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(54) **Temperature-responsive screen to detect malformations in the breast**

(57) A temperature-responsive screen 5 to detect anomalous conditions or malformations in the human breast comprises a supporting plate A of flexible material provided on at least one of its surfaces with a thermosensitive layer A1 consisting of liquid crystals held in place by a flexible binder whose thermal properties are similar to those of the human skin. The liquid crystals may be cholesteric and/or smectic and/or nematic type and may be mixed in suitable proportions to provide different colourings at different body temperatures in the range of 30 to 42°C. A thermally conductive film A3 may be securely applied to the thermosensitive layer A1 to product said layer and to allow disinfection of the screen.

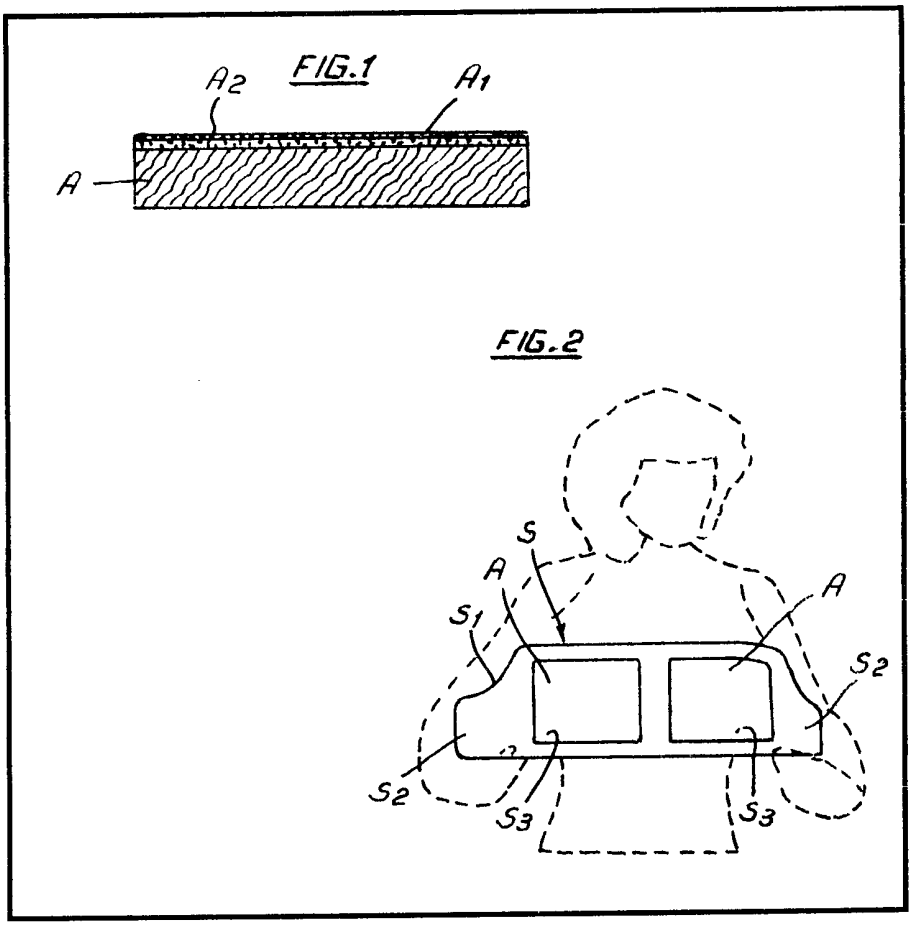

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FIG.1

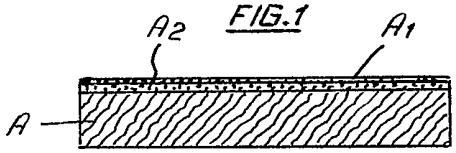


FIG.5

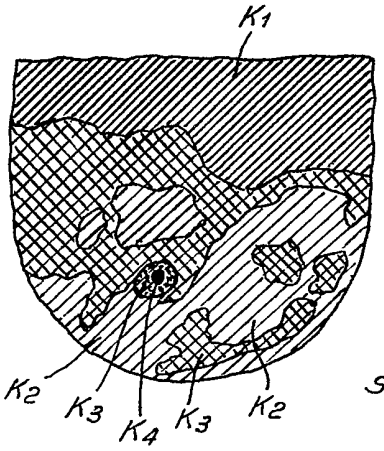


FIG.2

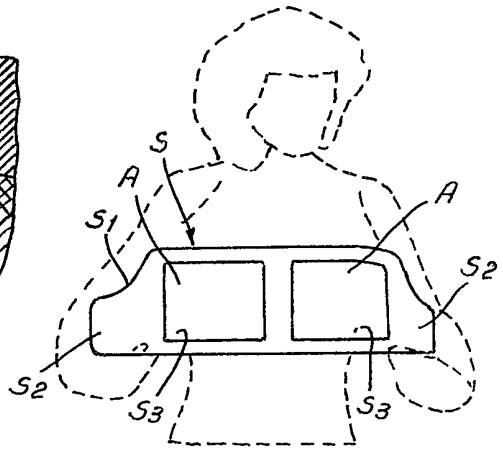


FIG.3

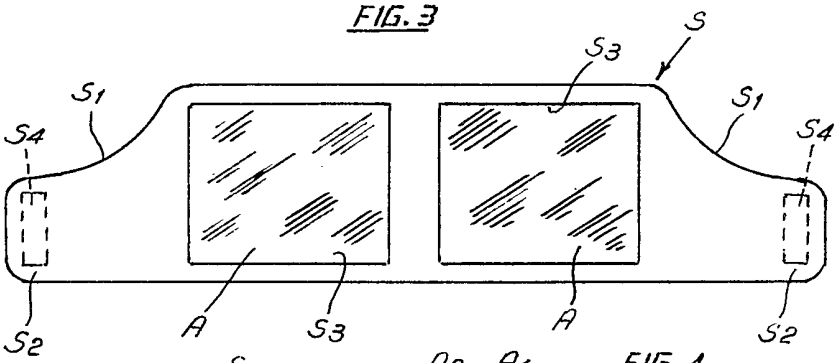
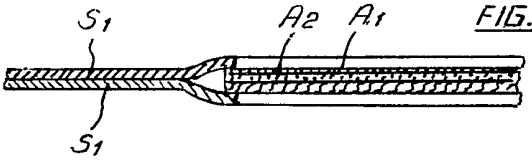


FIG.4



SPECIFICATION

Thermographic screen to detect malformations in the breast

This invention relates to a screen to detect thermographically anomalous conditions or malformations of the human breast, such as cysts, adenomas, mastitis, etc.

The object of the invention is to provide a screen by means of which any person may easily detect the thermal topography of his own breast to reveal the onset or incipience of certain anomalous conditions, even of a serious nature.

In particular the invention proposes to place any person in the position to determine the thermal distribution in the breast in order to ascertain the presence or not of an asymmetric or altered thermal status, usually determined by neoplastic conditions and to enable said person to immediately and promptly seek medical assistance to avoid the progress of the condition and its consequences.

The screen according to the invention consists of a plate of transparent flexible material and is characterized in that one of its surfaces is provided with a heat sensitive layer of liquid crystals held in place by a suitable bonding material so that by placing the screen in contact with the part of the breast desired, the heat of said part is collected and the different colouring imparted to the plate as a function of the temperature of said parts, reveals the altered or anomalous area.

One advantageous version of the screen for thermographic examination of both breasts embodies a support of flexible material provided with a zone which holds thermosensitive layers to be thus simultaneously applied on both breasts.

