the blades and extending through an opening in the upper blade to engage the intermediate blade, the control shaft including a cam follower biased by the intermediate blade against an arcuate cam surface with end stops formed on the said portion of the bracket and facing the upper blade.

The cam surface preferably descends smoothly from an upper temperature stop down towards the blades over an arc of between 180° and 230° , the surface rising angularly adjacent the lower temperature stop such that the contacts are quickly separated to provide a sharp thermostat "off" position against the lower stop.

The single bracket provides a shaft bearing, a cam surface and end stops, and also locates all parts of the assembly. The simplified construction has fewer parts than known assemblies.

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By way of example only an embodiment of the invention will now be described with reference to the accompanying drawings in which:

10 Figure 1 is a partial elevation of a typical surge steam iron partly broken away to show the location and arrangement of a stacked thermostat assembly embodying the invention,

15 Figure 2 is an enlarged perspective of the assembled thermostat, and

Figure 3 is an elevation view of the thermostat with the structural bracket partly in section.

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The illustrated thermostat can be used with many appliances but will be described in connection with a lightweight plastic iron since it is especially applicable to such use.

Referring to Figure 1, there is shown an electric steam iron which includes a soleplate 10 with a plurality of steam ports 12 and an outer shell 24 suitably connected with handle 16 in known fashion.

5 Soleplate 10 can conveniently be cast aluminum with electric heating element 18 cast in position for uniform heat distribution when the iron is plugged in.

The iron includes means for generating steam with water tank 20 that may be part of a single plastic housing secured by L-shaped fastener 22 and other suitable mechanism in conventional fashion. For steam, soleplate 10 has a steam generator 24 into which, under control of button 26 and guided valve steam 28 movable between an on/off position, water controllably drips from tank 20 onto hot soleplate 10 through metering water valve 30 of a known type, the resulting steam flowing through distributing passages 32 under coverplate 34 and out ports 12 onto the fabric being ironed. As shown, an additional surge is provided by injecting water into a separate forward surge generator 36 by a separate bellows pump manually operated by control button 38. A temperature adjustment means 40, external to the shell 14 and high on the front of handle 16, connects with vertical control rod 41 in the forward portion of the handle to operate a thermostat generally indicated at 42 of the known stack type which is snugly mounted on soleplate boss 43. The boss is preferably formed as shown as part of the iron soleplate casting for good heat sink contact.

If the iron is a self-cleaning iron of the type of U.S. Patent 3,747,241, it has means for suddenly and completely dumping tank 20 onto the hot soleplate through a large opening that preferably, though not necessarily, is spaced and separate from the usual water valve 30. Controlling this large opening, dumper valve 44 is disposed in the bottom of tank 20 and operated through a rod 46 from a button on the side of the iron not shown to quickly empty the

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tank onto the soleplate where the combination of hot water and steam suddenly purges the internal passages, tank, and soleplate ports of lint and mineral deposits.

5 As best shown in Figs. 2 and 3, the illustrated thermostat reduces the number of parts conventionally required and uses a single integral bracket that performs multiple functions. The thermostat is of the stacked blade type that comprises a multi-metal, usually a bi or tri-metal heat deformable or temperature responsive bimetal blade 48, a relatively stiff but flexible conductive intermediate spring blade 50, and a less stiff upper spring blade 52. The three blades 48, 50 and 52 are supported and secured together at one end in a sandwich configuration along with an integral support bracket 54 parallel to and above flexible blade 52. The mounting soleplate boss 43 provides a close and intimate contact support below the bimetal 48 for rapid and efficient heat conduction to the bimetal. The stacked sandwich further includes separate conductive electrical terminals such as 56 positioned contacting stiff spring blade 50 and flexible spring blade 52 respectively. The blades, support bracket, etc. are spaced apart and electrically insulated at the one end by a conventional central insulating tube and interposed ceramic insulators 58 to electrically separate the parts and a suitable fastener 60 clamps the stacked assembly together at the one end for a mounting post to secure the assembly snugly to soleplate boss 43.

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The spring blades 50 and 52 are provided respectively with facing electrical contacts 62 and 64. When the contacts 62 and 64 are closed current flows through heating element 18 of the iron, and when open as shown, no current flows through heating element 18.

The bimetal blade 48 has insulator 66 at its free end such that when bimetal 48 is heated by the medium whose temperature it senses, its free end carrying insulator 66 bends upwardly toward flexible blade 52 and presses against blade 52 to open contacts 62 and 64 as shown in Figure 1.

The thermostat 42 further comprises a control mechanism, shown in Figure 3, generally indicated at 68 for adjusting the temperature at which the thermostat will maintain the soleplate 10 at the desired temperature. The control mechanism rotatably vertically positions insulator 70 which, in turn, locates the horizontal positioning of contact 62 for each desired temperature setting after the initial calibration obtained by adjusting screw 72. In other words, adjusting screw 72 is set at the factory to properly locate the vertical positioning of insulator 70 and then the user sets temperature by rotation of adjustment means 40 and control rod 41 connecting with control shaft 74 by any suitable slidable connection.

