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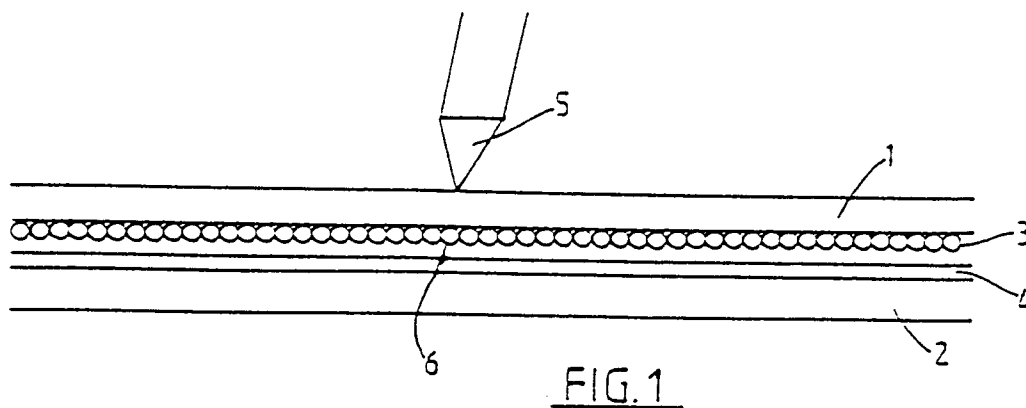
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(54) **Substrates having revealable, non visible messages.**

(57) The invention provides a substrate having an invisible message that is revealable. The substrate is formed of a recording sheet upon which is a first-image forming component that is capable of reacting with a complementary image forming component to produce a visible reaction product. The first image component is arranged on the recording sheet in a pattern corresponding to the positive or negative image of a desired message. Alternatively the recording sheet has a desensitising component on it that is arranged in a pattern corresponding to the positive or negative image of a desired message. In use, the desensitising component prevents the formation of the visible reaction product when the complementary image forming component is applied on the first image forming component.



This invention relates to a method of providing a non-visible message and to a method of revealing the non-visible message. The invention also relates to substrates that have revealable but non-visible messages printed on them.

The invention has particular application in "scratch and win" type of competitions and lotteries. At present, and one example of this is the "Instant Kiwi" lottery in New Zealand, the message is printed on a ticket and an opaque film is applied over the printing. Once the ticket has been sold, the message (usually in the form of numbers) is revealed by scratching off the surface film. These tickets work well but are relatively expensive to produce. Also the films are susceptible to damage when the ticket is bent or abraded.

It is an object of the invention to provide a substrate on which non-visible messages, that can be later revealed, are incorporated. It is also an object to provide a method of producing non-visible messages which can later be revealed.

Accordingly, this invention provides a substrate comprising:

a recording sheet;
a first-image forming component on the recording sheet, the first image forming component being capable of reacting with a complementary image forming component to produce a visible reaction product; and

the first image component being arranged on the recording sheet in a pattern corresponding to the positive or negative image of a desired message or the substrate having a desensitising component on the recording sheet in a pattern corresponding to the positive or negative image of a desired message, the desensitising component preventing the formation of the visible reaction product when the complementary image forming component is applied on the first image forming component.

Preferably the first image forming component is a dye component that is chemically reactive and colourless and that is encapsulated in a plurality of microcapsules on the recording sheet. The dye component may be any suitable chromogenic compound that is capable of changing from a colourless form to a coloured form on contact with an acidic substance.

The microcapsules may be formed of a shell or wall of polymeric material. The microcapsules may range from 0.1 microns to 500 microns in diameter.

The first image forming component may also be in the form of a coating containing a dye precursor that is capable of reacting with a complementary dye component. A coating of a phenolic resin or of a reactive clay would be a suitable example.

The complementary image forming component can be applied to the substrate by means of a suitable dispensing means; for example a writing instrument.

In another embodiment the recording sheet may

be a plain paper sheet. The first-image forming component is then printed on the plain paper sheet in a pattern corresponding to the positive or negative image of a desired message. Then, when the complementary image forming component is applied to the substrate, the components react to make the message visible.

The invention also provides a message forming kit comprising, in combination, a dispensing means containing a complementary image forming component and a substrate as described above. The invention also provides a method of providing a non-visible message which can later be made visible, the method comprising:

(i) providing a substrate that has a first-image forming component on it, the first image forming component being capable of reacting with a complementary image forming component to produce a visible reaction product; and

(ii) applying a desensitising component on the substrate in a pattern corresponding to the positive or negative image of a desired message, the desensitising component preventing the formation of the visible reaction product when the complementary image forming component is applied on the first image forming component.

