TEMPERATURE HISTORY INDICATING DEVICE

An indicating device for displaying the temperature history of an object is disclosed. The indicating device includes a reservoir of indicating material secured with respect to the object, where the indicating material is solid below a predetermined temperature and liquid at or above this temperature and a wicking member arranged in contact with the reservoir so that the indicating material migrates from the reservoir when in liquid form through the wicking member thereby altering the visual appearance of an indicating portion of the wicking member. Furthermore, the indicating device includes a barrier layer substantially overlaying and in contact with the wicking member, wherein the barrier layer includes a viewing aperture to view the indicating portion of the wicking member.
TEMPERATURE HISTORY INDICATING DEVICE

FIELD OF THE INVENTION
The present invention relates to an indicating device that is able to display the temperature history of an object.

BACKGROUND OF THE INVENTION
In my earlier filed PCT Application No PCT/AU2005/000882 entitled "An Indicating Device for Displaying the Temperature History of an Object Over Time" whose disclosure is herein incorporated in its entirety by reference, there is disclosed a temperature indicating device including a reservoir of indicating material that is solid below a predetermined temperature and which turns liquid above this temperature. This reservoir is in contact with a wicking member so that the indicating material will migrate from the reservoir when in liquid form to a peripheral portion of the wicking member. Furthermore, this device includes indicating means spaced from the reservoir so that when the indicator material has migrated to the indicating means then a predetermined temperature history is indicated.

Although this arrangement is still considered quite satisfactory for those instances where the material is likely to migrate a certain distance along the wicking member to indicate a particular temperature history of an object of interest, often it is preferable that a direct and easily viewable "on-off" indication of a relatively immediate change in temperature be given.

Additionally, if the manufacture of the indicating devices can be further simplified then this will result in a significant reduction in costs as these devices may then be mass produced as labels.
It is an object of the present invention to provide a temperature history indicating device capable of clearly displaying that an object to which the indicating device is attached has exceeded a predetermined temperature.

It is an object of the present invention to provide a temperature history indicating device that is capable of being mass produced in label form.

SUMMARY OF THE INVENTION

In a first aspect the present invention accordingly provides an indicating device for displaying the temperature history of an object including;

- a reservoir of indicating material secured with respect to said object, said indicating material being solid below a predetermined temperature and liquid at or above said predetermined temperature,
- a wicking member arranged in contact with said reservoir so that said indicating material migrates from said reservoir when in liquid form through said wicking member thereby altering a visual appearance of an indicating portion of said wicking member; and
- a barrier layer substantially overlaying and in contact with said wicking member, wherein said barrier layer includes a viewing aperture to view said indicating portion of said wicking member.

Preferably, said viewing aperture is located over a contact region of said wicking member that is in contact with said reservoir.

Preferably, said viewing aperture includes a substantially transparent film portion that does not absorb the indicating material.

Preferably, said substantially transparent film portion is formed as a transparent underlay or overlay to said barrier layer.
Preferably, said wicking member and said indicating material are of highly contrasting colours and wherein said visual appearance of said indicating portion is altered due to the presence of the colour of said indicating material in said wicking member.

Preferably, said viewing aperture is shaped in the form of a logo or device.

Preferably, said logo or device includes a plurality of windows in said barrier layer.

In a second aspect the present invention accordingly provides a continuous tape of temperature indicating devices, said continuous tape including a plurality of individual indicating devices in accordance with the first aspect of the present invention spaced apart along a continuous web.

In a third aspect the present invention accordingly provides a temperature indicating device for displaying the temperature history of an object, said device including:

a first base layer having an adhesive surface for attachment to said object;

a second layer incorporating a reservoir of indicating material, said indicating material being solid below a predetermined temperature and liquid at or above said predetermined temperature;

a third layer including a wicking member arranged in contact with said reservoir so that said indicating material migrates from said reservoir when in liquid form through said wicking member thereby altering the visual appearance of an indicating portion of said wicking member; and
a fourth layer substantially overlaying and in contact with said wicking member, wherein said fourth layer includes a viewing aperture to view said indicating portion of said wicking member.

In a fourth aspect the present invention accordingly provides a continuous tape of temperature indicating devices, said continuous tape including a plurality of individual temperature indicating devices in accordance with the third aspect of present invention spaced apart along a continuous web.

BRIEF DESCRIPTION OF THE DRAWINGS
A preferred embodiment of the present invention will be discussed with reference to the accompanying drawings wherein:
FIGURE 1 is an exploded view of an indicating device for displaying the temperature history of an object according to a first embodiment of the present invention;
FIGURE 2 is an assembled view of the indicating device as illustrated in Figure 1; and
FIGURE 3 is an assembled view of the indicating device according to a second illustrative embodiment of the present invention.
In the following description, like reference characters designate like or corresponding parts throughout the several views of the drawings.

