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(71) Applicant: **Hawes Signs Limited**
Northampton NN3 6EU (GB)
(72) Inventor: **Fitzhugh, Robert**
Moulton Park Northampton NN3 6EU (GB)
(74) Representative: **Hedges, Martin Nicholas**
A.A. Thornton & Co.
235 High Holborn
London WC1V 7LE (GB)

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(54) **Edge illuminated signs**

(57) An illuminating sign (1) comprising a solid core (2) of at least translucent material, said core (2) having a front face, a rear face, sides (5) extending between said front and rear faces, and at least one channel (8) formed in the rear face, an at least partially reflective front covering (4) on the front face of the core (2), and at least partially reflective backing plate (3) attached to the rear face of the core (2) so as to overlie the at least one chan-

nel (8), and a plurality of LEDs (7) mounted on the backing plate (3), said LEDs (7) locating in said at least one channel (8) in the core (2) and being thermally connected to the backing plate (3) such that they can transmit heat thereto, wherein light from the LEDs (7) is transmitted into the core (2) from the at least one channel (8) and is emitted from at least the sides (5) of the core (1) in a diffused manner.

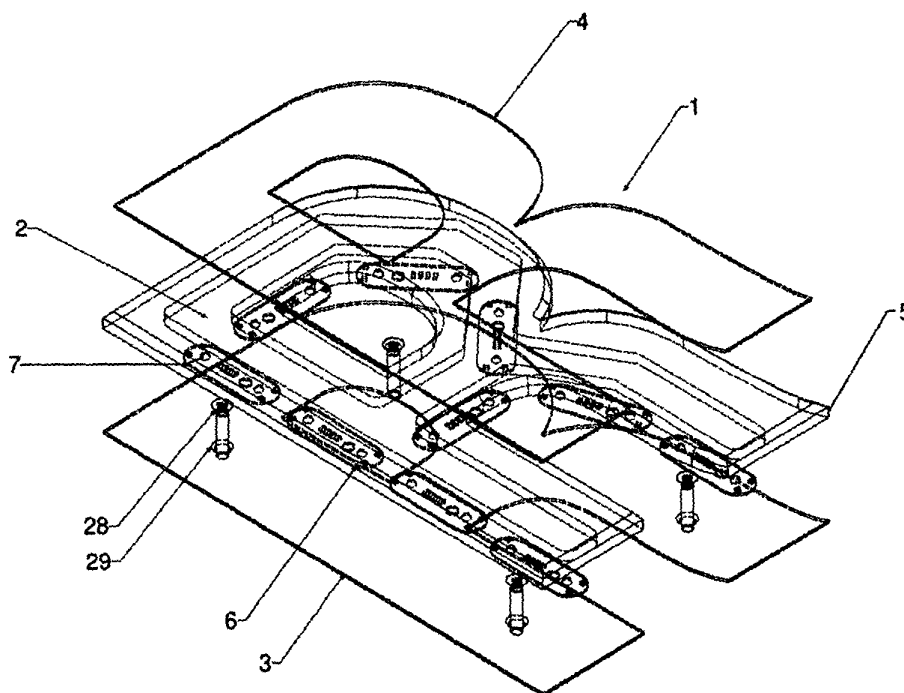


Figure 1A

Description

[0001] The present invention relates to edge illuminated signs.

[0002] Edge illuminated signs which use fluorescent tubes are well known, but typically suffer from the disadvantage that they are bulky, cannot be mounted flush with a surface, and are not reliably weatherproof. LEDs have therefore been used as an alternative light source due to their compactness, but their point source characteristic and mounting requirement tend to limit the shapes with which they can be used and the lighting effects achieved. It is therefore an object of the present invention to provide an edge illuminated sign that is both compact, weatherproof and evenly illuminated.