In another aspect, the invention provides a method of providing a non-visible message which can later be made visible, the method comprising:

(i) providing a substrate upon which a first-image forming component may be sprayed or printed; and

(ii) spraying or printing a first-image forming component on the substrate in a pattern corresponding to the positive or negative image of a desired message.

The invention also provides a method of revealing the message by applying a complementary image forming component over the area of the message, the complementary image forming component then reacting with the first image forming component to produce a visible message in the areas where the desensitising substance has not been applied or, when there is no desensitising component, where the first-image component has been applied.

The invention therefore provides the advantage that a desired message can be provided in invisible form relatively inexpensively with a good level of security. Also the message can be revealed simply by drawings a pen containing a complementary dye component over it.

Embodiments of the invention are now described, by way of example only, with reference to the accompanying drawings in which:

Figure 1: shows a conventional form assembly;

Figure 2: is a cross-sectional view of a carbon front (CF) sheet having a desensitising layer applied on it;

Figure 3: is a plan view of figure 2;

Figure 4: is a cross section taken along A-A of figure 3 showing the application of a complementary image forming component to produce a visible message;

Figure 5: shows a carbon back (CB) sheet;

Figure 6: shows a further carbon front (CF) sheet; and

Figure 7: shows another carbon front (CF) sheet.

Figure 1 illustrates a conventional carbonless copying system. The system has a top sheet 1 that has microcapsules 3 coated on its back surface. The microcapsules 3 contain a dye precursor that is initially colourless (or at least is of neutral colour) but that is chemical reactive to form a colour. The top sheet 1 is known as a "carbon back" sheet in the art.

The lower sheet 2 contains a coating 4 on its front surface. The coating 4 includes a dye component that is capable of reacting with the dye precursor contained in the microcapsules 3 to form a colour. Usually the coating 4 contains a phenolic resin or a reactive clay. The bottom sheet 2 is referred to in the art as a "carbon front" sheet. When the two sheets are placed in a manifold form assembly, the top sheet 1 is arranged above the bottom sheet 2 with the coated surface of the top sheet 1 adjacent the coating 4 of the bottom sheet 2. When pressure is applied to the top sheet 1 (for example by means of a pen 5) this causes the microcapsules 3 beneath the point of applied pressure to break. The dye precursor contained in the microcapsules 3 is then released to react at area 6 with the dye component in the coating 4 on the bottom sheet 2. The reaction of the dye precursor and the dye component of the coating 4 produces a visible or coloured liquid on the coating 4 which later dries. In this way a copy of a message written on the top sheet 1 is produced on the bottom sheet 2.

The microcapsules 3 generally comprise a core of fill material surrounded by a wall or shell of polymeric material. The fill material is thus enveloped within generally continuous polymeric walls. The microcapsules 3 may range from about 0.1 to 500 microns in diameter.

Referring now to figure 2, a first embodiment of a substrate 8 containing a non visible message is illustrated. The substrate 8 is formed of a sheet 10 that has a coating of microcapsules 11 on one of its surfaces. The sheet 10 therefore corresponds to the carbon back sheet 1 illustrated in figure 1 but in this case would be a carbon front sheet.

The microcapsules 11 contain a suitable complementary dye component that is initially non-visible against its background but which is capable of chemically reacting with a dye precursor to become visible. Examples of complementary dye components include crystal violet lactone, benzoyl leucomethylene blue, rhodamine, lactam, p-toluene, sulphinate of Michler's hydrol, and any of the various chromogenic com-

pounds that are capable of changing from a non-visible form to a coloured form on contact with an acidic substance.

The complementary dye component is encapsulated in microcapsules 11 and the microcapsules 11 are bound to the sheet 10 in a known manner. Suitable binder materials, such as polyvinyl alcohol binders, can be used. Commercially available sheets of self-copy paper can be used. One example is the self copy paper sold by the Kanzaki Corporation of Japan under the name "Phoenix".

A layer 12 of a desensitising component is then applied on the microcapsules 11. The layer 12 is arranged in a pattern corresponding either to the negative or the positive image of a desired message. A plan view of the substrate 8 is illustrated in figure 3. This shows the message 13.