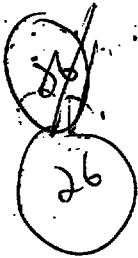
Support bracket 54, which may conveniently be of powdered metal, consists of a single structural bracket of integral one-piece construction extending

over the blades and mounted cantilever-like from one end as shown. For holding the movable parts, the bracket has an enlarged integrally formed portion 76 on the free end with a smooth unobstructed bore 78 completely through the enlarged portion forming an elongated bearing guide above the mid portion or between the ends of and over the blades. Disposed in the bore is control shaft 74 that, with no threads, is freely slidable vertically at all times in the bore whose long supporting surface acts as an elongated bearing for the control shaft. The shaft, with its contained insulator 70 extending through an opening 80 in the upper spring blade 52, thus positions the intermediate spring blade 50 upon vertical movement of insulator 70. To provide the vertical movement, an arcuate cam surface 82 is formed directly on the lower surface of enlarged portion 76, the cam surface falling smoothly down for substantially 180° - 230° and each end of the arc is provided with end stops such as lower temperature stop 84 which is the "off" position of the thermostat. A similar stop, not shown, is located on the opposite side or upper end of the cam which is the highest temperature "on" position for the thermostat. For cooperating with the cam surface 82 facing the upper blade, a cam follower 86 in the form of a pin extends outwardly from control shaft 74 and bears against the cam surface with the pin being held in position on the cam surface by the biasing effect of the intermediate stiff spring blade

50. It can be seen in FIG. 3 that cam surface 82 formed directly on and as part of the enlarged portion 76 is a substantially linear surface falling smoothly from the upper temperature stop on the opposite side of FIG. 3 down towards the blades over its arc of 180°-230° ~~(82°-140°)~~ to the "off" position shown in FIG. 3. For a clean break to widely space contacts 62 and 64, the cam surface is provided with angular sharp rise 88 of about 30° closely adjacent the lower temperature stop 84 to quickly separate the contacts providing a sharp "off" position against the lower stop 84.

One of the main differences between the present construction and the prior art is the placement of the cam directly on the lower surface of the enlarged portion 76 and the cam follower on rotating control shaft 74. By the use of the single integral support bracket 54 with its enlarged and contained cam portion, it is possible to achieve the same results as the reverse conventional arrangement while using fewer parts.

The arrangement described of the single bracket and its included cam surface provides a long smooth bearing 88 for the control shaft 74 while the enlarged portion also provides a structure for the cam surface and stops to limit the control shaft travel. It lends itself well to the biasing effect of intermediate spring blade 50 to force the relatively small follower 86 tightly against the cam surface for constant control of the vertical height. Finally, the integral substantially heavy support bracket 54 fixed the relationship of all the structural parts which are composed of essentially two groups of components. The first group is the complete stacked assembly of parts



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including the rivet, and the second group includes the control rod 41 with its associated parts. Thus the bracket integrates the line-up of components between each of the groups and ties them together to fix the relationship of all the structural parts.

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CLAIMS

1. A stacked thermostat assembly comprising a lower heat-responsive deformable blade, an intermediate conductive stiff spring blade, and an upper conductive less stiff spring blade, the blades being supported, secured and spaced apart at one end by interposed insulators with electrical contacts on the conductive blades being responsive to movement of the heat-responsive blade transmitted to the upper blade to make and break an electrical circuit controlling the heating of a medium sensed by the thermostat; the assembly further comprising a temperature setting mechanism including a single structural bracket extending over the blades and mounted on and above the supported ends of the blades, the free end of the extended portion of the bracket being enlarged and formed with a bore providing an elongate bearing guide for a control shaft disposed over the blades and extending through an opening in the upper blade to engage the intermediate blade, the control shaft including a cam follower biased by the intermediate blade against an arcuate cam surface with end stops formed on the said portion of the bracket and facing the upper blade.

2. An assembly according to Claim 1 wherein the cam surface descends smoothly from an upper temperature stop down toward the said blades over an arc of between 180° and 230° , the surface rising angularly adjacent the lower temperature stop such that the contacts are quickly separated to provide a sharp thermostat "OFF" position against the lower stop.

3. An electric steam iron comprising a steam generating sole plate with outlet ports and further comprising a thermostat assembly according to claim 1 or claim 2 mounted on the sole plate.

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4. A stacked thermostat assembly substantially as herein described with reference to the accompanying drawings.

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5. An electric steam iron including a stacked thermostat assembly substantially as herein described with reference to the accompanying drawings.

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