[0003] According to the present invention there is provided an illuminating sign comprising a solid core of at least translucent material, said core having a front face, a rear face, sides extending between said front and rear faces, and at least one recess formed in the rear face, an at least partially reflective front covering on the front face of the core, and at least partially reflective backing plate attached to the rear face of the core so as to overlie the at least one recess, and a plurality of LEDs mounted on the backing plate, said LEDs locating in said at least one recess in the core and being thermally connected to the backing plate such that they can transmit heat thereto, wherein light from the LEDs is transmitted into the core from the at least one recess and is emitted from at least the sides of the core in a diffused manner.

[0004] An illuminated sign in accordance with the invention has the advantage that, due its utilisation of integrated LEDs in combination with an effective heat sink, it can be compact and weatherproof. Furthermore, a substantial percentage of the light transmitted from the LEDs through the core is internally reflected within said core, substantially between the partially reflective front covering and back plate, before it is emitted therefrom. Thus, in this way, the light transmitted from the LEDs is emitted from at least the sides of the core in a diffused manner such that an effective, evenly spread illumination pattern is produced which is at least as acceptable as that produced by such signs incorporating florescent tube lights.

[0005] Preferably, the substantially transparent core is made of opal translucent acrylic (although clear and coloured acrylic can be used), which aids light diffusion, is advantageously light and easy to manufacture compared to alternatives such as glass, and the at least one recess desirably extends proximate to the boundaries of the back face of the core such that plurality of LEDs can be located proximately to the sides of the core and the light emitted therefrom can be efficiently emitted from at least the sides of said core. Furthermore, the surfaces of the core are then polished or abraded such that the transparency of the core is reduced in a manner that causes increased diffusion of the light before it is emitted from said core, which, in turn, produces more evenly spread illumination.

[0006] With the use of clear acrylic a particularly desirable effect is achieved by buff polishing each side of at least one recess which does not face towards the core's front face so that less light passes through said sides. In this way, a substantial proportion of the light that is emitted by the LEDs and is incident on said sides tends to be reflected therefrom rather than transmitted there-through, leading to a higher percentage of the light emitted by the LEDs entering the body of the core via an un-buffed face of the at least one recess rather than said sides, said un-buffed face facing towards the front face of the body. As a result, a substantial percentage of the light emitted from the LEDs is prevented from being transmitted through the sides of the at least one recess and directly out of at least the sides of the core. Rather, a higher percentage of the light emitted from the LEDs enters the body via said un-buffed face and can be internally reflected within the core before it is emitted therefrom, and this advantageously increases the diffusion of the light such that illumination of the sign is more evenly spread.

[0007] Alternatively, however, the sides of the at least one recess could instead be lined with a layer of translucent material in order to diffuse the light passing through said sides, an example of one such material being a layer of white vinyl.

[0008] Furthermore, the sides of the core are preferably abraded such that light within the material of the core that is incident thereon is more likely to be transmitted therethrough, rather than reflected back into the core, the advantage of which is that the sign is again more efficiently and evenly illuminated. Additionally, light that is transmitted through abraded surfaces is generally scattered, and this further helps to diffuse the point source nature of LEDs such that the sign is more evenly illuminated.

[0009] Preferably, the at least partially reflective covering on the core's front face is advantageously opaque, light in colour, and of high lustre/highly reflective. In this way, light landing thereon from within the core is efficiently reflected back into said core, such that it can then be emitted from at least its sides, which are subsequently more clearly illuminated. In particular, the covering can be provided by a metallic plate mounted thereon, with a high reflective surface towards the light source. However, the covering could alternatively be provided by any other substantially opaque, light and reflective material, such as white vinyl.

[0010] Likewise, the at least partially reflective back plate is also advantageously substantially opaque, light in colour, and of high lustre/highly reflective. In this way, light landing thereon from within the core is again efficiently reflected back into said core such that at least the sides are more clearly illuminated. In particular, the back plate is preferably a polished metallic plate, such as aluminium, which is not only opaque and reflective but can also act as an efficient heat sink for the LEDs. Alternatively, though, the back plate could be made of any ma-

terial that is substantially opaque, reflective and suitable for use as a heat sink for the LEDs.

[0011] Desirably, the back plate is sealingly mounted to the core using VHB (very high bonding) double-sided tape applied all around its perimeter such that the LEDs are concealed within the channel of the core in a water-tight manner, although it will again be understood that any known sealing means could alternatively be used.