The desensitising component is not visible, against its background, to the human eye so that the message 13 formed by the layer 12 is not visible.

To reveal the message 13, a source of a dye precursor 14 is drawn across the substrate 8. Since the layer 12 contains a desensitising component, only those areas 15 of the layer of microcapsules 11 that are left exposed are able to react with the dye precursor 14. If the layer 12 is arranged in a pattern corresponding to the negative image of the desired message, the message 13 itself will appear coloured. Alternatively if the layer 12 is arranged in the pattern corresponding to the positive image of the message, the background will be coloured and hence the message 13 will become inversely visible.

The desensitising component may be any substance which prevents reaction between the complementary dye component contained in the microcapsules 11 and the dye precursor 14. This can be done by chemically neutralizing the dye precursor 14 or the complementary dye component in the microcapsules 11 or by using a substance which is impervious to one or the other dye component to stop them from coming into contact. A suitable example of a desensitising component that prevents reaction is a mixture of a desensitizing ink sold by the Kanzaki Corporation of Japan under the name "Phoenix", a desensitizing ink sold by Morrison Printing Inks and Machinery Limited of Auckland, New Zealand and an ethylenediaminetetraacetic acid filler. The filler is used in the mixture to reduce the browning of the desensitizing component which would make the image visible. Other fillers to give a matt appearance may also be used.

The dye precursor 14 can be selected from known components such as clays, treated clays, aromatic carboxylic acids such as salicylic acid, derivatives of aromatic carboxylic acids and their metal salts, phenolic developers, acidic polymeric material such as phenol-formaldehyde polymers, and metal-modified phenolic resins. Numerous other examples

are available and are known.

The dye precursor 14 may be contained in a pen 16, similar to a felt tipped pen. The pen 16 releases the dye precursor 14 so that it can react with the complementary dye component in the microcapsules 11. It will be appreciated that the pen will also contain a solvent in which the dye precursor 14 is carried in suspension or dissolved.

The pen 16 may be a pen commonly used in the industry to check whether or not a carbon front sheet is in operational condition. Alternatively the dye precursor 14 can be applied using rollers, sprayers, or other dispensing means. This is particularly the case where large messages are to be recovered.

Referring to figure 5, another embodiment is shown. In this embodiment, the layer 17 that contains the desensitising component is applied to the surface of the sheet 18 opposite to the surface upon which the microcapsules 21 are applied. The desensitising component in the layer 17 soaks through the sheet 18 and desensitises the complementary dye component in the microcapsules 21. The dye precursor 14 is absorbed by the sheet 18 and reacts with the complementary dye component contained in the microcapsules 21 in the areas 20 where the layer 17 is not applied. Therefore a visible reaction product is produced in areas approximate to area 20.

Referring to figure 6, an embodiment corresponding to a carbon front sheet is illustrated. In this embodiment, the sheet 22 has a coating 23 that contains a dye precursor (previously referred to as the dye precursor 14). The dye precursor can be bound on the sheet 22 by using a suitable binder, for example a starch/latex binder can be used to adhere the dye precursor to the sheet 22. A layer 24 of a desensitising component is then applied over the coating 23 as described previously.

Although the layer 24 is illustrated as a layer separate from the coating 23, this is done for ease of illustration. The desensitising component can be absorbed into the coating 23 so that only a single layer or coating will appear to be present.

A complementary dye component (that would have been contained in the microcapsules in the embodiment illustrated in figure 2) can then be applied to the substrate 32 to produce a message in the manner described previously. A pen 25, similar to the pen 16 illustrated in figure 4, may be used to apply the complementary dye component.

A further embodiment of a carbon front substrate is illustrated in figure 7. In this embodiment, the layer 27 of the desensitising component is applied to the surface of the sheet 28 opposite the surface to which the coating 29 containing the dye precursor is applied. The sensitising component in the layer 27 will be absorbed through the sheet 28 to react with the dye precursor in the coating 29. Thus when a pen 30 containing the complementary dye component is drawn

over the coating 29 (or over the surface of the sheet 28 containing the layer 27), the complementary dye component reacts with the dye precursor as described previously.

In all embodiments, an ink pattern may be printed or sprayed on the substrate to assist in diffusing and hiding the dye component and the desensitising component.