DESCRIPTION OF PREFERRED EMBODIMENT
Referring now to Figure 1, there is shown a temperature indicating device 100 according to a first embodiment of the present invention including a number of layers 1 to 4. Figure 1 also shows the relative size of the various components between layers 1 and 4.
Layers 1 and 4 are formed of a polymeric film 10, 50 with layer 4 as thin as possible to ensure good heat conductivity. Layer 4 has adhesive applied to both sides 51, 52 and functions as a base layer.

Layer 3 includes a reservoir 40 of indicating material and in this embodiment reservoir 40 is blotting paper impregnated with a coloured organic compound such as a fatty acid or an alcohol or their derivatives which in this embodiment is coloured red. As an alternative to blotting paper, any form of sponge or woven or non-woven fibrous material could also be employed as the reservoir.

Layer 2 includes the wicking member 30 which is a thin sheet of blotting paper. Alternatively, any form of woven or non-woven sheet material having the required wicking properties would be suitable. In this illustrative embodiment, wicking member 30 is coloured green.

The wicking member 30 is shown as having a much larger diameter than the reservoir 40. The reservoir 40 and wicking member 30 are shown as being circular with the reservoir 40 being located centrally with respect to the wicking member 30.

As referred to previously, layer 1 is a non-transparent polymeric film 10 forming a barrier layer and having a circular viewing aperture 11 located generally centrally with respect to layer 2. In this illustrative embodiment, viewing aperture 11 incorporates a transparent film portion 12 that does not absorb the indicating material, which functions to overlay the region of layer 2 that is exposed by viewing aperture 11. In this manner, layer 2 may be protected from contamination by the operating environment.
As would be appreciated by those skilled in the art, layer 1 incorporating transparent film portion 12 may be readily manufactured as a single layer by incorporating a transparent film underlay or overlay to layer 1. Alternatively, a transparent film, having either top or bottom adhesive surfaces, may be applied as a separate layer between layer 1 and layer 2 as part of the manufacturing process.

Referring now to Figure 2, which shows assembled temperature indicating device 100, layer 1 is located over the top of both layer 2 and layer 3 and also adheres to layer 4. In this way, the various layers are bound together with viewing aperture 11 of layer 1 located over a contact region between the wicking member 30 and reservoir 40 with the overall thickness of indicating device 100 being kept to a minimum.

In operation, on exposure to a predetermined temperature, the indicator material migrates by capillary action from reservoir 40 into the wicking member 30 and extends generally outwardly from the reservoir 40. As the indicator material is coloured red, its presence in wicking member 30 forms an indicating portion and is immediately apparent, thereby providing a rapid visual indication that the predetermined temperature has been reached. Thus the indicating device according to this embodiment provides a positive “yes” or “no” visual indication as to whether or not a particular temperature has been met.

The embodiment shown in Figures 1 and 2 employs a circular wicking member 30 in combination with a generally circular reservoir 40. Referring now to Figure 3, there is shown an indicating device 200 according to a second illustrative embodiment of the present invention where aperture 211 has been modified to be in the shape of a logo, which in this case is a tick.
device. Clearly, the logo may consist of one or more separate windows or apertures located in top layer 1 in order to make up the required logo. As would be apparent to those skilled in the art, the size, location and shape of both the reservoir (not shown) and wicking member 230 may also be adapted to correspond with that of the logo.

To manufacture the various embodiments described above, the 1st and 4th layers may be formed continuously with layers 2 to 3 being positioned either continuously or at regular intervals along the length of a continuous web or band with score lines or perforations between adjacent indicating devices so that they can be easily separated during the process of applying them for example to packaging.

During the manufacturing process, it would be necessary to maintain the various layers below the predetermined temperature which would keep the indicating material solid. The formed indicating devices will in turn need to be maintained at this lower temperature prior to application to packaging.

Once applied to the packaging, the indicating material will only become liquid and migrate within the wicking material upon the predetermined temperature being reached thereby providing a clear visual indication that this predetermined temperature has been reached.

As would be apparent to those skilled in the art, there will be a temperature gradient between the core temperature of the object to which the indicating device is attached and the air temperature surrounding the object. Accordingly, there will be a region of transition of temperature so that the surface of the object will be above the temperature of the core of the object but below the temperature of the surrounding air mass. Accordingly, the actual
predetermined temperature can be proportionally lower to take into account the likely temperature gradient.

In the previously described embodiments, the indicating device will respond primarily to temperature changes at the surface of the object to which it is attached and to some extent the air temperature around its location. To make the indicating device more responsive to the surrounding air temperature, layer 4 may be formed from an insulating material thereby forming a heat conducting barrier between the object and the reservoir so that the indicating device becomes relatively more responsive to the air temperature around the object.

The construction process according to the above embodiments ensures that the effects of external humidity, dirt, dust and high pressure cleaning will have minimal effect on the operation of the absorbent properties of the wicking member.

A brief consideration of the above described embodiments will indicate that the present invention provides an extremely simple and economical indicating device which on attachment to an object provides a clear visual indication that an object or the surrounding environment has reached a predetermined temperature. The device can be readily manufactured as a continuous tape for ease of application to multiple objects. Additionally, as the viewing aperture of the indicating device can be formed in the shape of a corporate logo or the like, the indicating device may also be used as a trade mark indicator with regard to the object it is applied to.