[0012] Preferably, the LEDs are evenly distributed along the length or boundaries of the at least one recess. Advantageously, the LEDs are furthermore provided on at least one LED strip and are preferably mounted to the back plate using thermally conductive adhesive. In particular, the at least one LED strip is, in use, energised by an external power source, and are conveniently electrically connected to supply wires that preferably extend out of the sign via a sealed, watertight hole in the back panel, and which are suitably electrically connected to said power supply. However, it is also possible that the LEDs could, in use, be energised by a power source integrated within the sign, preferably within the concealed channel.

[0013] In a further advantageous development, the at least one recess in the core is preferably dry machined or cast, although it will be understood that any other suitable manufacturing means could alternatively be used. Furthermore, the profile of the core is desirably 20mm or less.

[0014] Preferably, the sign is mountable flush to a mounting surface and accordingly has a plurality of securing means extending from the back plate that can be driven into a mounting surface such that the sign is securely mounted. In particular, these securing means could be screws, but it will be understood that any known securing means suitable for driving the sign securely into a mounting surface could be used. Alternatively, however, it is also possible that other known mounting means could be used such as adhesives or VHB double-sided tape.

[0015] As a further alternative, the sign can also optionally be mountable proud of a mounting surface. In particular, a first part of a mounting means can, for example, be provided on the rear face of the back plate such that the sign can advantageously be detachably slotted into a second, complementary part of the mounting means that is already secured to the mounting surface.

[0016] In a preferred embodiment of the invention, the sign is shaped in the form of a single letter, character or symbol that is, in use, edge illuminated. The core of the sign is therefore advantageously shaped into at least one section forming the shape of said letter, character or symbol, and the at least one recess is desirably at least one channel just wide enough to receive the LEDs and extends substantially centrally along said at least one section of the core such that light from the LEDs located therein is emitted substantially equally from the sides of said at least one section. Alternatively, though, the at

least one channel could extend along a circuit running proximate to and along the periphery of the at least one section of the core. In a further alternative, however, the at least one recess is an at least one central recess that extends up to a boundary running proximate to and along the periphery of the at least one section of the core, the LEDs preferably being mounted proximately to said boundary.

[0017] In an advantageous development of this embodiment, light is only emitted from the sides of the core. Thus, the back plate preferably extends across the rear face of the core such that it is congruent with at least an outer perimeter thereof in order that light is not able to escape through said rear face. Likewise, the covering on its front face preferably extends across the entire surface of said front face such that light cannot escape therefrom either.

[0018] In a further advantageous development of this embodiment, the edge of the core where the core's front face joins its sides is desirably chamfered and abraded such that the resulting face promotes the exit of light therethrough in a scattered manner that is particularly pleasing to the eye.

[0019] In an alternative embodiment of the invention, the sign comprises an illuminated portion on its front face as well as being at least edge illuminated. Preferably, the covering on the front face of the core is therefore provided with two layers of vinyl applied thereon; a first layer of substantially reflective vinyl, preferably white vinyl, and a second layer of substantially opaque vinyl, preferably matt black vinyl, which is congruently applied on the first layer and has a cut-out portion formed therein through which light can escape the core, the cut-out portion for example being text or a symbol. Thus, in use, some of the light entering the core is internally reflected therein and, despite the first layer being substantially reflective, is partially transmitted therethrough in the area of the cut-out portion such that said portion is illuminated. However, it will be understood that such illumination of a portion on the front face of the core could alternatively be achieved by simply cutting text into any front covering thereon.

[0020] In an advantageous development of this alternative embodiment, the layers of vinyl are applied on the front face of the core such that a preferably even boarder portion of said front face is left uncovered and therefore partially transparent, said boarder portion being beyond the outer perimeter of the at least one recess in the core. Thus, in use, this boarder portion of the front of the sign is advantageously also illuminated in an aesthetically pleasing manner. To further improve the aesthetics of this effect, the boarder portion is preferably polished and the back plate is desirably arranged substantially congruently with the applied vinyl such that the resulting uncovered boarder portion of the rear face can be covered by an appropriately coloured, partially reflective material, such as white vinyl, that provides a suitable background to the illuminated front boarder portion.