In a further embodiment, a CF ink (for example the ink sold under the trademark "OPAS" by the Mead Corporation of the USA) is printed on a plain paper substrate in a pattern corresponding to the positive or negative image of a desired message. An ink pattern may also be printed onto the substrate to assist in diffusing and hiding the CF ink. To reveal the message, a dye component complementary to the CF ink is drawn across the sheet to reveal the message. Hence, in this embodiment, a desensitising component is not required since only those areas of the sheet that are coated by the CF ink become coloured. In this embodiment the complementary dye component (being the CF ink) can be viewed as a sensitising component.

The sheets upon which the dye components are applied can be any suitable sheets. For example paper, card, plastics and the like. The type of sheet used will be dictated by the function to which the substrate is put.

Plainly the message can be in the form of writing, numbers, logos, devices and the like.

An example of a specific substrate produced in accordance with the invention is now described.

A commercially available carbon front paper, in plain white, was obtained from the Kanzaki Corporation of Japan. This paper is sold under the name "Phoenix". A desensitizing ink mixture was then sprayed or printed on the face of the paper that contained the carbon front complementary dye component. The desensitizing ink mixture comprised 70 parts by weight of "Phoenix" desensitizing ink and 65 parts by weight of Morrison Constat trans white ink (an ink base sold by Morrison Printing Inks and Machinery Limited that includes 25 parts by weight of an ethylenediaminetetracetic filler and 10 parts by weight of a matt filler [for example the filler sold under the trademark "Syloid"]). A conventional blue ink was used to print a pattern on the same surface of the carbon front paper to further defuse and hide the desensitizing inks. The message was revealed by drawing across the carbon front paper a conventional felt-tipped pen that contains dye precursors, complementary to the dye components in the carbon front paper.

In this instance, the dye precursor reacted to produce a blue colour.

Claims

1. A substrate comprising: a recording sheet (10, 18, 22, 28); and a first-image forming component (11, 21, 23, 29) on the recording sheet, the first image forming component (11, 21, 23, 29) being capable of reacting with a complementary image forming component (14) to produce a visible reaction product; characterised in that (i) the first image component (11, 21, 23, 29) is arranged on the recording sheet in a pattern corresponding to the positive or negative image of a desired message or (ii) the substrate has a desensitising component (12, 17, 24, 27) on the recording sheet (10, 18, 22, 28) that is arranged in a pattern corresponding to the positive or negative image of a desired message, the desensitising component (12, 17, 24, 27) preventing the formation of the visible reaction product when the complementary image forming component (14) is applied on the first image forming component (11, 21, 23, 29).

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2. A substrate according to claim 1 in which the first image forming component (11, 21) is a dye component, preferably a chromogenic compound, that is chemically reactive and colourless and that is encapsulated in a plurality of microcapsules coated on a surface of the recording sheet (10, 18).

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3. A substrate according to claim 1 in which the first image forming component (23, 29) is a dye precursor, preferably a phenolic resin or a reactive clay, in the form of a coating applied to one surface of the recording sheet (22, 28).

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4. A substrate according to any of claims 1 to 3 in which a layer of desensitising component (12, 24) is arranged on the same surface of the recording sheet (10, 22) as the first image forming component (11, 23).

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5. A substrate according to any of claims 1 to 3 in which a layer of desensitising component (17, 27) is arranged on the surface of the recording sheet (18, 28) opposite to that on which the first image forming component (21, 29) is arranged.

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6. A substrate according to claim 1 which comprises the recording sheet (10, 18, 22, 28) and the first-image forming component (11, 21, 23, 29) arranged in a pattern on the recording sheet (10, 18, 22, 28) corresponding to the positive or negative image of a desired message.

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7. A substrate according to claim 6 in which the first-image forming component (11, 21, 23, 29) is a carbon front ink.

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8. A message forming kit comprising a substrate according to any of claims 1 to 7 and dispensing means (16, 19, 25, 30) for dispensing the complementary image forming component (14).

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9. A kit according to claim 8 in which the dispensing means (16, 19, 25, 30) is a felt-tipped pen containing the complementary image forming component (14) in a solvent.