Although a preferred embodiment of the method and system of the present invention has been described in the foregoing detailed description, it will be
understood that the invention is not limited to the embodiment disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the scope of the invention as set forth and defined by the following claims.
THE CLAIMS:

1. An indicating device for displaying the temperature history of an object including:
   a reservoir of indicating material secured with respect to said object, said
   indicating material being solid below a predetermined temperature and liquid at or
   above said predetermined temperature;
   a wicking member arranged in contact with said reservoir so that said
   indicating material migrates from said reservoir when in liquid form through said
   wicking member thereby altering a visual appearance of an indicating portion of said
   wicking member; and
   a barrier layer substantially overlaying and in contact with said wicking
   member, wherein said barrier layer includes a viewing aperture to view said
   indicating portion of said wicking member.

2. The indicating device as claimed in claim 1, wherein said viewing aperture is
   located over a contact region of said wicking member that is in contact with said
   reservoir.

3. The indicating device as claimed in claim 1 or 2, wherein said viewing
   aperture includes a substantially transparent film portion that does not absorb the
   indicating material.

4. The indicating device as claimed in claim 3, wherein said substantially
   transparent film portion is formed as a transparent underlay or overlay to said
   barrier layer.

5. The indicating device as claimed in any one of the preceding claims, wherein
   said wicking member and said indicating material are of highly contrasting colours
   and wherein said visual appearance of said indicating portion is altered due to the
   presence of the colour of said indicating material in said wicking member.
6. The indicating device as claimed in any one of the preceding claims, wherein migration of said indicating material when in liquid form is caused by capillary action acting on the indicating material.

7. The indicating device as claimed in any one of the preceding claims, wherein said reservoir includes a porous material that is able to absorb or hold the indicating material.

8. The indicating device as claimed in claim 7, wherein said porous material is saturated with said indicating material and said wicking member is located over said reservoir.

9. The indicating device as claimed in claim 8, wherein said reservoir is secured to a base layer and wherein said base layer includes an adhesive backing for attachment to said object.

10. An indicating device as claimed in claim 9, wherein said wicking member is also secured to said base layer.

11. The indicating device as claimed in any one of the preceding claims, wherein said reservoir is located approximately centrally with respect to said wicking member and said viewing aperture.

12. The indicating device as claimed in any one of the preceding claims, wherein said viewing aperture is shaped in the form of a logo or device.

13. The indicating device as claimed in claim 12, wherein said logo or device includes a plurality of windows in said barrier layer.

14. A continuous tape of temperature indicating devices, said continuous tape including a plurality of individual indicating devices according to any of the preceding claims spaced apart along a continuous web.
15. A temperature indicating device for displaying the temperature history of an object, said device including:

- a first base layer having an adhesive surface for attachment to said object;
- a second layer incorporating a reservoir of indicating material, said indicating material being solid below a predetermined temperature and liquid at or above said predetermined temperature;
- a third layer including a wicking member arranged in contact with said reservoir so that said indicating material migrates from said reservoir when in liquid form through said wicking member thereby altering the visual appearance of an indicating portion of said wicking member; and
- a fourth layer substantially overlaying and in contact with said wicking member, wherein said fourth layer includes a viewing aperture to view said indicating portion of said wicking member.

16. The temperature indicating device as claimed in 15, wherein said viewing aperture includes a substantially transparent film portion that does not absorb the indicating material.

17. The temperature indicating device as claimed in claim 16, wherein said substantially transparent film portion is formed as a transparent underlay or overlay to said barrier layer.

18. The temperature indicating device as claimed in any one of claims 15 to 17, wherein said wicking member and said indicating material are of highly contrasting colours and wherein said visual appearance of said indicating portion is altered due to the presence of the colour of said indicating material in said wicking member.

19. The temperature indicating device as claimed in any one of claims 15 to 18, wherein migration of said indicating material when in liquid form is caused by capillary action acting on the indicating material.
20. The temperature indicating device as claimed in any one of claims 15 to 19, wherein said reservoir includes a porous material that is able to absorb or hold the indicating material.

21. The temperature indicating device as claimed in claim 20, wherein said porous material is saturated with said indicating material and said wicking member is located over said reservoir.

22. The temperature indicating device as claimed in any one of claims 15 to 21, wherein said first base layer includes an adhesive front surface for securing the second, third and fourth layers.

23. The temperature indicating device as claimed in any one of claims 15 to 22, wherein said reservoir is located approximately centrally with respect to said wicking member and said viewing aperture.

24. The temperature indicating device as claimed in any one of claims 15 to 23, wherein said viewing aperture is shaped in the form of a logo or device.

25. The temperature indicating device as claimed in claim 24, wherein said logo or device includes a plurality of windows in said fourth layer.

26. A continuous tape of temperature indicating devices, said continuous tape including a plurality of individual temperature indicating devices according to any one of claims 15 to 25 spaced apart along a continuous web.
Fig 3