[0021] In order that the invention may be well under-

stood, there will now be described some embodiments thereof, given by way of example, reference being made to the accompanying drawings, in which:

Figure 1A is a first exploded view of a first embodiment of the invention;

Figure 1B is a second exploded view of the embodiment shown in Figure 1A;

Figure 1C is cross-sectional view of a section of the embodiment shown in Figure 1A;

Figure 2A is a rear view of a second embodiment of the invention;

Figure 2B is a first side view of the embodiment shown in Figure 2A;

Figure 2C is a plan view of the embodiment shown in Figure 2A; and

Figure 2D is a second side view of the embodiment shown in Fig 2A.

[0022] Referring to Figs 1A-1C, there is shown a first embodiment of the invention in the form of a letter R that is edge illuminable. The sign 1 comprises a opal or clear acrylic, R-shaped core 2 having a rear face, to which an aluminium back plate 3 is mounted, a front face, to which a stainless steel face plate 4 is mounted, and sides 5 extending between the front face and the back face.

[0023] To enable illumination of the sign 1, the aluminium back plate 3, which overlies the rear face of the acrylic core 2 and is substantially congruent with the outer edge thereof, has nine LED strips 6 bonded to its front face using thermally conductive adhesive, said strips 6 each having a pair of LEDs 7 mounted thereon. Specifically, the LED strips 6 are arranged such that they are evenly distributed in an R-shape that runs substantially centrally to the boundaries of the R-shape of the acrylic core 2, and are electrically connected to supply wires that extend out of the sign via a sealed, watertight hole in the back panel, said wires, in use, being suitable for energising the LEDs 7 via an external power source.

[0024] The aluminium back plate 3 is sealingly bonded to the acrylic core 2 by VHB (very high bonding) double-sided tape applied all around its perimeter, and the acrylic core 2 accordingly includes a complementary R-shaped channel 8 milled in its rear face for receiving the LED strips 6 such that they are concealed within said recess 8 in a watertight fashion. The sides 9 of the channel 8 are buff polished whilst the front face extending between said sides 9 is un-buffed. Furthermore, the sides 5 of the acrylic core 2 are abraded and additionally chamfered at their edge adjoining the core's front face, said front face having the complementarily sized stainless steel face plate 4 bonded thereto using VHB double-sided tape, such that it is substantially congruent therewith.

[0025] Thus, in use, the external power supply energises the LEDs 7 such that they emit light. The majority of this light then enters the acrylic core 2 via the un-buffed front face of the channel 8 due to the fact that said front face is directly above the LED strips 6 and that the sides

9 of the channel 8 are buffed and therefore more likely to reflect light. Having entered the acrylic core 2, the light is then prevented from leaving via its front and rear faces by the opaque, reflective plates 3, 4 thereon, and the majority of the light is instead internally reflected until it reaches the sides 9 and chamfered edge of the core 2 where it can escape the core, said sides and edge being abraded such that they are more likely to let light pass therethrough and furthermore scatter any such light that is passed therethrough.

[0026] In this way, the point source light emitted from the LEDs 7 is substantially prevented from directly leaving the core 2 via the sides 9 of the channel 8 and is instead well diffused such that the sign 1 is evenly edge illuminated. Furthermore, the aluminium back plate 3 acts as a suitable heat sink for the LEDs, increasing their operating life expectancy.

[0027] Additionally, the sign 1 also comprises securing means such that it is mountable, said securing means consisting of four screws 28 which extend through complementary holes 29 in the back plate 3, said holes being located away from the LED strips 6 mounted thereon, and which are driveable into a mounting surface so as to secure it substantially flush thereto. Once the back plate 3 has been securely mounted in this way, the core 2 and face plate 4 can be mounted thereon using VHB double sided tape.

[0028] Of course, it will be understood that the sign 1 could alternatively take the form of any letter, character or number.