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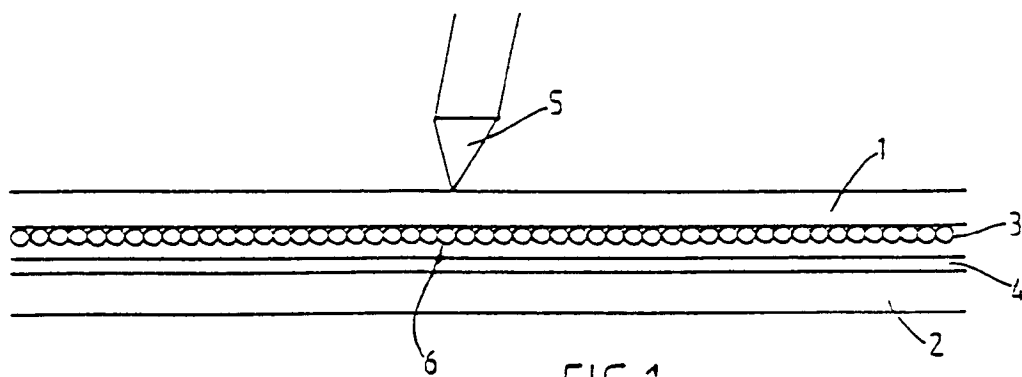