The ends of the flexible support are provided with suitably shaped hollows forming extensions or wings which, when held firmly in the armpits, ensure correct positioning of the screen on the breast during the thermographic test.

In order to protect the thermically sensitive layer, said layer is covered with a fine transparent film, which is also thermically conductive, as well as allowing the cleaning and disinfecting of the layer, when conditions of use require it.

The invention will now be described in detail, in conjunction with the annexed drawings, which illustrate, by way of example, some advantageous forms of embodiment of the screen according to the invention. In the drawings:

Figure 1 is a cross section on an enlarged scale of a simplified version of the screen.

Figure 2 shows the use of a version of the screen for simultaneous thermographic examination of both breasts.

Figure 3 is an elevated view of the screen of Fig. 2.

Figure 4 is a detailed cross section, on an englarged scale, of the screen shown in Fig. 3.

Figure 5 illustrates in the conventional manner the thermographic image of a breast obtained with the screen according to the invention, in which the differently coloured areas are identified with different dash patterns.

With reference to Fig. 1 in the drawing, the thermographic screen shown consists of a flexible transparent plate A of non-toxic, anti-allergic material having thermal properties similar to those of the human skin. One of the surfaces of said plate is provided with a layer A1 of liquid crystals held in a suitable binder to ensure adequate adhesion and flexibility of said layer to said plate A. The flexible plate thus obtained can be conveniently applied and made to adhere to the breast by applying an adequate pressure without deforming or damaging the crystals permanently.

In view of the particular conditions of use of the screen, the thermosensitive plate A is covered by a thin film A2 of a transparent, thermoconductive material. The plate A is thus effectively protected and, in particular, the cleaning and disinfecting of the screen, carried out by usual means, is allowed.

Depending on the thermal field explored in each case, and the chromatic intensity to be achieved, chlolesteric and/or smetic and/or nematic crystals, in the proper proportions, are used for layer A1.

It is thus possible to obtain a range of colours that may vary more or less intensely within the temperature range of 25 to 48°C, from black to dark blue and successively red, brown, yellow and green.

With reference to Figs. 2 thru 4, the screen shown consists of a support S of suitable flexible material, for example, cloth, paper, etc., which forms a strip provided at its ends with suitably shaped hollows S1 which form wings S2, conveniently engageable with the armpits of the user.