[0029] Referring to Figs 2A-2D there is shown a second embodiment of the invention in the form of a square-shaped sign 11 that is edge illuminable and also has illuminable text on its front face. The sign 11 comprises a clear acrylic, square-shaped core 12 having a rear face, to which an aluminium back plate 13 is mounted, a front face, to which two layers of vinyl 20, 21 are applied, and sides 15 extending between the front face and the back face.

[0030] To enable illumination of the sign 11, the aluminium back plate 13, which is square-shaped and arranged substantially centrally to the back face of the acrylic core 12 such that its perimeter is proximate to the edge of said acrylic core 12, has four LED strips 16 bonded to its front face, said strips 16 having a plurality of white LEDs 17 mounted thereon at regular intervals. Specifically, the LED strips 16 are arranged in the form of a square, the sides of which are proximate to and substantially parallel with the boundaries of the square-shaped back plate 13, and are electrically connected to supply wires that extend out of the sign via a sealed, watertight hole in the back plate, said wires, in use, being suitable for energising the LEDs 16 via an external power source.

[0031] The aluminium back plate 13 is sealingly bonded to the acrylic core 12 by VHB double-sided tape applied all around its perimeter, and the acrylic core 12 accordingly includes a complementary channel 18 milled in its rear face which extends along a square-shaped

circuit for receiving the LED strips 16 such that they are concealed within said channel 18 in a watertight fashion. Specifically, as in the first embodiment, the channel 18 is buff polished on each of its sides 19 but un-buffed on its front face. However, unlike the first embodiment, the second embodiment does not have a stainless steel front plate. Instead, two layers of vinyl 20, 21 are applied onto a square portion of the front face of the acrylic core 12, said square portion being substantially congruent with the perimeter of the back plate 13. Specifically, a first layer of vinyl 20 is white and an overlying second layer of vinyl 21 is opaque matt black and has a cut-out portion formed therein, in the shape of text, through which light can escape the core. Additionally, the perimeter portion 22 of the back face of the acrylic core 12 that is not covered by the back plate is instead covered with strips of white vinyl 24, the perimeter portion 23 of the front face that is not covered with vinyl is polished, and the sides 15 of the acrylic core are abraded.

[0032] Thus, in use, the external power supply energises the LEDs 17 such that they emit light. The majority of this light then enters the acrylic core 12 via the un-buffed front face of the channel 18 due to the fact that said front face is directly above the LED strips 17 and that the sides 19 of the channel 18 are buffed and therefore tend to reflect rather than transmit the light.

[0033] Having entered the acrylic core 12, the majority of the light is then internally reflected therein, via the reflective vinyl combination 20, 21 on its front face and the reflective material 13, 24 on its rear face, until it is emitted therefrom via one of the partially transparent surface. The majority of the light within the core 12 is then emitted therefrom via its edge region, either via the abraded sides 15 or via the outer portion 23 of the front face of the core, which nevertheless also emits some light despite being polished and therefore more reflective than normal. Additionally, however, some of the light that internally reflects towards the centre of the core 12, rather than its edge, is emitted via the cut-out portion in the black vinyl such that the text of the white vinyl revealed by said cut-out portion is illuminated. Indeed, whilst the white vinyl layer 20 is substantially reflective, it also allows some light to pass therethrough when there is no black vinyl thereon.

[0034] In this way, the point source light emitted from the LEDs 16 is well diffused such that the sign 11 is evenly edge illuminated, the illumination from the polished outer portion 23 of the front face of the core 12 provides an aesthetically pleasing boarder, and the text on the front of the sign 11 is illuminated. Furthermore, the aluminium back plate 13 advantageously acts as an effective heat sink for the LEDs 17, such that their operating life expectancy is significantly increased, and the strips of white vinyl 24 covering the perimeter portion 22 of the back face of the core 12 advantageously improve the aesthetics of the outer portion 23 of its front face whilst also limiting unwanted escape of light from its rear face.