FIG. 1

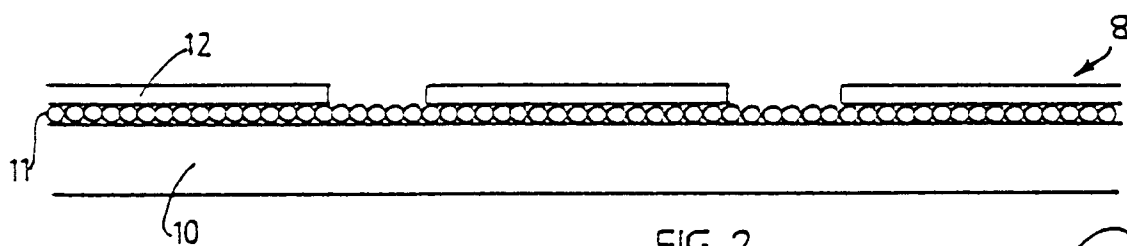


FIG. 2

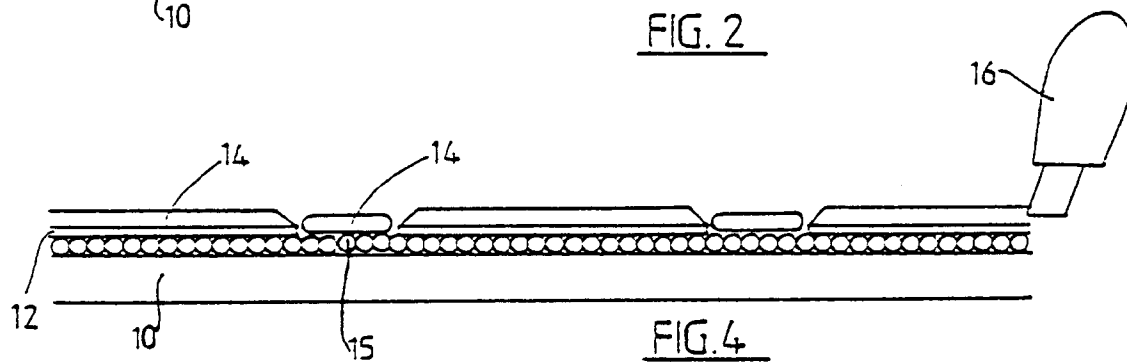


FIG. 4

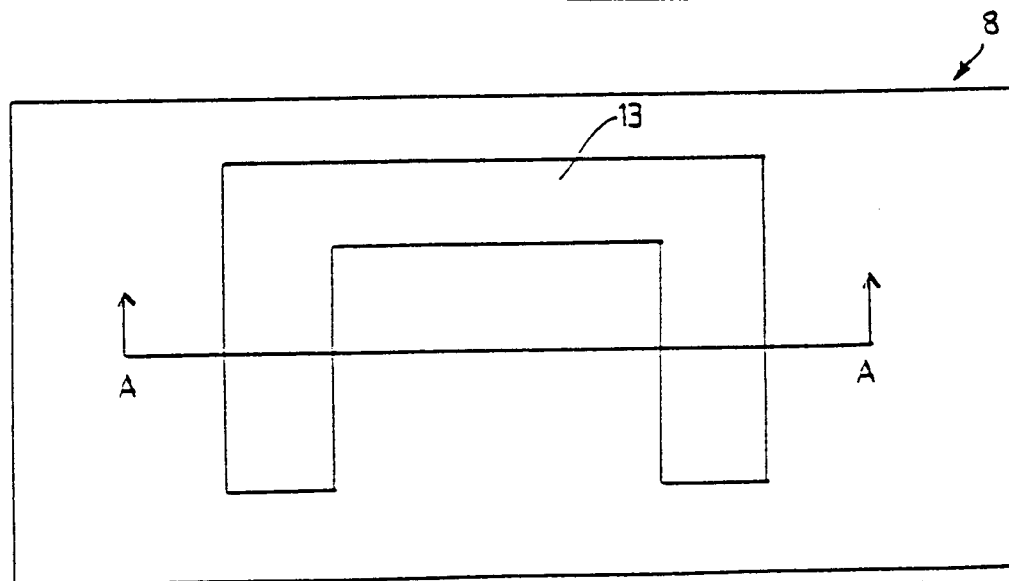


FIG. 3

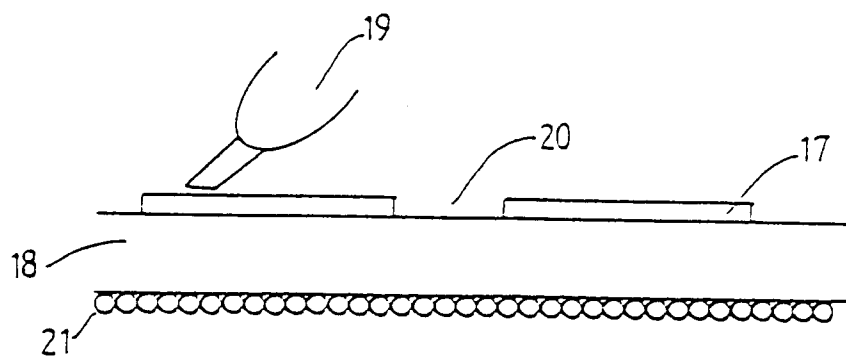


FIG. 5

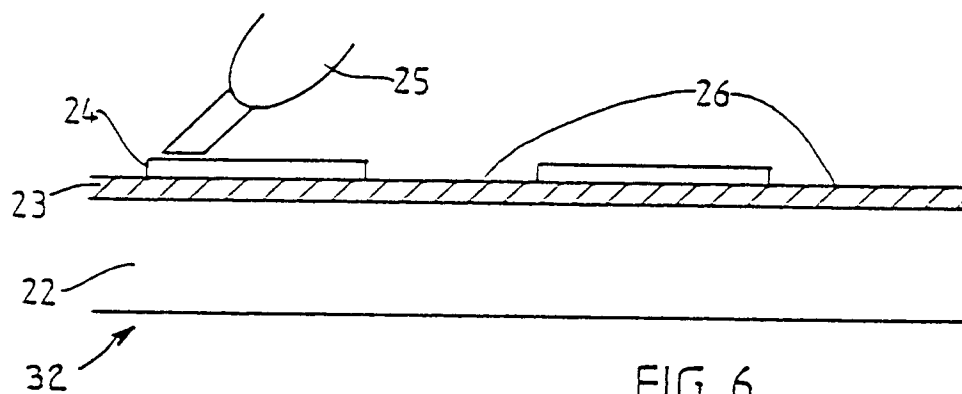


FIG. 6

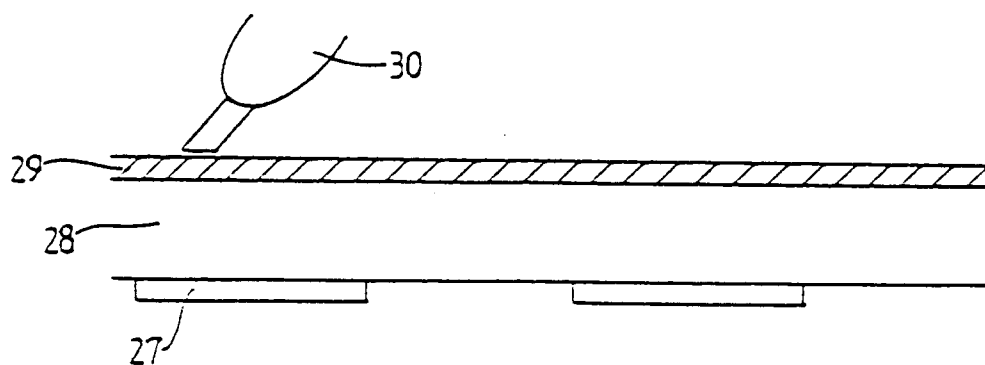


FIG. 7