If required, the extremities of said wings S2 can be provided on their rear surfaces with zones S4 which may in turn be provided with self adhesive strips to secure screen S in position during the themographic test.

In the case shown, supporting strips S consist of two overlapping elements S and S′, the mid part of which is provided with two square apertures S3 each of which is apt to hold the edges of a flexible plate A, which closes said apertures. Obviously, the supporting strip may consist of one element only and, in this case, flexible plates A are secured to the edges of apertures S3 either by adhesives or welding or also by securing a frame to the edge of each aperture S3. Flexible plate A is transparent and its lower face, coming into contact with one of the breasts, is provided with a layer A1 consisting of suitable material

obtained from a solution with liquid crystals in suspension in micro-capsules. The crystals have different thermal sensitivities which enables them to change colour in a given temperature range comprised between 25°C and 48°C.

In fact, when the liquid crystals are exposed to the above considered temperatures, they change their colour more or less intensely starting from black, to dark blue and successively red, brown, yellow and green.

In view of the fact that plates A having thermosensitive layers A are flexible, it is possible and advantageous to realise screen S in one only piece of transparent, flexible material, applying to said screen, in the appropriate positions, the two zones of crystals A1. These zones are then protected with said transparent film A2 which are made to adhere to said layer, thus allowing good thermic contact, whilst the epidermic contact surfaces can be easily and properly cleaned and disinfected.

From the above description, the use of the screen described is evident; as shown in Fig. 1, the user applies screen S so that the flexible plates fully cover the breasts with slight compression, whilst wings S2 are held firmly under the armpits. The contact of the breasts with film A reveals, by different colouring, the temperature of the zone involved.

Breast malformations or anomalous conditions in general can be detected conveniently in the manner above described by any person by setting the screen on the breast, causing it to adhere by applying a slight pressure and securing it under the armpits or by means of adhesion strips S4.

The presence of a thermally differentiated area in the breast indicates an anomalous status or condition revealed comparatively by a different colouring with respect to that of the corresponding zone of the other breast.

As it can be observed in Fig. 5, the following differently coloured zones can be identified: a first zone K1 prevailing over the other zones is affected exclusively by ambient temperature (18–20°C) and presents a dark colouring; a second zone K2 consisting of a plurality of reddish zones, reveals normal body temperature (35–37°C)—these elementary zones are marked by edges gradually fading into yellow—; a third zone K3, with secondary zones all coloured in blue, where the center part is bright blue gradually fading into yellow and reddish toward the edges, donates temperatures comprised between 37 and 42°C.

Fig. 5 also shows, in conventional form, an outstanding dark coloured zone K3 circumscribed by a light halo K4 indicating an epithelioma.

It follows that depending on the smaller or greater area involved by the thermogram, it is possible to detect anomalous zones through the difference in colouring in different phases or simultaneously, with respect to the corresponding healthy zones (for example, different colouring of two corresponding zones in a healthy breast and diseased breast).

By simultaneous visual observation of the two thermograms of plates A, the user can easily compare the colouring of the thermograms and any differences, thereby to decide on the necessity of consulting a doctor.

It is understood that the screen may be supplied complete with instruction tables and illustrations, to facilitate recognition with a certain degree of reliability, the onset or insurgence of a malformation or anomalous condition of the breast.

CLAIMS

1. Thermographic screen to detect anomalous conditions or malformations in the human breast, characterized in that it has a supporting plate (A) of flexible material provided on at least one of its surfaces with a thermosensitive layer (A1) consisting of suitable liquid crystals held in place by a suitable binder.

2. Screen according to claim 1, characterized in that the binder for the liquid crystal layer is flexible and its thermal properties are similar to those of the human skin.

3. Screen according to Claims 1 and 2, characterized in that the liquid crystals of the thermosensitive layer are cholesteric and/or smectic and/or nematic type and that the three types may be mixed in suitable proportions to provide different colourings at different body temperatures in the range of 30 to 42°C.

4. Screen according to Claims 1 thru 3, characterized in that a thin, transparent, thermically conductive film (A3) is securely applied to the thermosensitive layer (A1) to protect said layer and to allow disinfection of the screen.

5. Screen according to Claims 1 thru 4, characterized by a support (S) in flexible material, provided with apertures (S3) and apt to hold two thermosensitive layers (A1) to allow the simultaneous application of the two layers to the breasts.

6. Screen according to Claim 5, characterized in that the flexible support (S) has, at its two ends, suitably shaped hollows (S1) forming wings (S2) which ensure correct positioning of the screen on the breasts during the thermographic examination, when held under the armpits of the user.

7. Screen according to Claim 6, characterized in that the ends of wings (S2) in flexible support (S) are provided with self adhesive zones (S4).

8. Screen according to Claims 4 thru 7, characterized in that the flexible support is provided with two apertures (S3) to hold two flexible plates (A) provided with thermo-sensi-

tive layers (A1).

9. Screen according to one or more of Claims 1 thru 8, characterized by the form of embodiment illustrated in the annexed drawing and substantially as described for the above mentioned purposes.

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