[0035] Additionally, the sign 11 also comprises a first

part of a securing means by which it can be mounted to a mounting surface. Specifically, said first part comprises a first and second clear acrylic member 25, 26 bonded to the rear face of the back plate using VHB double-sided tape, said acrylic members 25, 26 forming a gap therebetween in which, in use, a second part of the securing means, which is already mounted to the mounting surface, can slot such that said first and second parts are securely mounted together in a detachable manner. Furthermore, two screw fasteners 27 extending from a central spine of the back plate, between the first and second acrylic members 25, 26, can be used to provide additional or alternative mounting support.

[0036] Finally, it will be appreciated that many different variations of the described embodiments are possible. For example, the sign could alternatively take the form of any shape and many different suitable materials could be used to cover the front and rear faces of the core.

Claims

1. An illuminating sign (1) comprising a solid core (2) of at least translucent material, said core (2) having a front face, a rear face, sides (5) extending between said front and rear faces, and at least one recess (8) formed in the rear face, an at least partially reflective front covering (4) on the front face of the core (2), and at least partially reflective backing plate (3) attached to the rear face of the core (2) so as to overlie the at least one recess (8), and a plurality of LEDs (7) mounted on the backing plate (3), said LEDs (7) locating in said at least one recess (8) in the core (2) and being thermally connected to the backing plate (3) such that they can transmit heat thereto, wherein light from the LEDs (7) is transmitted into the core (2) from the at least one recess (8) and is emitted from at least the sides (5) of the core (1) in a diffused manner.
2. An illuminating sign (1) according to claim 1, **characterised in that** the core (2) is made of acrylic.
3. An illuminating sign (1) according to claims 1 or 2, **characterised in that** the at least one recess (8) extends proximate to the boundaries of the back face of the core (2) such that the plurality of LEDs (7) can be located proximately to the sides (5) of the core (2).
4. An illuminating sign (1) according to any of the preceding claims, **characterised in that** the surfaces of the core (2) are polished or abraded such that the transparency of the core (2) is reduced in a manner that causes increased diffusion of the light before it is emitted from said core (2).
5. An illuminating sign (1) according to claim 4, **characterised in that** each side (5) of the at least one

recess (8) which does not face towards the front face of the core (2) is either buff polished or lined with a layer of translucent material; and/or the sides (5) of the core (2) are abraded.

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6. An illuminating sign (1) according to any of the preceding claims, **characterised in that** the at least partially reflective front covering (4) and/or the at least partially reflective back plate (3) is substantially opaque, light in colour, and of high lustre, the at least partially reflective front covering (4) preferably being a metallic plate or white vinyl and the at least partially reflective back plate (3) preferably being a polished metallic plate, which is opaque and reflective and also acts as an efficient heat sink for the LEDs (7). 10 15
7. An illuminating sign (1) according to any of the preceding claims, **characterised in that** the profile of the core (2) is less than or equal to 20mm. 20
8. An illuminating sign (1) according to any of the preceding claims, **characterised in that** the core (2) is shaped into at least one section forming the shape of a letter, character or symbol. 25
9. An illuminating sign (1) according to any of the preceding claims, **characterised in that** the edge of the core (2) where its front face joins its sides (5) is chamfered and abraded such that the resulting face promotes the exit of light therethrough in a scattered manner. 30
10. An illuminating sign (1) according to any of the preceding claims, **characterised in that** a portion of the front covering (4) is cut out, preferably in the form of text or a symbol, such that the sign comprises an illuminated portion on its front face as well as being at least edge illuminated. 35
11. An illuminating sign (1) according to claim 12, **characterised in that** the front covering comprises two layers of vinyl (20, 21); a first layer (20) of substantially reflective vinyl, and a second layer (21) of substantially opaque vinyl, which is congruently applied on the first layer and has the cut-out portion formed therein through which light can escape the core. 40 45

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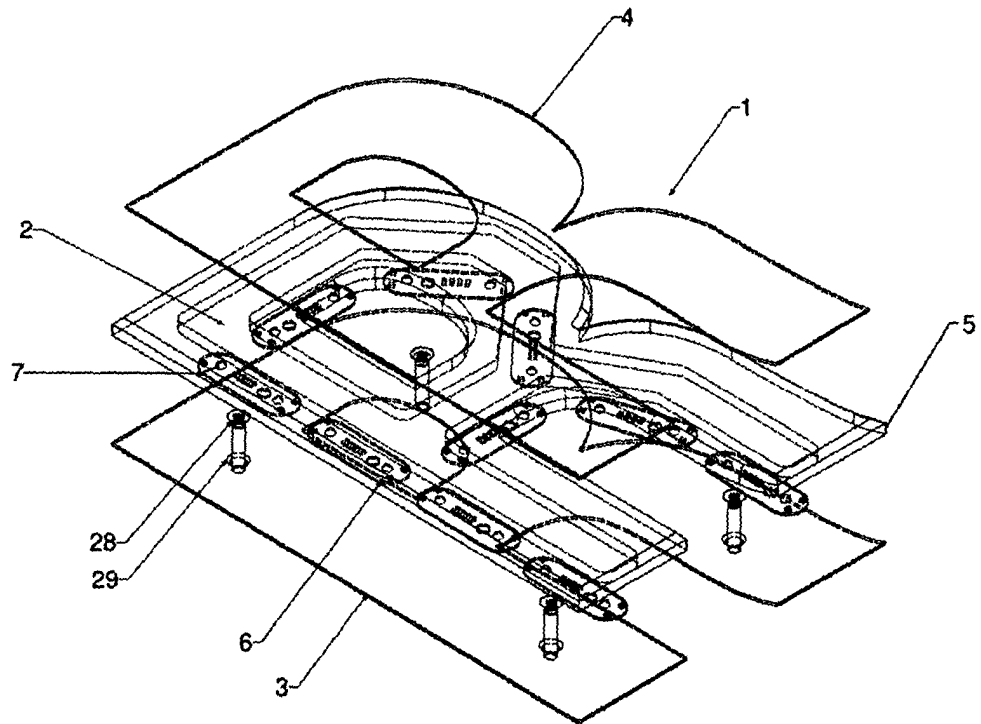


Figure 1A

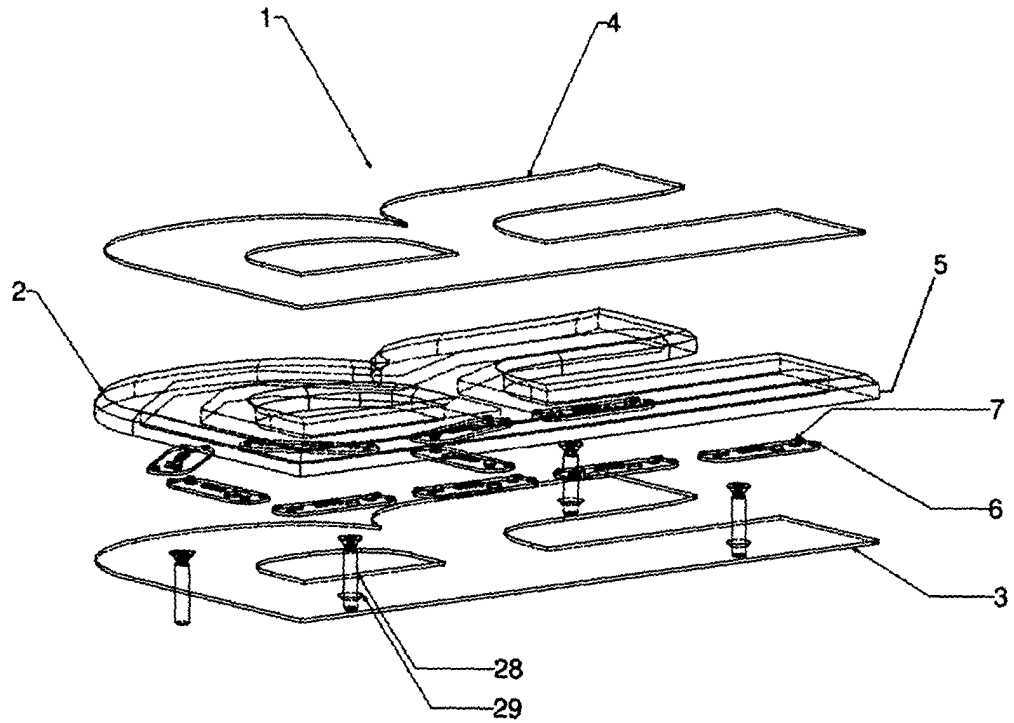


Figure 1B

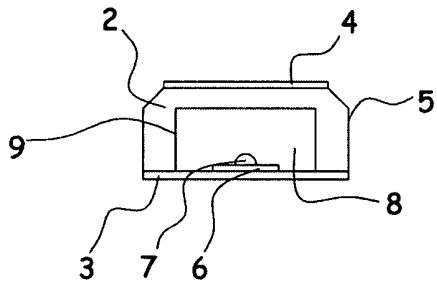


Fig 1C

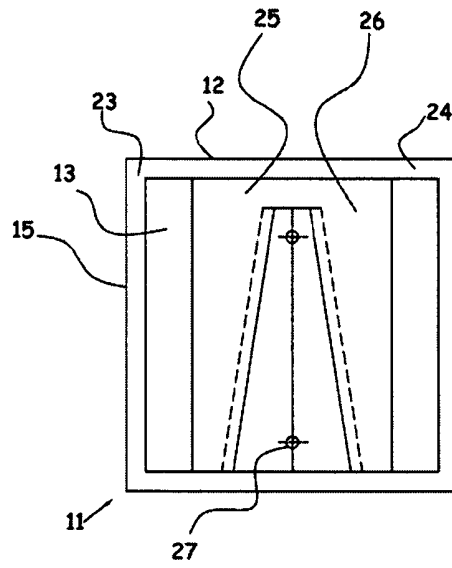


Figure 2A

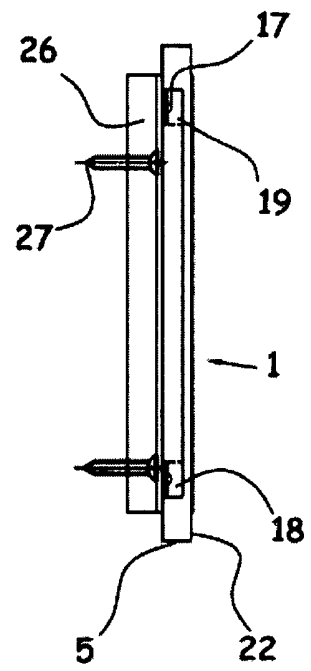


Figure 2B

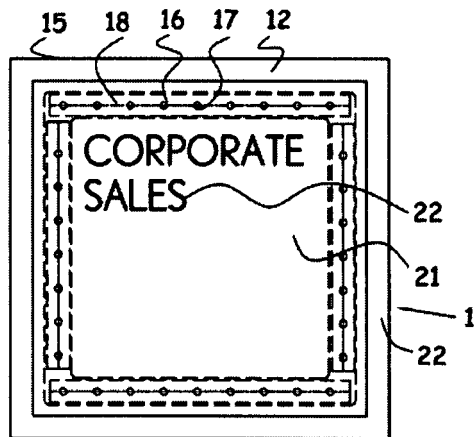


Figure 2C

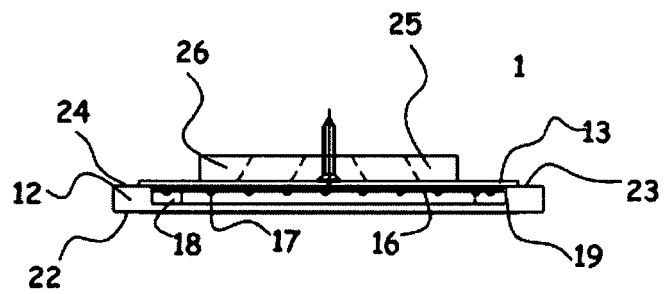


Figure 2D